

Chapter 9: Proposed Catskill Aqueduct Repair and Rehabilitation

This chapter of the Draft Environmental Impact Statement (DEIS) evaluates the proposed Catskill Aqueduct Repair and Rehabilitation (repair and rehabilitation) that would occur as part of Upstate Water Supply Resiliency. It provides background on the purpose and need for the repair and rehabilitation, describes the proposed activities and schedule for the repair and rehabilitation, and presents the environmental impact assessments for applicable impact categories.

9.1 PURPOSE AND NEED

DEP is proposing the repair and rehabilitation of the Catskill Aqueduct to provide water supply augmentation in support of the Rondout-West Branch Tunnel (RWBT) temporary shutdown and to extend the Catskill Aqueduct's useful life for many years to come (see **Figure 9.1-1**).

Over the years, the historical capacity of the Catskill Aqueduct has been reduced. The reduction in the capacity of the Catskill Aqueduct has occurred partly as a result of the accumulation of biofilm (a naturally occurring layer of microorganisms within a self-produced polymer) along the aqueduct's interior surface. Though relatively thin, the rough surface of this biofilm layer has contributed to slowing the flow of water from a historical capacity of 660 million gallons per day (mgd) to the current maximum capacity of 590 mgd. The repair and rehabilitation seeks to restore the aqueduct's capacity closer to its historical maximum by removing this layer of biofilm. New air vent structures would also be installed at key points along the aqueduct to improve water flow. By removing the layer of biofilm and adding air vents to enhance the flow of water through the aqueduct, repair and rehabilitation would provide additional capacity to convey water (i.e., water supply augmentation) to facilitate the RWBT temporary shutdown.

Both to potentially reduce the amount of biofilm prior to conducting biofilm removal and to limit regrowth (for the duration of the RWBT temporary shutdown), the addition of chlorine-based chemicals to the aqueduct is required.¹ Therefore, a chlorination facility is proposed for construction at the aqueduct headworks at Ashokan Screen Chamber in the Town of Olive, Ulster County, New York, and a dechlorination facility is proposed prior to discharge into the Kensico Reservoir at DEP's Pleasantville Alum Plant in the Village of Pleasantville, Westchester County, New York.

¹ Two chlorine-based chemicals (i.e., chlorine dioxide and sodium hypochlorite) would be used to prevent regrowth of biofilm on the aqueduct interior. To ensure that water within the distribution system is in compliance with safe drinking water standards as regulated by the New York State Department of Health, the chemical added, and its corresponding dose, would vary depending on seasonal operating conditions. These doses would be selected to achieve the goals of the project, while limiting the potential for effects to the City's water supply (i.e., Kensico Reservoir) and to the Outside Community Connections that rely on the Catskill Aqueduct as a primary or secondary drinking water supply. No more than one chemical would be used at a time.

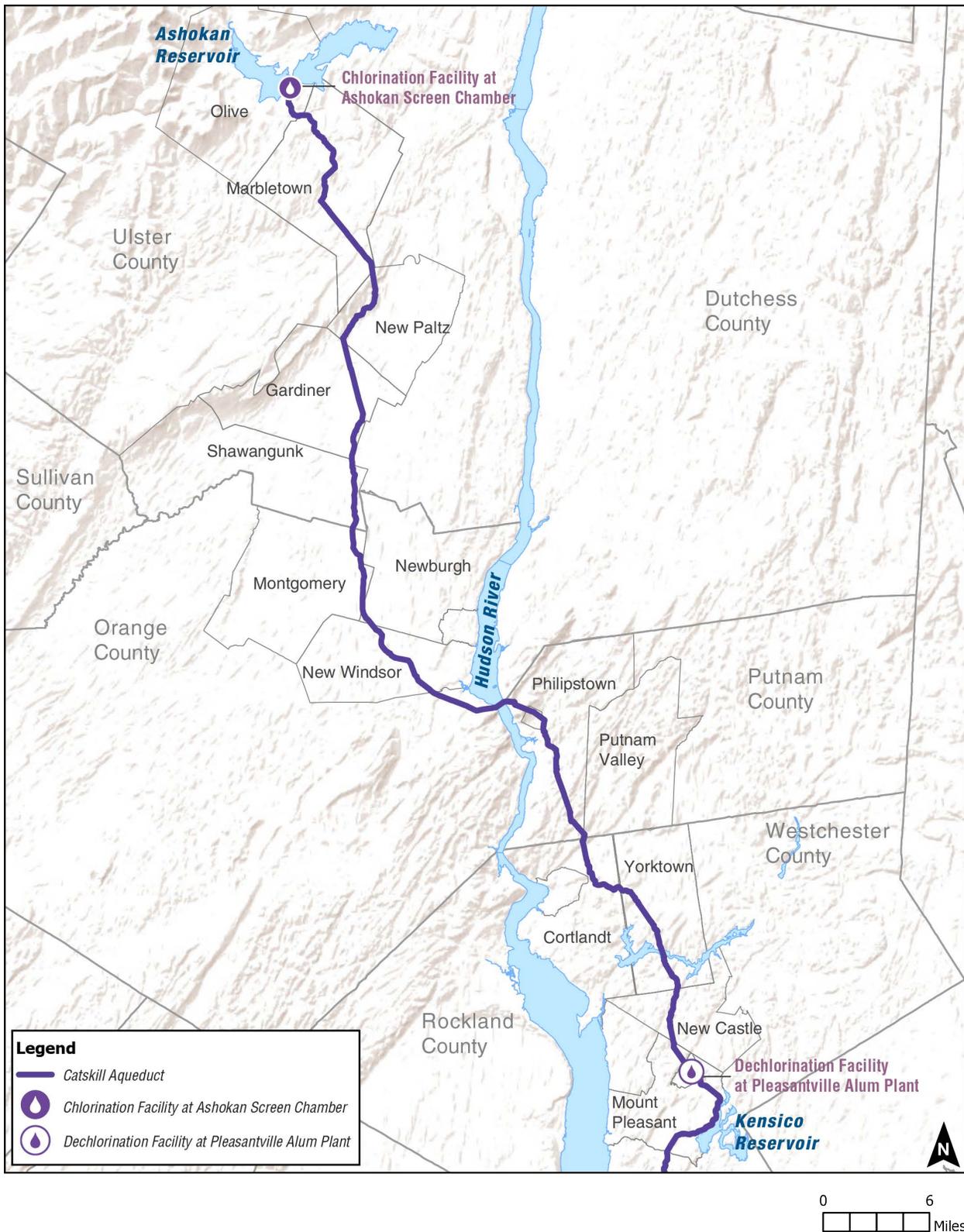


Figure 9.1-1: Upper Catskill Aqueduct



In addition to improved flow of water through the aqueduct, the repair and rehabilitation would provide long-term benefits to the water supply system through a full inspection of the aqueduct, repair of leaks, repair of valves and other mechanical equipment, and rehabilitation of existing aqueduct segments through structural repairs.

9.2 PROJECT DESCRIPTION

The following sections provide a detailed description of the repair and rehabilitation.

9.2.1 BACKGROUND

The Catskill Aqueduct, constructed between 1910 and 1927, extends approximately 86 miles from Ashokan Reservoir in Ulster County, New York, to Hillview Reservoir in Westchester County, New York. The Catskill System provides up to 40 percent of the City's total water supply. The portion referred to as the upper Catskill Aqueduct consists of the first 74 miles, beginning at Ashokan Reservoir in Ulster County, New York, and ending at Kensico Reservoir in Westchester County, New York (see **Figure 9.1-1**). This section of the aqueduct also serves a number of upstate communities along its route. The section connecting Kensico Reservoir to Hillview Reservoir, referred to as the lower Catskill Aqueduct, extends approximately 12 miles along the eastern side of the Hudson River.

In addition to the Catskill water supply system, the Delaware water supply system is a source of water for the City and surrounding upstate communities, providing up to 50 percent of the City's water supply. Water from the Delaware System is transported by the Delaware Aqueduct, one of the City's most critical pieces of water supply infrastructure. The Delaware Aqueduct is composed of several segments, the longest of which is the RWBT. The RWBT connects Rondout Reservoir in Ulster County, New York, to West Branch Reservoir in Putnam County, New York. The RWBT is currently leaking up to 35 mgd, primarily in the area known as Roseton, in the Town of Newburgh. A second leaking section is located near the Town of Wawarsing.

To address the leaks in the RWBT, an iterative planning process involving complex modeling paired with considerations for both time and cost was undertaken to determine the optimal method of repair (see Chapter 4, "Water for the Future Background and Planning"). As a result of this planning process, DEP elected to construct a bypass tunnel and two associated shafts to permanently circumvent the leaking section at the Roseton crossing, and to conduct internal repairs to the section in the Town of Wawarsing. Once the bypass tunnel is connected to the existing RWBT, the leaking section would be permanently removed from service and decommissioned in place. The work undertaken to circumvent the leaking section in the Roseton crossing area is referred to as the "RWBT Bypass" (see **Figure 9.2-1**).

Once the bypass tunnel and shafts are completed in 2022, the RWBT would be temporarily taken offline and drained to allow connection of the bypass tunnel to the existing RWBT and to make repairs in the Town of Wawarsing. DEP estimates that the maximum shutdown duration of the RWBT would be approximately 8 months. During the RWBT temporary shutdown, water from the Delaware System west of the Hudson River would be unavailable for water supply to the

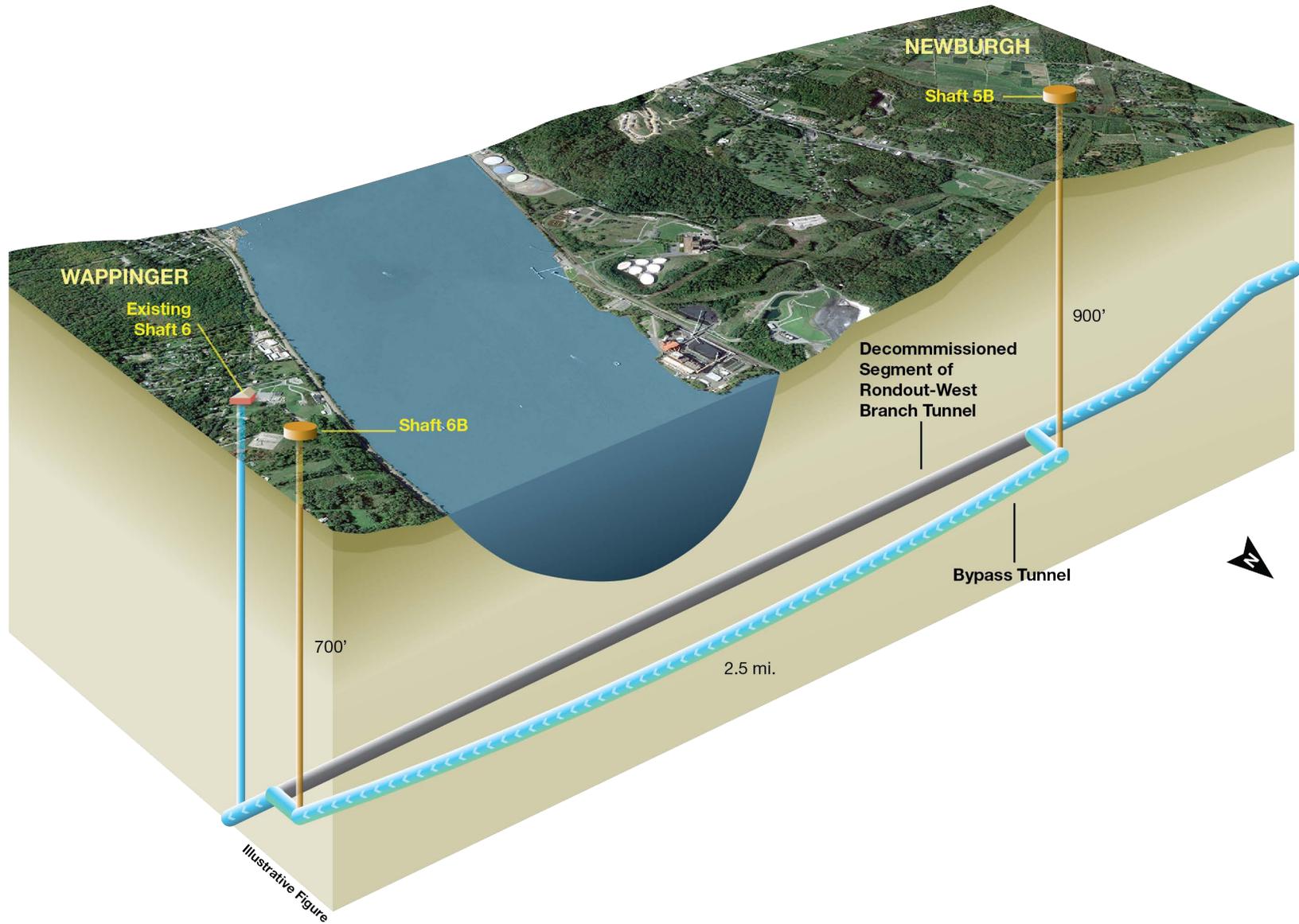


Figure 9.2-1: Rondout-West Branch Tunnel: Decommissioned Section and Bypass Tunnel



City and its customers. To bridge this supply gap, DEP is proposing to repair and rehabilitate the Catskill Aqueduct to increase the amount of water the aqueduct can transport closer to its historical maximum, and rely more heavily on the Catskill and Croton water supply systems.

As noted above, the Catskill Aqueduct's historical capacity has been reduced over time as a result of the accumulation of biofilm within the interior surface of the aqueduct. The presence of biofilm within the aqueduct is not unusual. Biofilm forms when microorganisms and other organic and inorganic materials adhere to surfaces in water-based environments. It grows virtually everywhere in almost any environment where there is a combination of moisture, nutrients, and a surface on which the film can accumulate. Biofilm deposits have formed on the interior wall surface of the aqueduct as a result of naturally occurring constituents in the raw aqueduct water, specifically iron and manganese. Though the biofilm layer is relatively thin (approximately 0.0625-inch to 1-inch thick), the deposits increase friction between the water and interior aqueduct surface, which reduces the amount of water that can flow through the aqueduct.

Biofilm removal and the remaining project components that would restore the aqueduct's capacity for the duration of the RWBT temporary shutdown and contribute to its longevity are described below.

9.2.2 OVERVIEW OF PROPOSED ACTIVITIES

Biofilm removal from the interior surface of the upper Catskill Aqueduct is the primary activity that would restore the aqueduct's capacity to support the RWBT temporary shutdown. As part of the repair and rehabilitation, biofilm would be removed along the unwatered upper Catskill Aqueduct, except within deep pressure tunnels that have limited accessibility. In addition to increasing the aqueduct's capacity, biofilm removal along cut-and-cover, grade tunnels, and steel pipe siphons would provide an opportunity for a full condition assessment to be completed within these aqueduct segments near the end of construction. As biofilm is removed, it would be collected. Wash water from the biofilm removal process, in addition to any residual water within the aqueduct, would be treated at specific locations along the Catskill Aqueduct, typically at boatholes located before the start of a pressure tunnel or steel pipe siphons (see **Figure 9.2-2**). Wash water treatment activities would largely occur at the surface (see Section 9.2.6.5, "Biofilm Removal and Condition Assessment"). In addition to biofilm removal, new air vent structures would be installed at key points along the aqueduct to improve water flow.

The repair and rehabilitation would include addition of chlorine-based chemicals at the head of the aqueduct that would potentially facilitate biofilm removal and inhibit its regrowth. These chemicals would be introduced into the aqueduct via a new chlorination facility that would be located within the existing Ashokan Screen Chamber on the southern end of Ashokan Reservoir in the Town of Olive. A new dechlorination facility would be constructed at the existing Pleasantville Alum Plant, located in the Village of Pleasantville, to remove sodium hypochlorite, chlorine dioxide, and/or chlorine residuals (generally referred to as chlorine residuals) prior to discharge into Kensico Reservoir. Site improvements would be undertaken at both the Ashokan Screen Chamber and Pleasantville Alum Plant to facilitate these chlorination and dechlorination operations, as well as to maintain water quality in Kensico Reservoir due to the increased reliance on the Catskill System during the RWBT temporary shutdown.

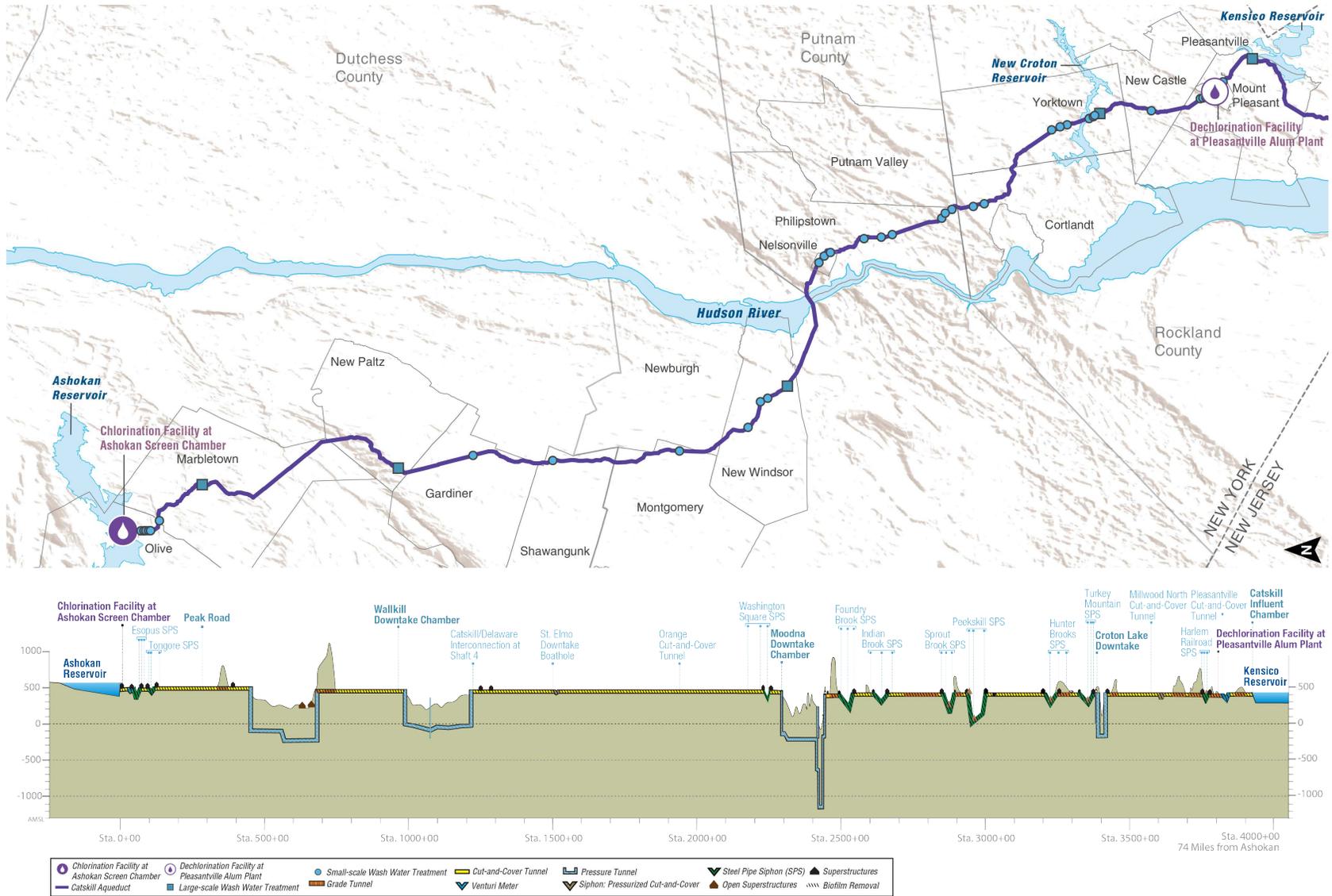


Figure 9.2-2: Biofilm Removal along the Upper Catskill Aqueduct



In addition, several leaks would be repaired along the length of the aqueduct to ensure that no chlorine residuals are introduced into the environment during testing and operation of the chlorination facility. At locations where leak repairs are not feasible or prove unsuccessful, local dechlorination systems would be installed to achieve the same goal.

Additional activities to support the aqueduct's capacity enhancements and extended serviceable life of the aqueduct would include (see **Figure 9.2-3**):

- Establishment of temporary staging areas for construction crews and access improvements (rehabilitation or construction of access roads);
- Installation of boatholes (large points of entry) to facilitate biofilm removal and condition assessments;
- Structural repairs, including rehabilitating the existing steel pipe siphon bridge structures; replacement of valves, sluice gates, and other mechanical equipment used in unwatering the aqueduct; and
- Removal of sediment within the Catskill Kensico Bypass, restoring its capacity for emergency use.

The Catskill Aqueduct would be taken out of service and unwatered to accommodate many components of the repair and rehabilitation. More specifically, three separate shutdown periods, each lasting up to 10 weeks, spaced over 3 years, would allow for access to the interior of the aqueduct to carry out the primary repair and rehabilitation activities. These shutdowns (referred to as 10-week shutdowns) are currently scheduled for the fall of 2017, 2018, and 2019.

9.2.3 SCHEDULE

Repair and rehabilitation requires a phased approach to construction and operation that would span several years. Since biofilm removal would be the key activity that would restore the aqueduct's capacity to support the RWBT temporary shutdown, much of the proposed work is phased to support this activity. Overall, the repair and rehabilitation is anticipated to begin in 2017 and finish in 2023 in advance of the temporary shutdown (see **Figure 9.2-4**). However, staging areas used to support the repair and rehabilitation construction activities would be restored to baseline conditions in 2020, as the activities would be completed by that time.

As noted above, three shutdowns lasting up to 10 weeks each would be spaced over a period of 3 years from 2017 to 2019. These 10-week shutdowns are required to facilitate the repair and rehabilitation, and would generally take place between October and December to coincide with the lowest water demand period of the year. Depending on time constraints and other factors, additional shutdowns may be planned. For example, an additional shutdown may be needed in the spring of 2018 to ensure all of the necessary mechanical and structural repairs are completed. If spring shutdowns are required, they would occur early in the season when demand is still low. The 10-week shutdowns may be temporarily delayed at DEP's discretion based on drought conditions, extreme storm events, or other condition that DEP deems a potential threat to the water supply system, or to DEP staff or contractor safety. The shutdowns would then proceed once DEP has determined that there is minimal risk to the water supply system or worker safety.

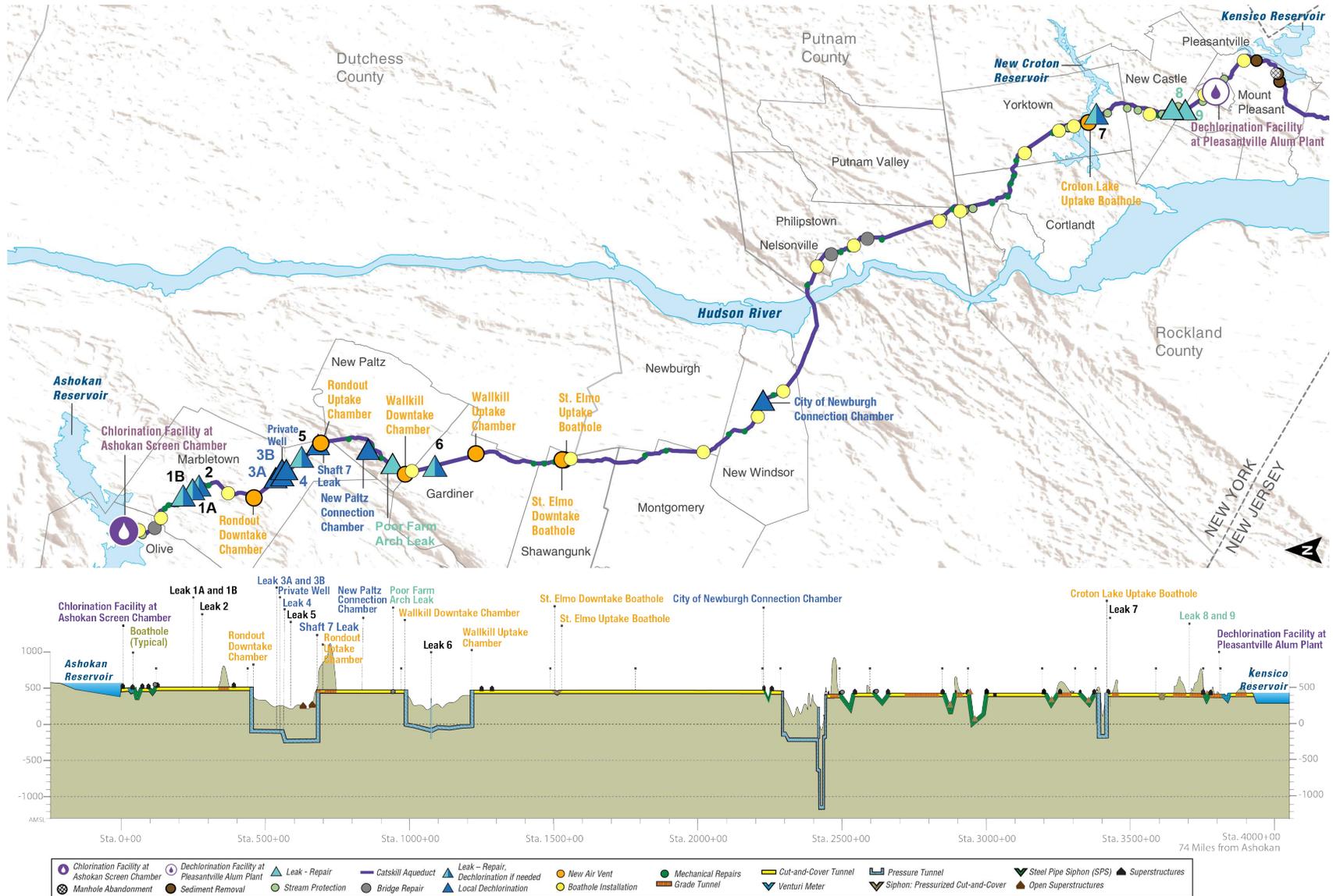


Figure 9.2-3: Leak Repair, Local Dechlorination, and Mechanical and Structural Repairs along the Upper Catskill Aqueduct



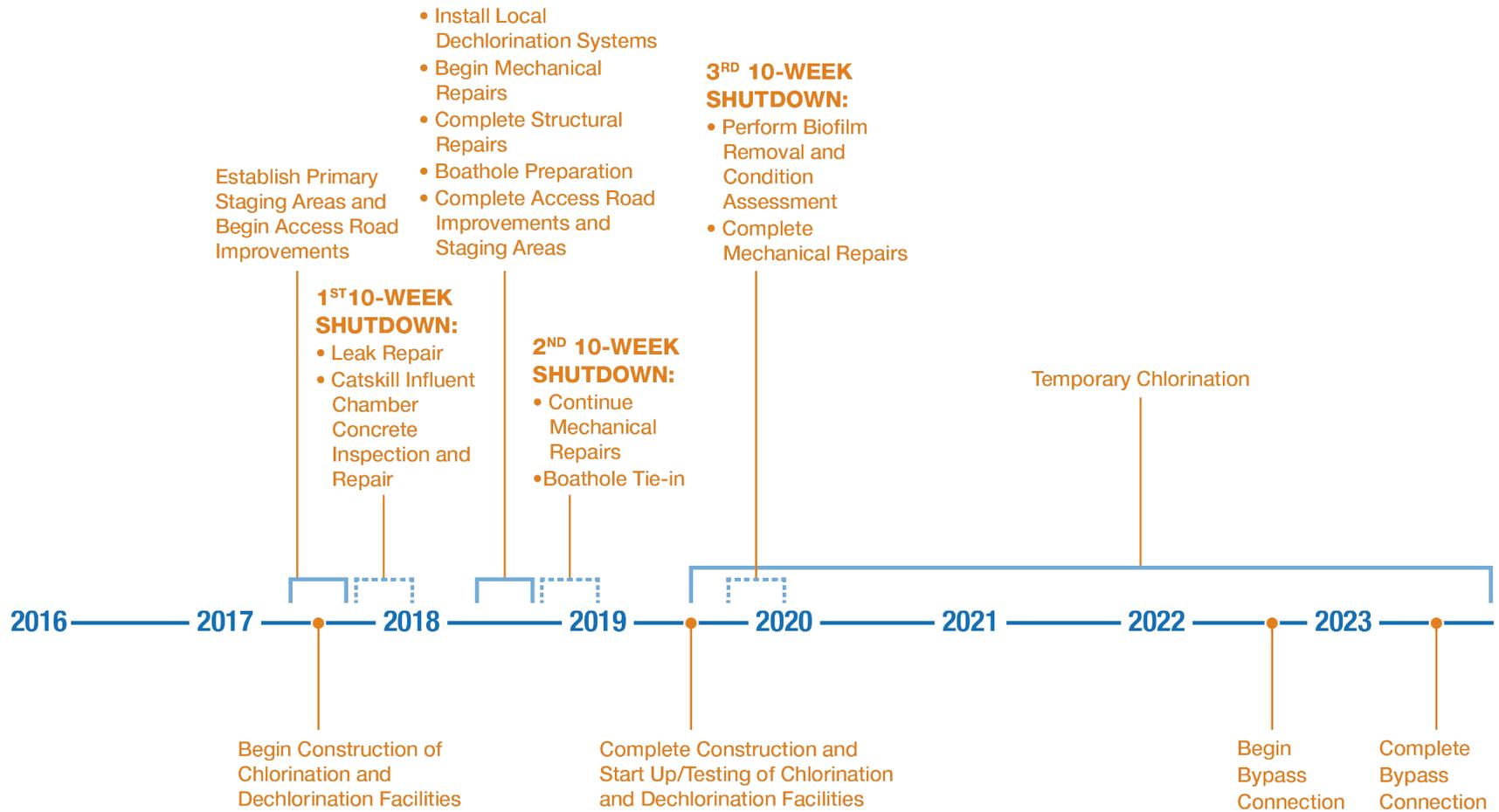


Figure 9.2-4: Catskill Aqueduct Repair and Rehabilitation Schedule



The 10-week shutdown length is governed by the water supply needs of the City and other communities that rely on the Catskill Aqueduct for water supply. There are 15 water supply connections that receive water supply from the upper Catskill Aqueduct to serve approximately 20 communities. The planned 10-week shutdowns would temporarily suspend supply to these Outside Community Connections. The Catskill Aqueduct would not be taken out of service unless the City water supply and upstate customers are able to sufficiently manage alternative supplies. Where necessary, DEP would work with Outside Community Connections who currently do not have sufficient back-up supply to develop alternate water supplies for use during the shutdown periods (see **Table 9.2-1**).

Table 9.2-1: Outside Community Connections to the Catskill Aqueduct

Location	Water Supply Connections
West-of-Hudson	High Falls Water District ¹
	Village of New Paltz ¹
	Wallkill Correctional Facility
	Town of New Windsor, Jackson Avenue Pump Station ¹
	World Mission Society (formerly Mount Saint Joseph Convent)
	City of Newburgh ¹
	Village of Cornwall-on-Hudson ¹
	Town of New Windsor, Riley Road Water Treatment Plant ¹
East-of-Hudson	Village of Cold Spring
	Friars of the Atonement
	Continental Village Water District ¹
	Town of Cortlandt (emergency)
	Northern Westchester Joint Water Works
	Orchard Hill Water District (emergency)
	Town of New Castle, Millwood Water Treatment Plant ¹
<p>Note: ¹ These Outside Community Connections rely on the Catskill Aqueduct as their primary supply of drinking water. All other communities use the Catskill Aqueduct as a back-up supply. Note that due to recent water quality concerns, the City of Newburgh, which typically uses the Catskill Aqueduct as a back-up water supply source will begin to use this water as a primary source for the foreseeable future.</p>	

Construction of the chlorination facility at Ashokan Screen Chamber and the dechlorination facility at Pleasantville Alum Plant, as well as additional supporting improvements on those sites, would commence in early 2017. Later, during the RWBT temporary shutdown, alum treatment of Catskill System water at the Pleasantville Alum Plant would likely be required at a frequency higher than typical. Furthermore, higher than typical amounts of alum may be required to treat any temporary increases in turbidity that could result from temporary chlorination in advance of biofilm removal activities. Therefore, an additional separate, liquid alum system would be installed at the Pleasantville Alum Plant to supplement the existing dry alum system during turbidity events.

In 2017, site preparation to establish four primary staging areas and begin constructing access road improvements would take place. In fall of that year, DEP would shut down the Catskill Aqueduct for the first 10-week period to conduct leak repairs in advance of chlorinating the aqueduct and Catskill Influent Chamber concrete inspection and repair. In the summer of 2018, prior to the second 10-week shutdown, installation of local dechlorination systems would be installed at sites where leak repair is not feasible, or was not successful. The majority of the boathole construction activities (excluding the tie into the aqueduct) and structural repairs would also be completed at this time. Any access roads and staging areas not established in 2017 and access road improvements would also be constructed prior to the second 10-week shutdown. Mechanical repairs would continue during the second 10-week shutdown in the fall of 2018, and if warranted, during an additional 10-week shutdown in 2018 or 2019.

Construction of the chlorination facility at Ashokan Screen Chamber and the dechlorination facility at Pleasantville Alum Plant is anticipated to be complete by mid-2019. Since the leaks would be repaired and local dechlorination systems installed by this time, the chlorination and dechlorination facilities' start up and testing could commence. This testing would be conducted over the course of several months in spring 2019 to ensure that the chlorination and dechlorination facilities are operating effectively. Once deemed effective, operation of the chlorination facility would begin in order to reduce the amount of biofilm that has to be removed and collected. Therefore, chlorination and dechlorination would commence by mid-2019, in advance of biofilm removal during the third 10-week shutdown.

Biofilm removal would then occur during the third and final 10-week shutdown in fall 2019. During this shutdown, biofilm would be removed from the aqueduct interior, collected, and disposed, and any wash water used in the removal process would be treated prior to disposal. A detailed condition assessment would be performed, and any defects identified during the assessment would be repaired as part of the project, if feasible.

After the biofilm removal in 2019, chlorination of the aqueduct would resume to maintain restored aqueduct capacity until the bypass tunnel is connected to the RWBT in 2023. Once the RWBT Bypass is connected and the water supply system returns to typical operations in 2023, the chlorination and dechlorination facilities at Ashokan Screen Chamber and Pleasantville Alum Plant, respectively, would no longer be required and, therefore, would no longer be operated. Similarly, the local dechlorination systems would no longer be required. Therefore, in 2023, the local dechlorination systems would be removed and the associated sites restored to baseline conditions. Operation of the liquid alum system at Pleasantville Alum Plant would cease following the RWBT temporary shutdown. DEP would continue to rely on operational turbidity control measures and flexibility in the water supply system to control episodic turbidity post-shutdown, but could add alum at the facility, as needed and with New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) approval, during water quality events.

During construction, work durations would vary based on the complexity and scale of the activity. A substantial portion of the repair and rehabilitation work activities must be completed when the aqueduct is unwatered, and there are restrictions on the timing and duration of the 10-week shutdowns. Where possible, work that does not require the aqueduct to be unwatered would be conducted during normal work hours, from 7 AM to 5 PM, 5 days a week. This

includes establishing site access and staging, the majority of boathole construction, and installation of local dechlorination systems. All work hours would be coordinated with the local municipalities. The chlorination facility at Ashokan Screen Chamber would be constructed from 7 AM to 3:30 PM, 5 days a week. The dechlorination facility at Pleasantville Alum Plant would be constructed from 8 AM to 7 PM, 5 days a week. Extended work hours between 7 AM to 7 PM, 7 days a week would occur during the 10-week shutdowns, particularly to conduct mechanical and structural repairs and biofilm removal. During some phases of construction, such as work that requires extended periods of access to the interior of the aqueduct (i.e., internal leak repair), efforts would require work hours extending to 24 hours per day for several weeks.

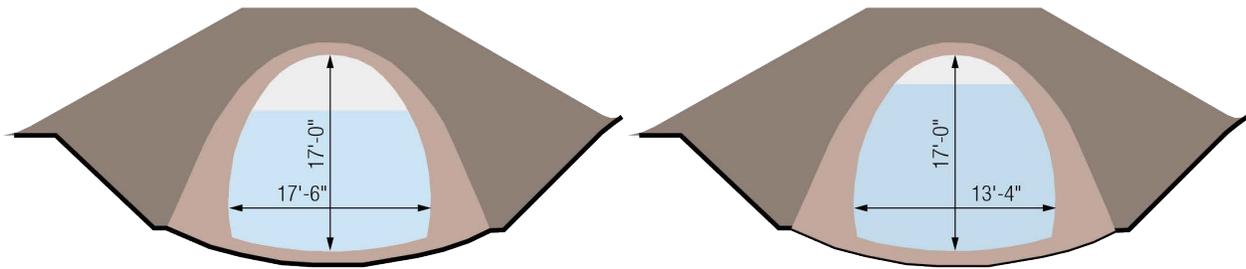
9.2.4 DESCRIPTION OF THE UPPER CATSKILL AQUEDUCT

This section describes the upper Catskill Aqueduct and its original components to contextualize the setting and constraints of the repair and rehabilitation. These include tunnel segment types, mechanical components, and existing access points to the aqueduct interior. The components of the upper Catskill Aqueduct dictate the types of construction activities and methods proposed to enhance the aqueduct's capacity and operation. **Figure 9.2-2** shows both plan and profile views of the upper Catskill Aqueduct, and aligns the location of boatholes, siphons, etc. and associated leaks along its length with the geographical location of this infrastructure.

There are multiple tunnel segment types that comprise the upper Catskill Aqueduct along its approximately 74-mile alignment. This alignment ranges from an elevation of approximately 500 feet above sea level at its highest point at the Ashokan Screen Chamber to approximately 1,100 feet below sea level at its lowest point where it passes below the Hudson River. The overlying topography (i.e., geologic features and elevation) along the aqueduct alignment dictated the type and methods of tunnel construction to ensure that gravity flow is maintained throughout the aqueduct. In particular, the majority of the aqueduct (approximately 59 non-contiguous miles) was constructed using cut-and-cover, grade tunnels, and steel pipe siphons. The remaining approximately 15 miles are composed of pressure tunnels. The types of tunnel segments are shown on **Figure 9.2-5** and described in more detail below.

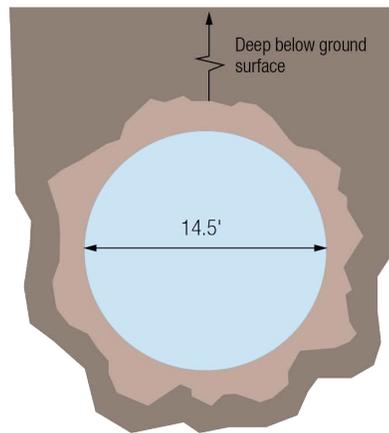
Cut-and-cover tunnel segments are horseshoe-shaped concrete arches that are approximately 17 feet high and 17.5 feet wide. These segments generally lie just a few feet below the ground surface creating a berm-like area, matching the local topography, with crossings for streams and other natural features.

Figure 9.2-6 is a historic photograph showing construction of the Peekskill Cut-and-Cover Tunnel with steel forms erected and ready for casting the concrete arch. Within the cut-and-cover tunnel segments, there is a gap or headspace between the water surface and the top of the tunnel under most conditions to ensure the water is able to flow freely. In some locations where the aqueduct crosses streams or drainage channels, culverts were installed as part of the original contract with sluice gates for drainage. The sluice gates, when opened, allow the aqueduct to be drained into adjacent streams or drainage channels. However, many of these sluice gates have never been used to drain the aqueduct.

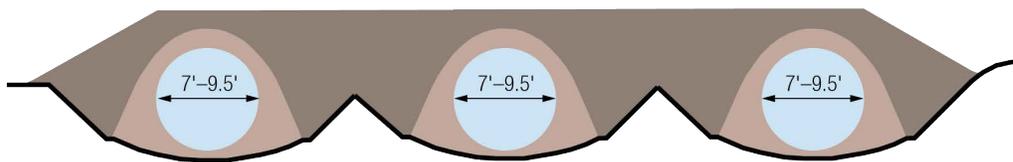


Cut-and-Cover Tunnel

Grade Tunnel



Pressure Tunnel



Steel Pipe Siphon

Figure 9.2-5: Types of Tunnel Segments along the Upper Catskill Aqueduct





Figure 9.2-6: Historic Photograph of the Peekskill Cut-and-Cover Tunnel, May 12, 1910



The second most common tunnel segment type along the upper Catskill Aqueduct are pressure tunnels, which travel under rivers and valleys where mountains or large rivers prohibited the construction of cut-and-cover tunnels. These segments constitute approximately 15 miles of the upper Catskill Aqueduct. Pressure tunnels are located deep beneath the surface in rock in order to sustain the heavy outward pressure from the water in the tunnel. These tunnels are circular, concrete-lined, pressurized sections that flow full, with diameters of up to 14.5 feet. Vertical shafts are located at each end of the pressure tunnels to connect to cut-and-cover or grade tunnel segments.

Grade tunnel segments comprise approximately 12 miles of the upper Catskill Aqueduct and are typically located through hills and mountains connecting two at-grade sections on either side of the elevated ground expression. Similar to cut-and-cover segments, the grade tunnel segments are unpressurized and horseshoe-shaped, but with steeper grades. Grade tunnels have smaller cross-sections than cut-and-cover segments. Like cut-and-cover segments, they are up to 17 feet high, with a narrower width of 13 feet.

Steel pipe siphons, which comprise approximately 5 miles of the upper Catskill Aqueduct, have U-shaped profiles and are constructed using a similar method to cut-and-cover tunnel segments. These tunnel segments convey water across low-lying areas and dip under or over (depending on the topography) small valleys, railroads, or waterways, and are up to several thousand feet in length. Steel pipe siphons are pressurized segments that flow full, forcing the water uphill and downstream to the cut-and-cover segments. They consist of three cement and mortar-lined steel pipes that run parallel to one another. Each of the steel pipes has a diameter ranging from 7 to 9.5 feet. Blow-offs, which consist of a pipe near the lowest portion of a siphon pipe, are intended to provide drainage of the siphon pipes. However, historic inspection reports indicate that a majority of these valves have not been used since their installation nearly a century ago and operability is unknown.

Access into the aqueduct is provided via multiple components. These include access manholes, boatholes, siphon chambers, screen chambers, influent/effluent chambers, and pressure tunnel uptake and downtake chambers. Boatholes provide access and have large openings, typically 3 to 4 feet in width by 13 to 18 feet in length. These were historically used to lower boats into cut-and-cover segments for maintenance purposes. These and other aqueduct appurtenances and their associated tunnel types are shown in **Table 9.2-2** below.

Table 9.2-2: Description of Catskill Aqueduct Appurtenances

Aqueduct Appurtenance	Description
Air Vents	Flue-like structures that allow release of trapped air at pressure tunnels, siphon chambers, and cut-and-cover segments.
Boatholes	A large access opening in cut-and-cover tunnel segments to allow personnel and large equipment access to the interior of the aqueduct. Larger than a manhole, and occurs less frequently along the aqueduct, sizes vary.
Bridge Structures	Bridge structures that allow cut-and-cover and steel pipe siphons to cross streams. There are five bridge crossings, three along steel pipe siphons, and two along cut-and-cover segments.

Table 9.2-2: Description of Catskill Aqueduct Appurtenances

Aqueduct Appurtenance	Description
Catskill Influent Chamber	Located at the southern terminus of the Pleasantville Cut-and-Cover Tunnel through which Catskill Aqueduct water discharges to Kensico Reservoir. Allows direct access into the aqueduct.
Catskill Kensico Bypass	The Catskill Kensico Bypass extends approximately 13,800 feet from the Catskill Influent Chamber to the Kensico Upper Influent Chamber. In the past, it served to bypass water beneath Kensico Reservoir when water quality requirements in the reservoir were not met during certain conditions (e.g., turbidity events), or if it became necessary to perform repairs on the numerous facilities that comprise the reservoir's water supply infrastructure. An inspection of this segment identified a buildup of sediment and debris along its length.
Connection Chambers	Chambers connected to the aqueduct where aqueduct water is provided to outside communities.
Culvert Drain Sluice Gates	Located where cut-and-cover tunnels pass over a drainage culvert, and consist of a 10-inch-diameter rising stem sluice gate in the Catskill Aqueduct. When open, the sluice gate allows aqueduct water to drain from the aqueduct into underneath culverts and into streams or drainage channels.
Downtake/Uptake Chambers	Located at the start and end of pressure tunnel segments and are the connection points with adjacent aqueduct segments. Allow personnel access directly into the shaft.
Gaging Chambers	Located at Ashokan, Peak, Wallkill, Breakneck, and Croton Gaging Chambers. Measure water flow. Personnel access is not possible.
Manholes	Located in cut-and-cover and steel pipe siphon tunnels. Concrete openings provide 3-foot by 3-foot square access directly into the aqueduct for personnel or venting.
Screen Chamber	Structure containing screens capable of capturing debris. One is located at the start of the Esopus Cut-and-Cover Tunnel near Ashokan Reservoir. Personnel access into the aqueduct is possible.
Siphon Drain Blow-offs and Blow-off Valves	Located at low points in the steel pipe siphon segments to allow water to drain siphon pipes into nearby streams. Each blow-off valve is located in a blow-off chamber and allows water to flow through the blow-off pipes and is intended to provide drainage of the siphon pipes through siphon drain blow-offs. Access into the aqueduct is neither required nor possible. Blow-off chambers are concrete structures that extend from the below-ground steel pipe siphons to the overlying ground surface. Personnel access the blow-off chambers and their enclosed blow-off valve by entering a manhole at the ground surface.
Steel Pipe Siphon Chambers	Chambers located at connection points adjoining cut-and-cover and steel pipe siphons. Direct access into the aqueduct is possible.
Venturi Meter Chambers	Chambers located downstream of Ashokan, Pleasantville, and Kensico Screen Chambers. Measure the flow of the water drawn from the reservoirs. Personnel access is not possible.

9.2.5 OPERATION OF THE UPPER CATSKILL AQUEDUCT

The aqueduct is routinely unwatered for short periods of time (typically a few days) to perform inspections on the aqueduct and appurtenances described above. During these periods, the majority of the aqueduct is unwatered by cutting off the flow of water into the aqueduct from Ashokan Reservoir, and allowing the water to drain by gravity, downstream toward Kensico Reservoir. While aqueduct segments upstream of Croton Lake Pressure Tunnel can be fully unwatered in this way, water remains in some tunnel segments during these routine unwatering events. These segments include low points along the aqueduct (such as pressure tunnels and siphon pipes), and aqueduct segments that are closer to Kensico Reservoir, where the higher reservoir elevation prevents the aqueduct from draining completely. Water in these segments is typically left in place.

In addition, water can remain in portions of the aqueduct to provide adequate water for Outside Community Connections from the aqueduct as a primary or back-up water supply (see **Table 9.2-1**). During shutdowns of the Catskill Aqueduct, DEP uses stop shutters, which are temporary barriers that allow water to back up behind them, to store water within aqueduct segments where taps are located. As a result, temporary shutdowns of approximately a few days can take place without compromising the ability to provide water to these communities.

Work along the aqueduct can also, at times, require access to tunnel segments that have been unwatered. As previously described, steel pipe siphons drop below the normal grade of the aqueduct, trapping water when the system is unwatered by gravity. Each of the steel pipe siphons is outfitted with blow-off valves, which are intended to drain this trapped water. However, the operability of these valves is unknown. To unwater these segments under existing operations, siphon pipes can be unwatered while the aqueduct is in service by isolating one of the three pipes using existing sluice gates and shutters, or by erecting temporary dams within the aqueduct. Water can then be pumped from that pipe to a downstream segment of the aqueduct or to a nearby stream.

If not isolated from Kensico Reservoir, water remains in the aqueduct sections downstream of Croton Lake Pressure Tunnel (including the Harlem Railroad Steel Pipe Siphon), during an unwatering event because the bottom of the siphon in this portion is below the level of the reservoir. They are only unwatered by installing stop shutters at the Catskill Influent Chamber to prevent the backflow of Kensico Reservoir water, and either draining at a sluice gate or pumping water from the segment. **Figure 9.2-3** shows the Croton Lake Uptake boathole, which is the approximate location of the downstream section of the pressure tunnel.

The 10-week shutdowns would influence the operation of Ashokan Reservoir by reducing flows out of the reservoir and provision of water to the Outside Community Connections. Ashokan Reservoir operations are regulated by the Interim Ashokan Release Protocol. DEP would continue to conform to the requirements of the Interim Ashokan Release Protocol (or its successor) during the 10-week shutdowns. As indicated, DEP would work with Outside Community Connections who currently do not have sufficient back-up supply to develop alternate water supplies for use during the 10-week shutdowns.

9.2.6 PROPOSED REPAIR AND REHABILITATION ACTIVITIES

This section describes the components of the proposed repair and rehabilitation that would restore the capacity of the upper Catskill Aqueduct closer to its historical maximum for the duration of the RWBT temporary shutdown. These activities would include air vent installation, biofilm removal, and construction and operation of a chlorination facility at Ashokan Screen Chamber and a dechlorination facility at Pleasantville Alum Plant. Also described are the additional activities proposed to support the aqueduct capacity enhancements, such as site access improvements and staging areas, mechanical and structural repairs, and condition assessments. These activities are generally discussed in chronological order according to the anticipated construction sequence.

9.2.6.1 Site Access Improvements and Staging Areas

The repair and rehabilitation activities would be performed in segments along the approximately 74 miles of the upper Catskill Aqueduct. Due to the geographic span and number of proposed work activities, multiple staging areas would be established at several locations to allow work crews to streamline execution of work activities while reducing temporary environmental effects (i.e., construction traffic) to local communities. To this end, four larger, primary staging areas would serve as the main headquarters for overseeing construction activities. While in use, management of these primary staging areas would typically take place during normal business hours, and may be adjusted to 24 hours per day during the shutdowns. These primary staging areas, each proposed to be established on DEP property, would include: Ashokan Screen Chamber, Catskill/Delaware Interconnection at Shaft 4 (Shaft 4 Interconnection), Croton Lake Downtake Chamber, and the Catskill Influent Chamber (see **Figure 9.2-7**). These primary staging areas would offer large cleared areas for staging and parking and would be located near main roads, while also being in the vicinity of other work sites. Given the volume of workers needed during the shutdown periods, multiple secondary staging areas would be established. These would often be co-located at the work sites, to reduce the distance workers travel to and from the sites each workday, to distribute construction vehicle traffic, and to serve as equipment storage and laydown areas to support the work site(s).

Workers would gather at these secondary staging areas at the beginning of each workday. After driving to the staging areas and parking their vehicles, they would carpool and proceed a relatively short distance to the specific work sites associated with each of these smaller staging areas. Similar to the primary staging areas, secondary staging areas would be used throughout the duration of the repair and rehabilitation work activities. However, the level of activity at each secondary staging area would vary, depending on the point in the construction schedule and the number of concurrent work activities at that time. Some of these staging areas would require minor disturbance, such as grading and tree clearing. However, tree removal would be kept to the minimum necessary, and trees would be replanted where possible.

As described in the study area project descriptions (see Sections 9.4, “Town of Olive,” through 9.17, “Village of Pleasantville”), several smaller on-site staging areas would be located in the immediate vicinity of many of the work sites to support activities at those sites. Workers would access these staging areas via local roads, access roads, and by driving along the top of the aqueduct.

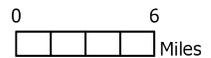
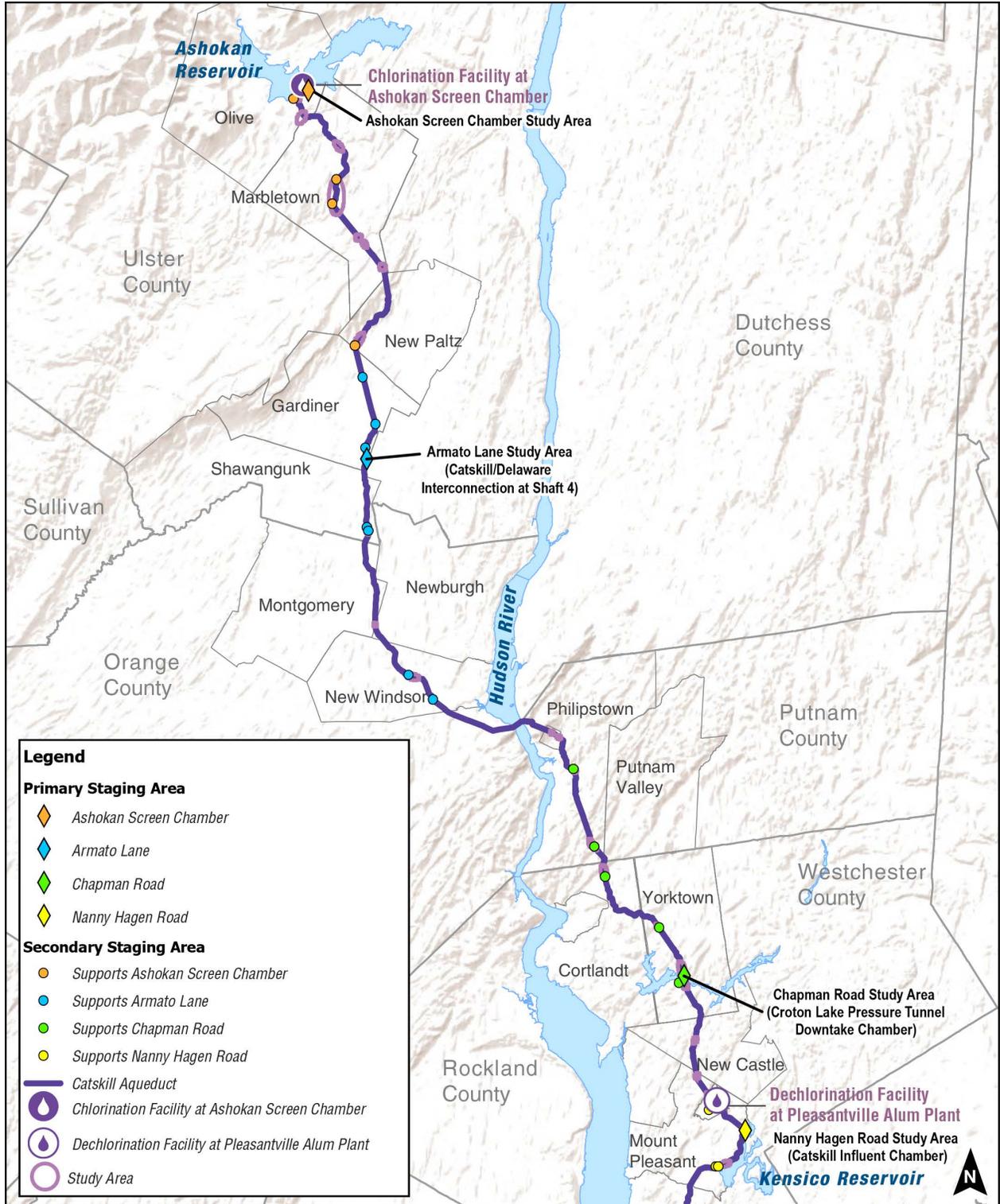


Figure 9.2-7: Primary and Secondary Staging Areas and Study Areas

Some of the access roads would require improvements to safely accommodate construction vehicles. To accomplish this, some of these roads would need to be widened in key areas to create truck turnarounds and pull-offs. This would require minor fill and some tree removal, in addition to temporary or permanent improvements to existing bridges and stream crossings. In certain locations, new access roads would be built.

These temporary improvements would include reinforcing an existing culvert or bridge with steel plates and installation of handrails and other safety features to allow for safe vehicular and worker access. Permanent improvements would include replacing culverts and repairing existing bridges, including stabilizing and refurbishing piers, enlarging bridge decks, and providing streambank restoration where necessary. Sediment and erosion control measures (such as check dams, silt fences, haybale lines) would be installed, as appropriate, to prevent disturbed soils from migrating to the surrounding areas during staging area and access road construction and use. Any floodplain fill would be kept to a minimum and would not interfere with floodflow passage or floodflow storage. Stream crossings would be designed to preclude any streambed or bank damage, and areas associated with temporary stream crossings would be returned to baseline elevations. Site-specific access road improvements and sediment and erosion control measures are described in the individual study area descriptions.

With a few exceptions, access road improvements and primary staging areas would be completed prior to the second 10-week shutdown. Any site preparation activities not completed during that time would take place prior to the second shutdown.

9.2.6.2 Chlorination and Dechlorination

As mentioned above, biofilm removal is the primary activity that would allow for additional capacity in the Catskill Aqueduct during the RWBT temporary shutdown. Therefore, to reduce the amount of biofilm to be removed, and to maintain the aqueduct's restored capacity following biofilm removal and for the duration of the temporary shutdown, chlorine-based chemicals would be added to the aqueduct via a proposed chlorination facility located at Ashokan Screen Chamber and removed via a proposed dechlorination facility located at Pleasantville Alum Plant (see **Figure 9.2-8** and **Figure 9.2-9**, respectively). As discussed above in Section 9.2.3, "Schedule," construction of both facilities would commence in early 2017, and the facilities are anticipated to be completed and in operation by mid-2019 in advance of biofilm removal.

Chemical oxidants and disinfectants such as sodium hypochlorite or chlorine dioxide are commonly used to control biofilm and prevent bacteria growth in water systems. The excess amount remaining after oxidation and disinfection is referred to as a residual.

While both chemicals can be used to control biofilm, during some hydrologic conditions (e.g., late summer when average water temperature is higher), sodium hypochlorite forms a greater amount of disinfection by-products (DBPs) than chlorine dioxide. DBPs are undesirable compounds that form when oxidants react with other naturally occurring materials in the water. Accordingly, chlorine dioxide would be used under such conditions as an alternative to sodium hypochlorite to limit DBP formation.



Figure 9.2-8: Chlorination Facility at the Ashokan Screen Chamber





Existing



Proposed

Figure 9.2-9: Dechlorination Facility at the Pleasantville Alum Plant



Sodium hypochlorite or chlorine dioxide would be introduced into the aqueduct via the new chlorination facility located in the existing Ashokan Screen Chamber. The chemical feed system within the chlorination facility has been carefully designed by DEP to dose sodium hypochlorite or chlorine dioxide, respectively, under two operating conditions:

- (1) Potentially reducing the extent of the biofilm in advance of biofilm removal – this would correspond to maximum doses of 1.25 mg/L for sodium hypochlorite or 0.8 mg/L for chlorine dioxide.
- (2) Maintaining the increased Catskill Aqueduct capacity after biofilm removal to limit regrowth – this would require a lower dose, ranging from approximately 0.25 mg/L to 0.5 mg/L for sodium hypochlorite or chlorine dioxide.

These doses would achieve the goals of the project while limiting the potential for effects to: the City’s water supply (i.e., Kensico Reservoir); Outside Community Connections that rely on the Catskill Aqueduct as a primary or secondary drinking water supply; and private drinking water supply wells. In addition, DEP would work with all water suppliers who receive water from the Catskill System (Outside Community Connections) to implement measures aimed at monitoring and minimizing any potential changes to water supply characteristics as a result of temporary chlorination. These measures may include operational changes by Outside Community Connections to reduce water age² or oxidant use; monitoring of pH, chlorine dioxide, and disinfectant by-products; and addition of a corrosion inhibitor, as applicable (see Section 9.18.2.5, “Public Health”). Furthermore, the temporary chlorination could potentially affect groundwater at two leak locations along the Catskill Aqueduct. DEP is committed to working with well owners to implement an Action Plan for potentially affected private drinking water supply wells, if required (see Section 9.19, “Commitments”).

Additional improvements to support temporary chlorination operations at the Ashokan Screen Chamber would include installation of a new unloading station, site improvements to accommodate chemical delivery trucks, electrical upgrades, and improved stormwater management systems.

Just as adding an oxidant to the aqueduct is key to restoring the aqueduct’s capacity during the RWBT temporary shutdown, its removal is critical to ensuring that all water that enters Kensico Reservoir meets water quality standards. Therefore, sodium bisulfite would be added at a new dechlorination facility at Pleasantville Alum Plant to remove chlorine residual prior to discharge into Kensico Reservoir. Sodium bisulfite is highly effective and is commonly used for the removal of chlorine residual in water. The sodium bisulfite system and chemical storage tanks would be housed in a new building located directly north of the existing Pleasantville Alum Plant building (see **Figure 9.2-9**).

In addition to installation of the dechlorination facility at this location, the repair and rehabilitation would include construction of chemical system upgrades within Pleasantville Alum

² Water age is the term used to describe the amount of time water has been in contact with an oxidant, in this case sodium hypochlorite or chlorine dioxide.

Plant. Currently, the Plant houses an existing dry alum system, which is used to treat the Catskill Aqueduct flows during episodic turbidity events. Episodic turbidity events in the Catskill System are addressed by a combination of reducing flows from Ashokan Reservoir and treating the turbid water with dry alum at Pleasantville Alum Plant. Because of the need to rely more heavily on the Catskill System during the RWBT temporary shutdown, DEP would likely be precluded from reducing flows from Ashokan Reservoir in response to such events. As a result, alum treatment of Catskill System water at Pleasantville Alum Plant would likely be required at a frequency higher than typical during the temporary shutdown. Therefore, an additional separate, liquid alum system would be installed at Pleasantville Alum Plant to supplement the existing dry alum system during turbidity events.

Under typical conditions, if turbidity cannot be managed by operational actions, DEP can add alum to treat Catskill water before it enters Kensico Reservoir under approval from NYSDEC and NYSDOH. Alum may be required to treat any temporary increases in turbidity that may occur as a result of reactivating the aqueduct following shutdowns, during construction and as part of temporary chlorination, which could slough off some biofilm prior to its physical removal. While alum may be added as part of the repair and rehabilitation, the potential for more frequent alum treatment during the RWBT temporary shutdown is analyzed as part of Chapter 10, “Water for the Future Shutdown System Operations.” This new system would likely result in higher than typical deliveries of alum to manage the potential occurrence of turbidity in water diverted from Ashokan Reservoir during the temporary shutdown.

Additional improvements associated with the new dechlorination facility at the Pleasantville Alum Plant site would include electrical improvements, lighting, mechanical equipment, new chemical unloading stations, an expanded internal roadway to accommodate the turning radius of delivery trucks, and improved stormwater management systems.

Construction of these two facilities would begin in 2017. Testing and operations of the chlorination and dechlorination systems would not begin until the necessary leak repairs and/or local dechlorination systems are in place (described below in Section 9.2.6.3, “Leak Repair and Local Dechlorination”). The new chlorination and dechlorination facilities would operate from testing until project completion in 2023. In preparation for biofilm removal during the third 10-week shutdown, chlorination of the aqueduct would temporarily cease several days before the start of the shutdown. This would ensure no chlorine residuals are in the aqueduct when it is unwatered (i.e., to ensure aqueduct water would meet water quality standards for discharge to surface water). A similar suspension in chlorination would occur prior to any subsequent unwatering events from 2019 through 2023. DEP would continue to rely on operational turbidity control measures, as needed with NYSDEC and NYSDOH approval, during water quality events.

9.2.6.3 Leak Repair and Local Dechlorination

Leaks along the aqueduct would be repaired, or have local dechlorination systems installed prior to testing and operation of the chlorination and dechlorination facilities to ensure that no chlorine is introduced to the environment. Similarly, local dechlorination systems would be installed at two connection chambers to dechlorinate water before it enters the City of Newburgh and the Village of New Paltz water supply systems, respectively.

Fourteen identified leaks are located along the upper Catskill Aqueduct in the form of cracks, open joints, or valve leaks.³ These leaks are generally small in magnitude (less than 250 gallons per minute [gpm]), with the exception of one approximately 2,100 gpm leak (Leak 5). The leaks travel to, and appear at the surface in several different manners depending on the type of aqueduct segment that is leaking. At some leak locations, the aqueduct water flows from cracks, joints, or other gaps in the aqueduct. For example, cut-and-cover segments of the aqueduct can have “toe-of-slope” leaks, where aqueduct water flows through small cracks in the concrete wall (or joints), and then seeps from a low point in the earthen berm adjacent to the aqueduct. Water from these types of leaks is visible from several points along the aqueduct’s berm, where the water generally forms pools in low-lying areas before flowing off site. Water from pressure tunnel leaks travels from deeply buried pressure tunnels, and usually bubbles to the surface before flowing away via shallow flowpaths. Finally, valve leaks (which tend to be larger in magnitude than the other leak types) are located within the valve chambers of the aqueduct and generally discharge to local streams or rivers through existing drainage pipes and outfalls.

Repairs are feasible at some leak locations (i.e., valve leaks and cut-and-cover segments), while others require local dechlorination systems to be installed (i.e., pressure tunnel leaks). Similarly, local dechlorination systems would be installed at locations where leak repair measures prove unsuccessful. Limited concentrations of DBPs could potentially enter the surrounding environment at these locations, although natural resources impacts are anticipated to include minor and temporary effects on vegetation at discharge points (see Section 9.18, “Project-wide Impact Analysis”). In addition, local dechlorination systems would be required to remove chlorine from water after it discharges from two connection chambers that provide a source of water supply to the City of Newburgh and the Village of New Paltz, respectively. DEP currently provides water to these communities via connection chambers that discharge water into adjacent surface waterbodies, which are part of the municipalities’ water supply systems.

As discussed above in Section 9.2.3, “Schedule,” DEP would shut down the Catskill Aqueduct for the first 10-week shutdown period in fall 2017 to complete leak repairs. Installation of local dechlorination systems would then be completed in the summer of 2018 (prior to the second 10-week shutdown) at the two connection chambers and sites where leak repair is either not feasible or not successful.

Leak Repair

For leaks that would be repaired, work would be conducted from within the aqueduct or within an aqueduct shaft. Leak repairs would typically include applying grout to cracks or application of a carbon fiber liner to the aqueduct’s inner wall. For larger leaks within pressure tunnel valves at vertical shafts (Leaks 5 and 6), water would remain in the tunnel segment during shutdown. Therefore, internal repairs would be performed by a diver from within the shaft.

As discussed above, leak repair requires unwatering of the aqueduct to access the aqueduct interior. Once unwatered, access to the interior of the aqueduct to carry out the spot repairs would be provided via existing manholes, boatholes, and, in the case of Leaks 5 and 6, pressure

³ Should any additional leaks be identified along the Catskill Aqueduct, DEP will repair the leak or provide local dechlorination.

tunnel drainage chambers. Any segment of the aqueduct undergoing leak repair would have localized biofilm removed first to ensure that the grout or liner is completely bonded to the inner aqueduct surface, and that all cracks are identified and repaired. Leak repair requires sequential activities that include inspection, followed by site preparation, repair, and a curing process for grouting and fiber lining. Therefore, all internal repair construction activities would take place 24 hours per day; 7 days a week to ensure the repairs are completed within the first 10-week shutdown. Once the repairs are made (assuming they are completely successful), the leaks to the surrounding environment would immediately cease. However, DEP would monitor these locations following leak repairs (over the course of several field visits) to verify that aqueduct water ceases to enter the environment. This monitoring could take the form of visual observations (i.e., evidence of dry flowpaths), flow monitoring, or if needed, water quality sampling to determine if the chemical constituents of water resources surrounding the former leak sites are similar to aqueduct water. If the monitoring program confirms the leaks are repaired, no further action at these sites would be required. However, in the event leaks continue, DEP would install local dechlorination systems, as needed, as described below.

Local Dechlorination Systems

In the event that a leak repair is not completely successful, a local dechlorination system would be installed to remove the chlorine residual prior to addition of chlorine to the aqueduct. Additionally, local dechlorination systems would be installed at locations where leak repairs are not feasible, and at the connection chambers in the City of Newburgh and Village of New Paltz. Finally, if potential flows from any new leaks are identified within this study area, local dechlorination systems may need to be installed.

Due to the small scale of the leaks, all but one of the local dechlorination systems at the leak locations would be passive systems that do not require electricity or piping. Depending on the type of leak, the passive dechlorination system would consist of an in-line trench constructed within an existing leak flowpath sized to treat the maximum anticipated flow (see **Figure 9.2-10**). The system would be filled with gravel and granulated activated carbon filters. Alternatively, a dechlorination mat containing tablets of sodium bisulfite would be used at one or more leaks with particularly low flow, instead of activated carbon filters to achieve the same goal. The dechlorinated water would discharge into the existing flowpath and eventually to a naturally occurring receiving waterbody. The systems would be covered to prevent stormwater or debris from entering, and if needed, minor grading at the leak would be undertaken to route stormwater around the dechlorination system to prevent overflows and clogging.

A passive dechlorination system at Leak 5 (located at the Rondout Drainage Chamber) would not be effective, as this leak has a much larger flow than the others. Instead, a sodium bisulfite injection system similar to the proposed dechlorination facility at Pleasantville Alum Plant, but on a smaller scale, would be used at this location. It is anticipated that the Rondout Drainage Chamber would be retrofitted to house this local dechlorination system. This would require installation of piping and pumps, upgrading existing electrical and heating systems, and installation of storage and secondary containment.

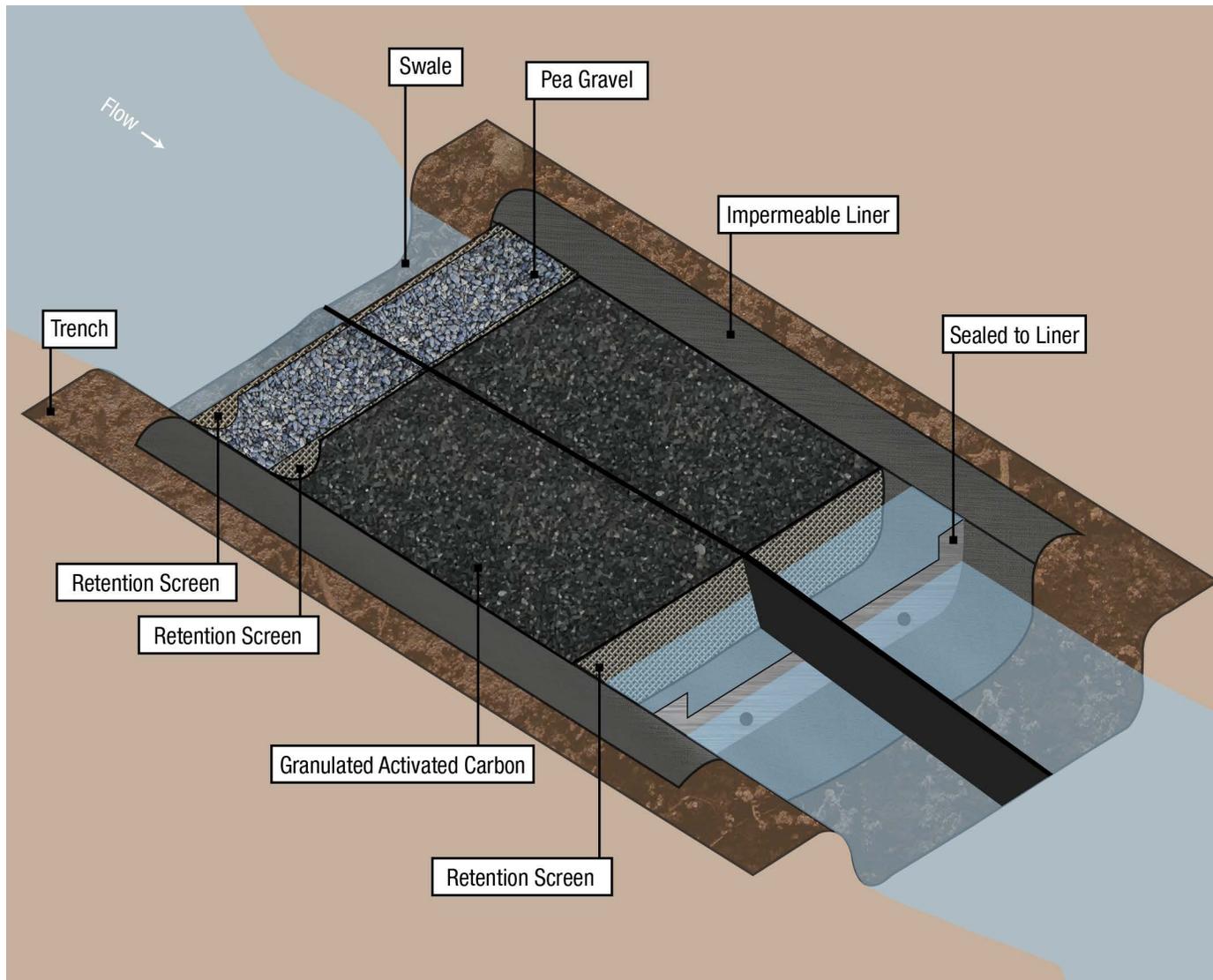


Figure 9.2-10: Local Passive Dechlorination System Schematic



Local dechlorination systems are also proposed for the connections to the water supply systems of the City of Newburgh and the Village of New Paltz. Modifications to these two community taps would be necessary to dechlorinate aqueduct water as it exits the connection chambers. At the New Paltz Connection Chamber, the local dechlorination system would be installed within the pump house building that conveys water from the aqueduct to New Paltz Reservoir. The City of Newburgh Connection Chamber is located in the Town of New Windsor, Orange County, New York.

A dechlorination system would be connected to the aqueduct to remove chlorine residuals before aqueduct water enters Silver Stream.

Site preparation activities would include installation of access roads or paths and staging areas, plus excavation and grading for the placement of the dechlorination systems. Local dechlorination systems would be constructed when the aqueduct is operational, as this work is not dependent upon entry to the aqueduct interior. However, bypass pumping of the existing leak flow around the work area may be required during construction of the systems to provide dry conditions necessary for their construction.

During operation of the passive systems, each of the locations would be routinely visited to conduct minimal maintenance, including inlet cleaning and replacement of the carbon filtration media. These passive systems include a flat panel (e.g., baffle) down the center to direct flow away from the area being maintained while continuing to provide treatment of leak flows. Operation and maintenance activities for the local sodium bisulfite addition systems would include monitoring of the chemical delivery systems and equipment maintenance. Any vegetation observed during this routine maintenance as exhibiting symptoms of chlorine toxicity (e.g., burned or scorched appearance) could be an indication of additional leaks. If testing reveals chlorine residuals, local dechlorination systems would be installed at these additional sites. Water quality monitoring required as part of applicable regulatory requirements or permits would also be conducted, as necessary, during operation of the local dechlorination systems. Therefore, access to the local dechlorination systems would be maintained while they are in operation until the end of the RWBT temporary shutdown in 2023.

Following completion of the RWBT temporary shutdown, chlorination of the aqueduct would cease. These local dechlorination systems would be removed and the associated sites would be returned to baseline conditions.

9.2.6.4 Mechanical and Structural Repairs

A number of mechanical and structural repairs are proposed, both to support restoring capacity to the aqueduct and to contribute to the longevity of the aqueduct and its associated systems. Air vent installation is the main mechanical and structural repair that would support restoring its capacity. Bridge repairs to address structural defects, boathole installation, siphon blow-off replacement and improvements, culvert drain sluice gate improvements, and repairs at the Croton Lake Downtake Chamber would each add to the useful life of the aqueduct, and would also allow DEP to fully unwater the aqueduct in support of biofilm removal and condition assessment. Coupled with these primary mechanical and structural repair activities, structural repairs of the Catskill Influent Chamber would further facilitate biofilm removal and condition

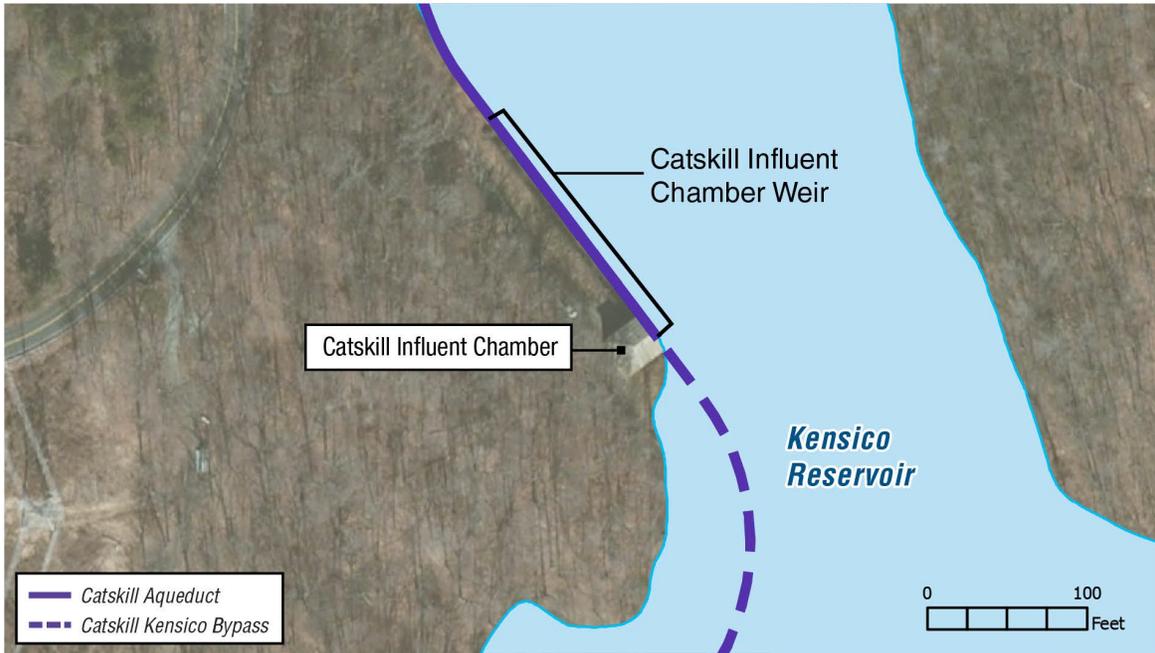
assessment by allowing the aqueduct to be fully unwatered downstream of New Croton Reservoir.

In addition, each of these work activities would contribute to the longevity of the aqueduct's systems. Air vent installation would continue to increase air flow within the aqueduct, new boathole installation would allow for expanded access into the aqueduct to conduct future maintenance, and siphon drain blow-off repairs and culvert drain sluice gate replacement would restore systems used in unwatering the aqueduct to facilitate future work. Similarly, the repair and rehabilitation would include removing sediment from the Catskill Kensico Bypass Tunnel and permanent closure of a damaged manhole in the same section to ensure long-term reliability of the Catskill System, as well as to maintain the integrity of the system's emergency back-up infrastructure.

Mechanical and structural repairs would commence with repairs to the Catskill Influent Chamber in fall 2017, followed by bridge repairs and siphon blow-off replacement and improvements in summer 2018, prior to the second 10-week shutdown. The majority of boathole construction activities (excluding the tie into the aqueduct) would also be completed during this time. Next, during the second 10-week shutdown, the remainder of the mechanical repairs would be completed including air vent installation, boathole tie-in, culvert drain sluice gate improvements, and repairs at the Croton Lake Downtake Chamber. Finally, rehabilitation of the Catskill Kensico Bypass would occur during the third 10-week shutdown (this activity is not required to perform biofilm removal and condition assessment). As noted in Section 9.2.3, "Schedule," an additional shutdown may be required to ensure adequate time to perform all of the mechanical repairs.

Catskill Influent Chamber Concrete Repairs

The repair and rehabilitation activities interior to the aqueduct would require complete unwatering to allow for dry conditions. However, without additional repairs, water would remain in several tunnel segments downstream of the Croton Lake Uptake Chamber. As discussed in Section 9.2.5, "Operation of the Upper Catskill Aqueduct," this is because the bottom (invert) of the aqueduct is below the elevation of Kensico Reservoir in this section. As a result, water from the reservoir flows back into the aqueduct when it is taken out of service. To prevent this backflow during the 10-week shutdowns (as well as future shutdowns), DEP is proposing to conduct an inspection and concrete repairs at the Catskill Influent Chamber to facilitate flashboard installation above the existing concrete weir (see **Figure 9.2-11**). Flashboards are removable vertical boards that would be fabricated off site and installed into grooves in the weir structure. The reservoir would potentially be drawn down approximately 2 feet lower than the maximum operating surface water elevation of 355 feet to an elevation of 353 feet (North American Vertical Datum of 1988). If feasible, the temporary drawdown to facilitate this work would be within the range of normal operating conditions, and could last up to 1 month during fall 2017. However, if this is determined not to be feasible, inspection and concrete repairs would be performed by divers. Flashboards would then be fabricated during the off-season and would be inserted by divers at the beginning of the third 10-week shutdown (and subsequent future shutdowns), thereby preventing backflow into the aqueduct.



■ Items to be installed

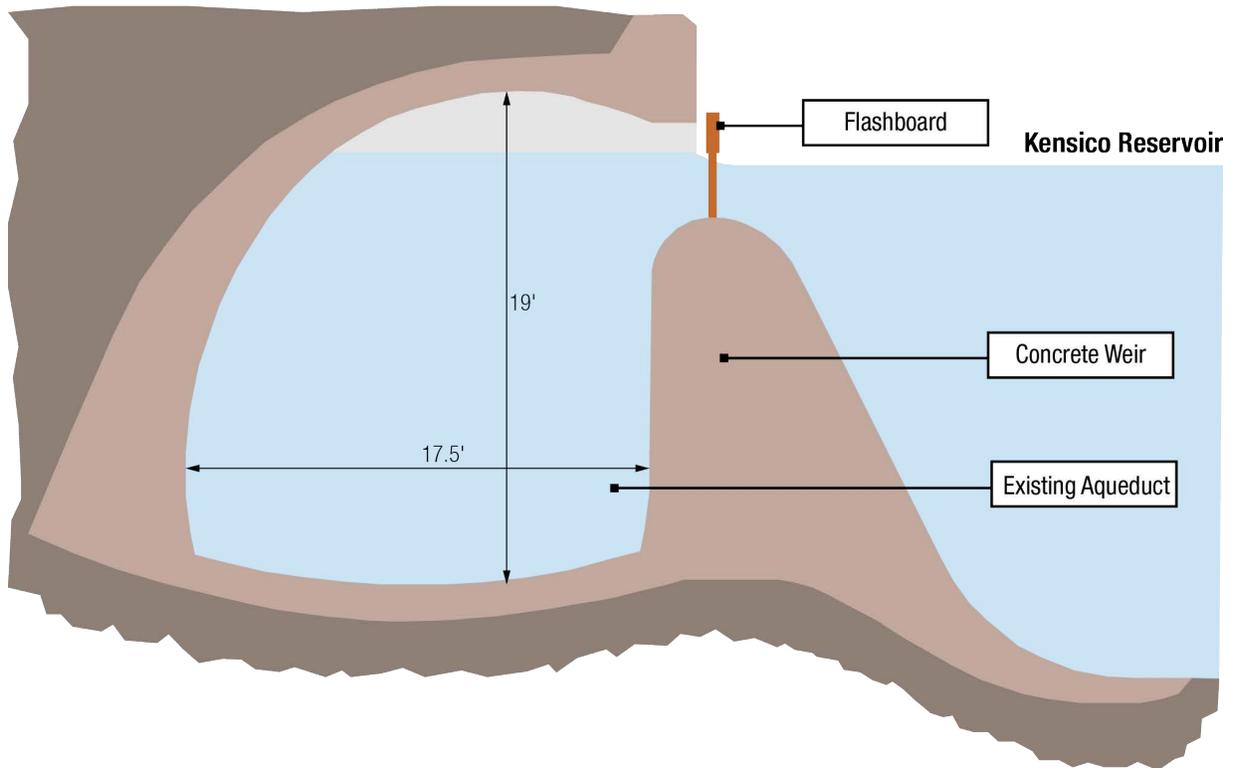


Figure 9.2-11: Catskill Inflow Chamber Concrete Repairs



Bridge Repairs

The Catskill Aqueduct crosses streams via bridge structures (see **Figure 9.2-12**). As part of the repair and rehabilitation, internal and external repairs would be conducted to repair structural defects on the Tongore, Poor Farm Arch, Foundry Brook and Indian Brook bridges to improve their structural integrity and, in turn, extend their longevity. Bridge repair work would entail visually identifying and sounding deteriorated concrete and patching with concrete mortar.

Structural elements such as rebar and steel beams would be inspected for damage. If found to be badly corroded, replacement sections would be spliced in or sections would be reinforced. Surface defects such as cracks, spalls, and gouges on the bridge abutments would be patched with repair concrete.

The bridge structures are typically not suitable to support construction traffic, except for Poor Farm Arch Bridge, as they were designed simply to protect the aqueduct (i.e., not to support additional loads). Therefore, accessing the steel pipe siphon bridge structures during construction may require multiple routes to reach both streambanks. Poor Farm Arch Bridge was originally designed to provide local access via a timber road, although this road is no longer in use.

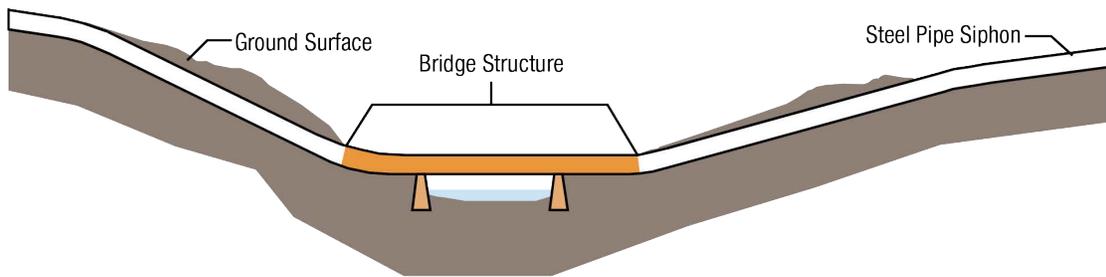
The exterior of the bridge structures can be accessed from the streams below, and, at some sites, would require installation of temporary scaffolding and rigging, or the use of specially-equipped trucks that would allow access to elevated portions of the bridge structures (e.g., snooper trucks). Clearance to the underside of the bridge crossing from the streambed varies from about 18 feet at Tongore, to 10 feet at Foundry Brook to 5 feet at Indian Brook. These external bridge repairs would take place over a period of approximately 4 to 8 weeks per site.

Steel Pipe Siphon Blow-off Repairs

The repair and rehabilitation of steel pipe siphon blow-offs would generally include structural repairs to 12 siphon drain blow-off (blow-off) chambers, replacement of manholes, access ladders, and replacement of the 36 blow-off valves within those chambers and their associated discharge pipes to adjacent streams. This work activity would restore the blow-offs' intended use (i.e., to facilitate steel pipe siphon unwatering), and in turn, would allow for complete unwatering and access for biofilm removal. Furthermore, restoring the operability of these components would facilitate steel pipe siphon unwatering for future maintenance. All work associated with blow-off valve repair would be external to the steel pipe siphons. Therefore, entrance into the siphon would not be required. However, the siphons would have to be unwatered before replacement can occur. There are three siphon pipes at each location. Only one of the three pipes would be unwatered at a time to allow the aqueduct to remain in service. Once the siphon pipes are unwatered, the valve replacement can be completed. Concurrent with the blow-off valve replacement, manhole covers and access ladders would be replaced to ensure consistent access, and concrete defects in the chamber walls and floors that have occurred over time as a result of exposure to weather conditions would be repaired, as needed. The existing blow-off chambers, all of which are deteriorating due to age, would either be replaced or reconstructed.



Typical Siphon Bridge Structure



Typical Bridge Section

Figure 9.2-12: Bridge Repair



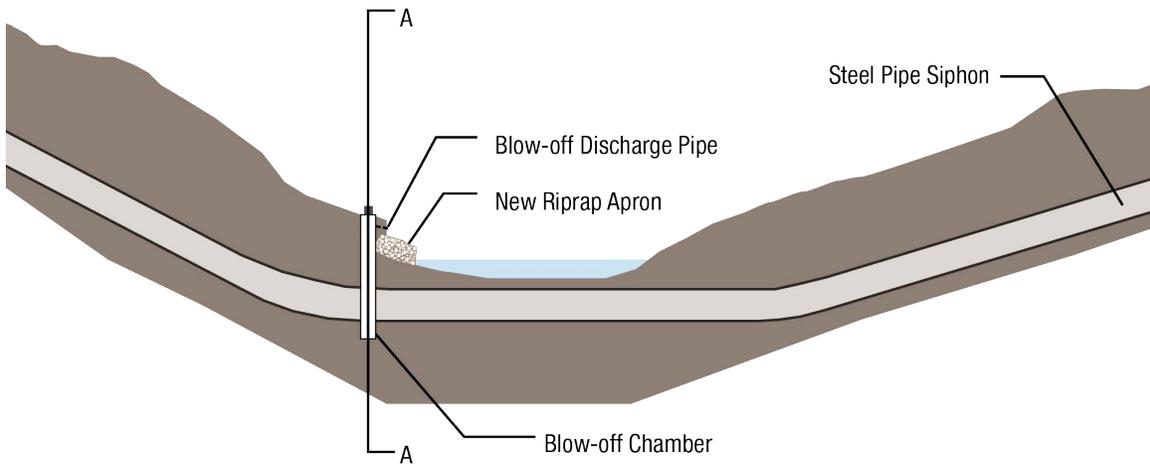
There are two existing configurations of blow-off discharge pipes; under-stream and over-stream (see **Figure 9.2-13** and **Figure 9.2-14**, respectively). Under-stream configurations consist of discharge pipes that daylight through concrete headwalls at the adjacent streambank. More extensive repairs would be required with this configuration, since erosion from historical unwatering has washed away discharge pipes and headwalls, damaged discharge pipes, damaged blow-off chamber exterior walls, and caused substantial accumulation of sediment or other materials within the pipes. In addition, streambank restoration and protection would be necessary at some of these under-stream locations to restore the integrity of the streambank while blow-offs are operated. In particular, this protection would ensure that higher velocities anticipated to occur only upon initial opening of the valves during unwatering events would not result in scouring. Over-stream configurations at the bridge crossing structures, where discharge pipes daylight along streambanks, also have three blow-offs that are used for siphon unwatering. The blow-off chambers are typically located several yards from the stream. During an unwatering event, aqueduct water travels from the chamber through the discharge pipe located in the siphon crossing bridge structure abutment (or retaining wall) and discharges into the stream below. New, larger discharge pipes would be installed to replace the existing pipes. The larger size would decrease the discharge velocity, reducing the potential for future erosion at these locations. Because the discharge velocity would be relatively low for over-stream configurations, and because the streambanks and beds are characterized by a rocky terrain, no streambank improvements are proposed at these locations.

Some siphon drain blow-offs repair sites are located along streams that support trout and can be designated as coldwater fisheries. In-water construction activities are generally prohibited from October 1 to April 30 unless otherwise authorized. While DEP anticipates that the majority of in-water construction activities would occur during the summer months and outside of the October 1 to April 30 prohibition, construction activities may need to occur within the restricted period. If this is required, DEP would implement additional measures to limit potential adverse impacts to natural resources.

Blow-off repairs would take place over a period of approximately 3 weeks at each location, followed by approximately 3 weeks for streambank restoration. The majority of this work would occur prior to the second 10-week shutdown. Following these repairs, both over-stream and under-stream siphon drain blow-offs would be operational during biofilm removal and future operational activities.

Boathole Installation

Existing boatholes are typically located at transitions between two different tunnel segment types (e.g., cut-and-cover tunnels to pressure tunnels) to provide direct access to the aqueduct interior. The number of existing boatholes is currently inadequate to provide sufficient tunnel access for repair and rehabilitation activities. Therefore, new boatholes would be installed at up to 19 locations to increase access to the interior of the aqueduct and allow for the use of larger vehicles and equipment during biofilm removal. Furthermore, construction of the new boatholes would facilitate future long-term maintenance of the Catskill Aqueduct by permanently providing improved access to the aqueduct.



Typical Under-Stream Configuration

- Equipment to be removed and replaced
- Equipment to be removed

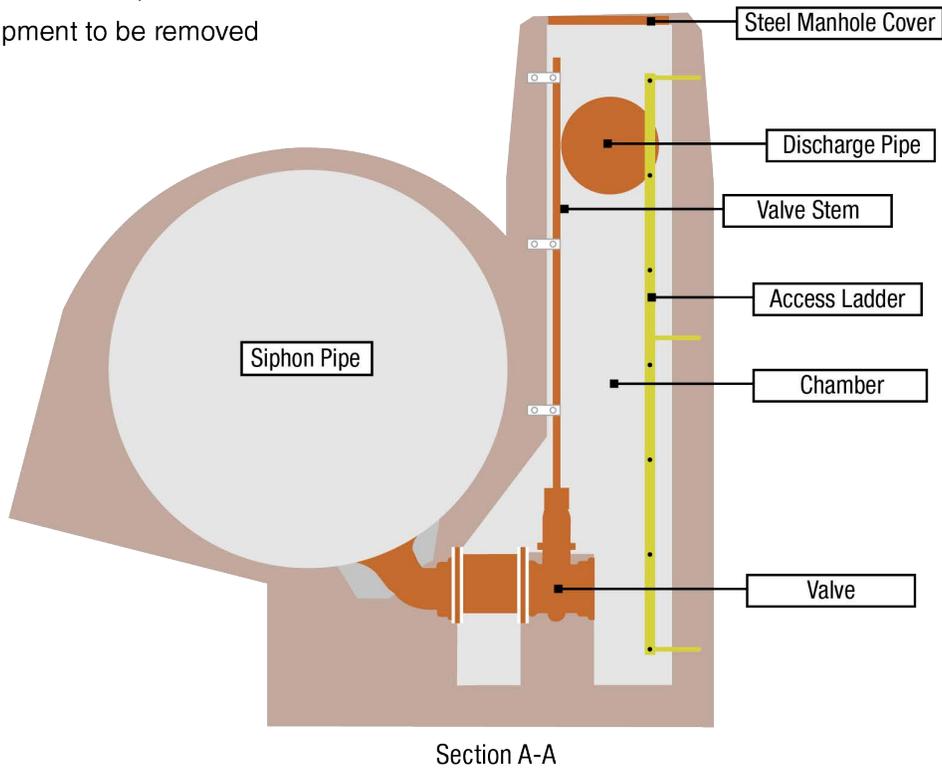
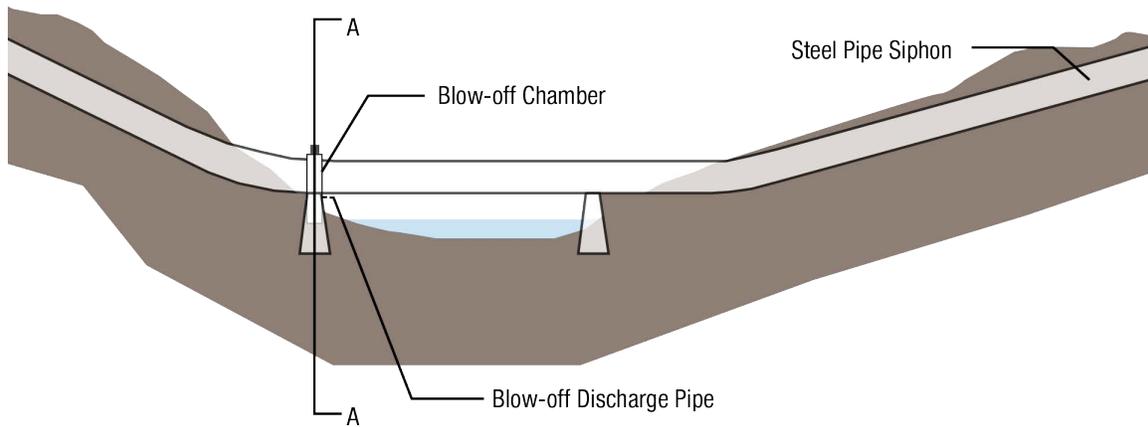


Figure 9.2-13: Siphon Drain Blow-off Valve Repairs – Under-stream





Typical Over-Stream Configuration (Bridge Structure)

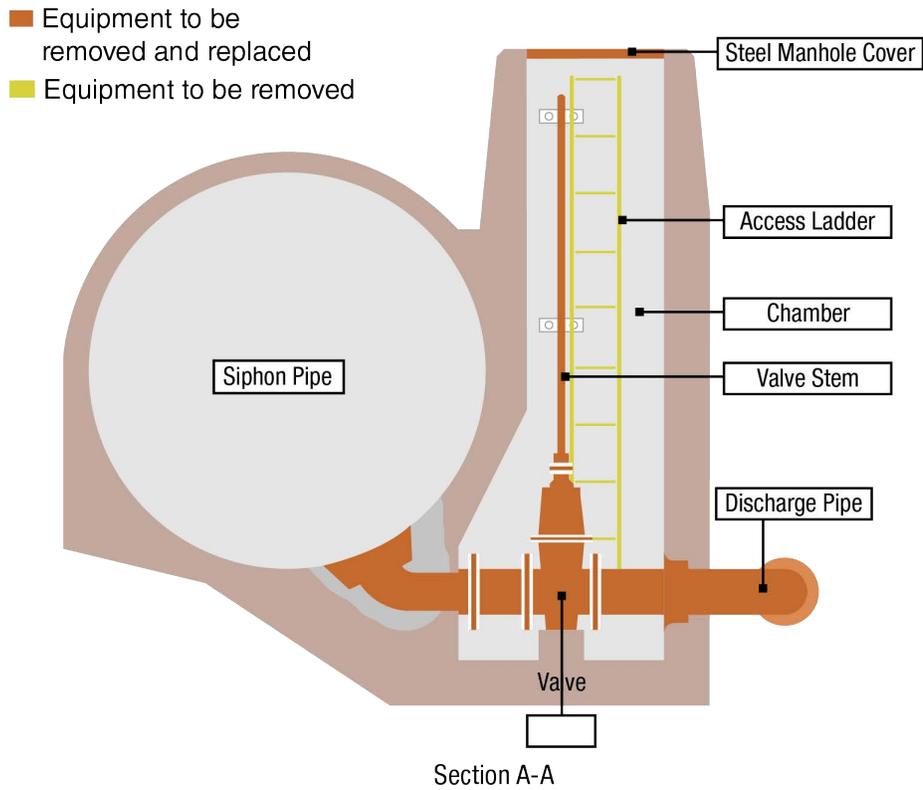


Figure 9.2-14: Siphon Drain Blow-off Valve Repairs – Over-stream



Boathole construction would include excavation of approximately 45 cubic yards of soil from the top of the aqueduct at each location, and construction of a cast-in-place concrete collar to support the cover for each new boathole. Site preparation and collar installation work would occur for approximately 3 weeks at each site while the aqueduct is in service. Then, during the second 10-week shutdown, installation of the boathole would be completed by removing a portion of the crown of the aqueduct to allow direct access to the tunnel interior. A pre-cast cover would then be placed over the boathole to seal the opening (see **Figure 9.2-15**). This work would occur for approximately 2 weeks at each site.

Air Vent Installation

Free flowing air travelling through the aqueduct is required to prevent pressurization or vacuum conditions, which contribute to reduced aqueduct capacity. For this purpose, air vents were constructed at all steel pipe siphon chambers and at four pressure tunnel facilities on the upper Catskill Aqueduct as part of the original design. However, because there are some locations along the aqueduct for which air vents were designed but never constructed, or where existing air vents are inadequate, additional vents are proposed. Therefore, installing new vents at these seven key locations would, in conjunction with biofilm removal, facilitate restoration of the aqueduct's historical capacity.

The vents, which would be removable to allow for future entry into the aqueduct, consist of double 90-degree "gooseneck" elbows constructed of standard 30-inch diameter steel pipes (see **Figure 9.2-16**). The new vents would be pre-fabricated structures mounted on concrete slabs that would either replace existing concrete slabs at uptake and downtake chambers or existing metal plates at boatholes. All work would be conducted at existing DEP facilities located on the top of the aqueduct. Vent installation at each of these sites would require some minor excavation to ensure the concrete base is properly secured and is anticipated to be conducted over approximately 15 days.

Culvert Drain Sluice Gate Replacement

Replacing culvert drains in-kind at certain locations would restore these systems' intended use for unwatering, and would, in turn, facilitate biofilm removal. Along the cut-and-cover segments of the aqueduct, the original design included drains at certain locations where culverts were constructed beneath the aqueduct. In total, there are 33, 10-inch diameter culvert drain sluice gates spread out along the 74-mile aqueduct. The sluice gates, when opened, allow aqueduct water to drain into the underneath culvert and into streams or drainage channels. Many of these sluice gates have never been used and are in varying conditions. Unlike blow-off valves, the sluice gates are unlikely to be used for drainage in the future, specifically the sluice gates located between Ashokan Reservoir and the Croton Lake Downtake Chamber, since the aqueduct can fully drain in this section without them. It is proposed to seal these 27 sluice gates with a permanent covering (e.g., blind flange), which is a metal plate that can be secured to the end of the drainpipe. At these locations, the sluice gates would be permanently decommissioned.

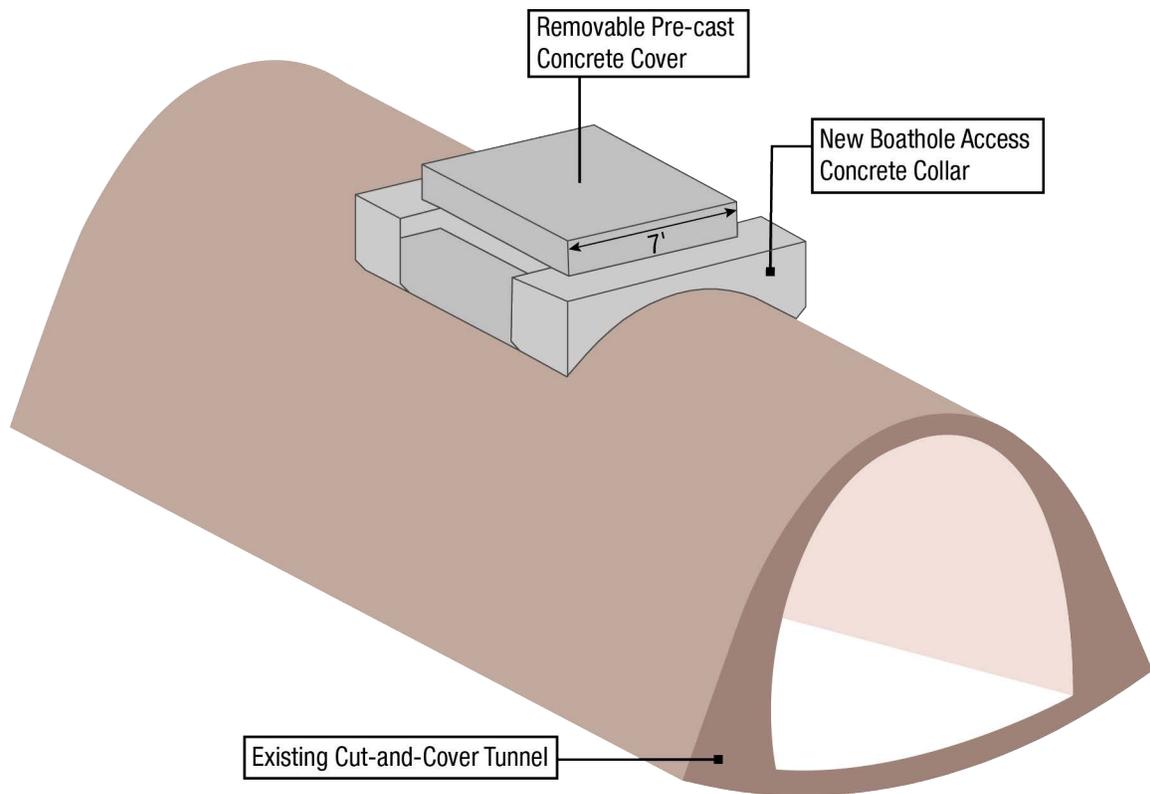


Figure 9.2-15: Boathole Installation



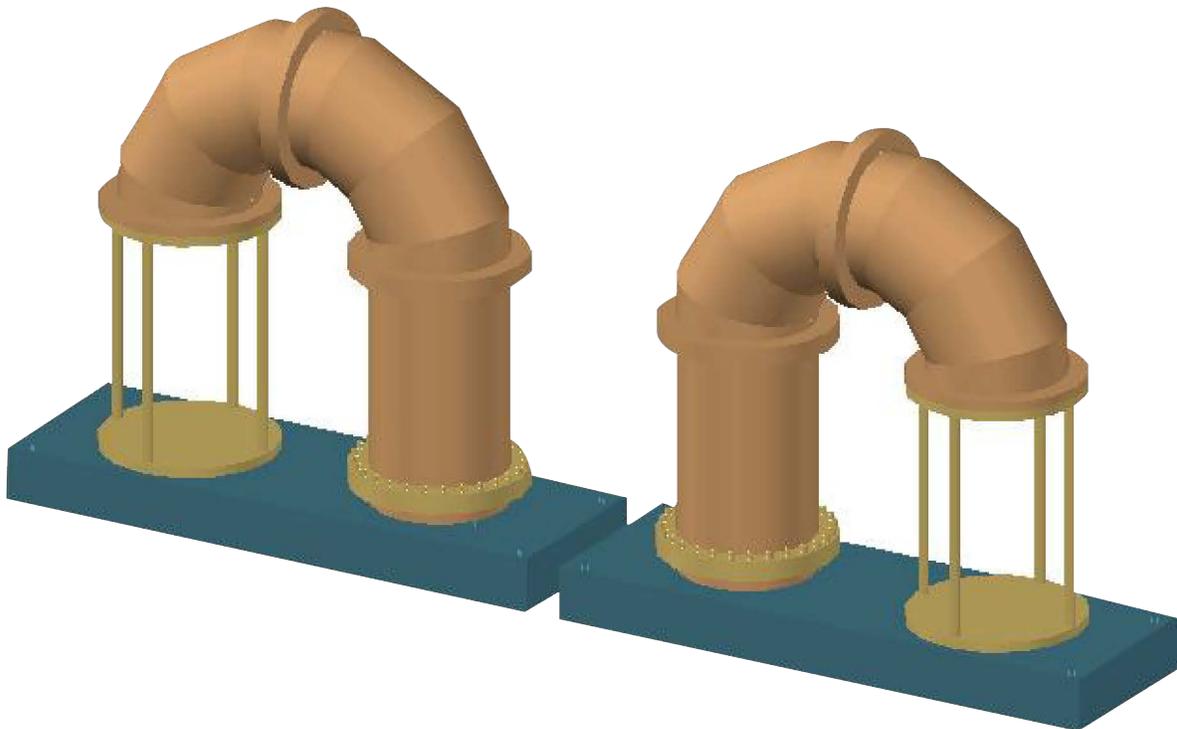
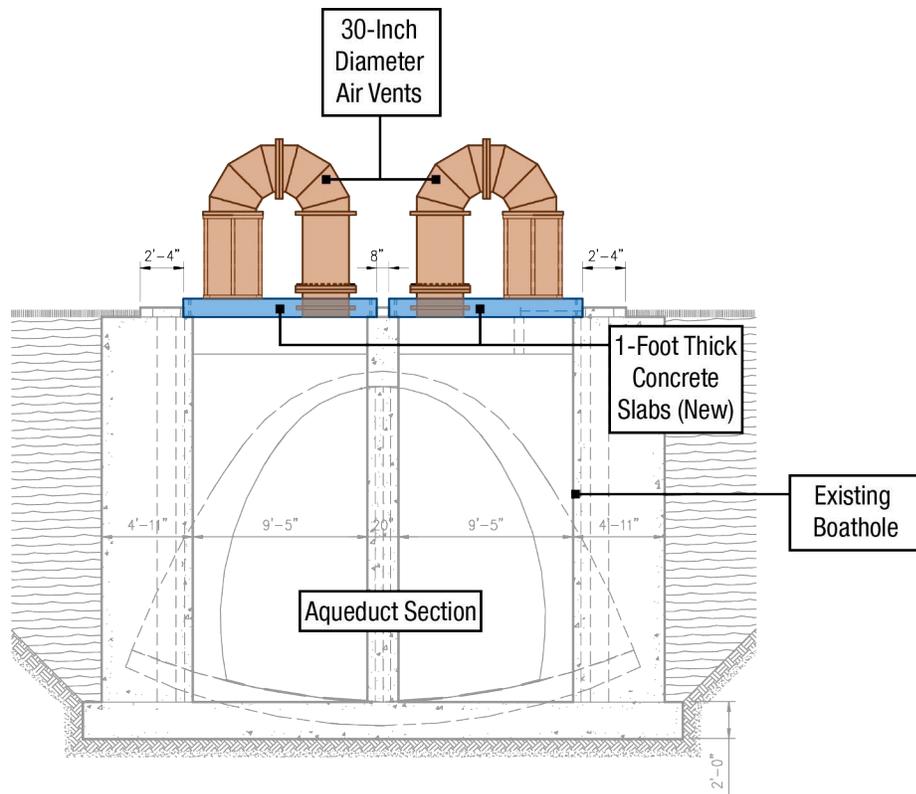


Figure 9.2-16: Air Vent Installation Example



However, the remaining six sluice gates located between the Croton Lake Uptake Chamber and Kensico Reservoir may be needed for future drainage and would be replaced in-kind (see **Figure 9.2-17**). For the six sluice gates that would be replaced in-kind, streambank restoration and protection would be necessary to repair existing and minimize future bank erosion while the sluice gates are operated. Similar to under-stream blow-off valve replacement locations, this would include regrading and the installation of riprap aprons to restore its original condition. The quantity of riprap placed would be the minimum necessary to preclude streambank and bed scouring and would not interfere with aquatic life passage.

Similar to siphon drain blow-offs repair sites, the timing of in-water construction is restricted for streams that can be designated as coldwater fisheries. One stream at a culvert drain sluice gate has a coldwater fisheries designation and requires a full diversion. However, DEP would complete this work outside of the coldwater fisheries window (e.g., during the summer months). Sluice gate repairs would take place over a period of approximately 3 weeks at each location, followed by approximately 1 week for streambank restoration. The majority of this work would occur during the second 10-week shutdown. Following these repairs, the six sluice gates with streambank restoration and protection would be operational during biofilm removal and future operational activities.

Croton Lake Downtake Blow-Off Repairs

The Croton Lake Downtake Chamber consists of a 14-foot diameter shaft that connects the Turkey Mountain Grade Tunnel to the Croton Lake Siphon and allows the Catskill Aqueduct to pass under New Croton Reservoir. In addition, the Croton Lake Downtake Chamber contains two 60-inch diameter cast iron gate valves that are connected to a blow-off that allows water from the Catskill Aqueduct to be discharged to New Croton Reservoir (see **Figure 9.2-18**). A 5-foot by 5-foot sluice gate in another blow-off conduit also allows discharge of Catskill Aqueduct water to New Croton Reservoir. This sluice gate would also require removal and replacement and concrete repairs. All mechanical repairs would consist of replacement in-kind as part of the repair and rehabilitation.

The two 60-inch diameter blow-off valves are located approximately 95 feet below the floor, and would require partial unwatering of the shaft for replacement. The aqueduct would drain by gravity up to a point, but water would remain in the downtake shaft and would need to be pumped out to allow work on the 60-inch blow-off valves. These replacements would take place over a period of approximately 10 weeks during the second 10-week shutdown.

Catskill Kensico Bypass

Sediment removal from within the Catskill Kensico Bypass and decommissioning of an existing manhole are proposed to preserve the function of the bypass for emergency water supply and to repair a known structural deficiency, respectively (see **Figure 9.2-19** and **Figure 9.2-20**). The Catskill Kensico Bypass was operated intermittently under various circumstances in the past. This includes when Kensico Reservoir water quality had become degraded due to a severe storm event (i.e., hurricane or tropical storm) or if it became necessary to perform repairs on the numerous facilities that comprise the Reservoir's water supply infrastructure. An inspection of this segment identified a buildup of sediment along its length.

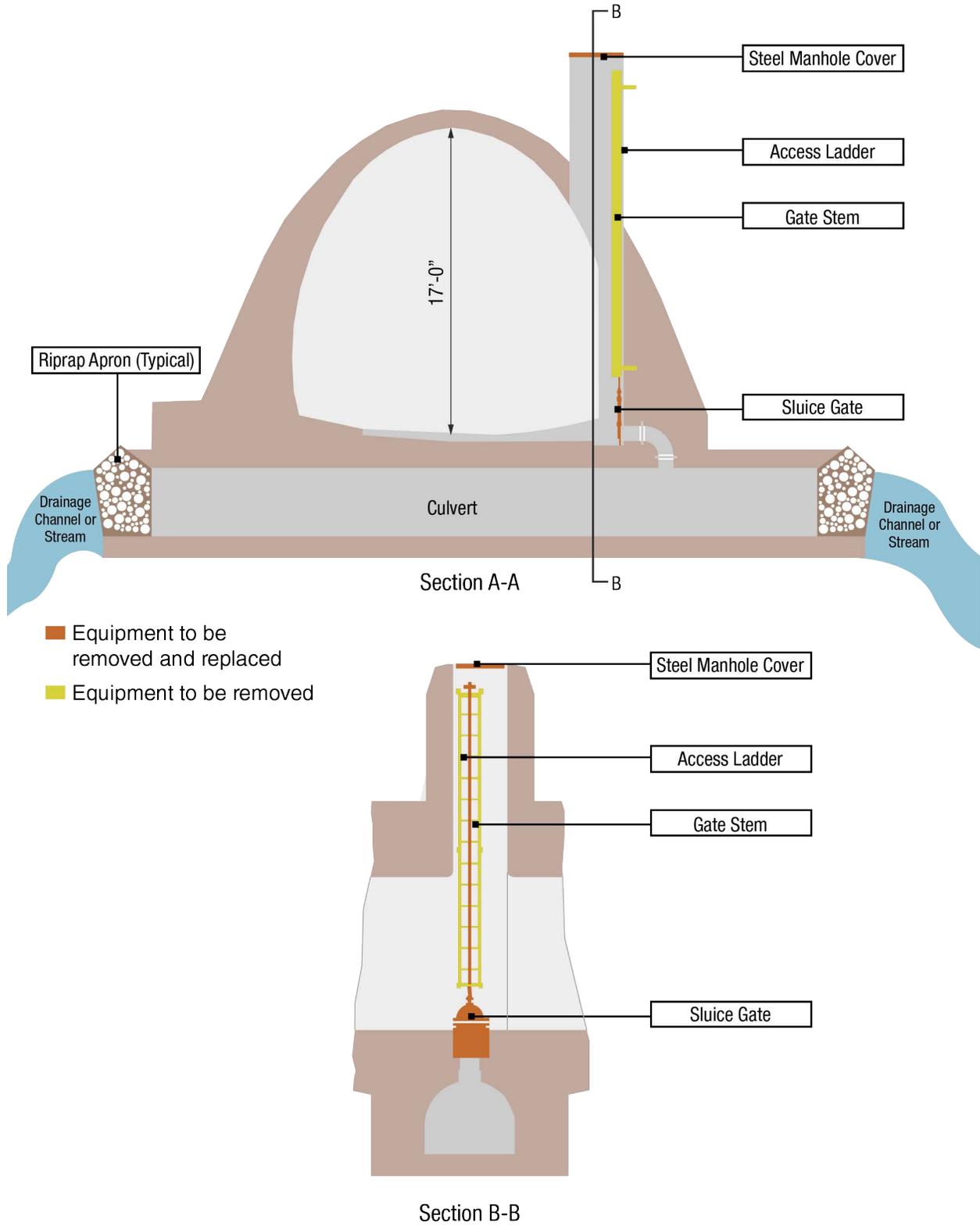


Figure 9.2-17: Culvert Drain Sluice Gate Repairs



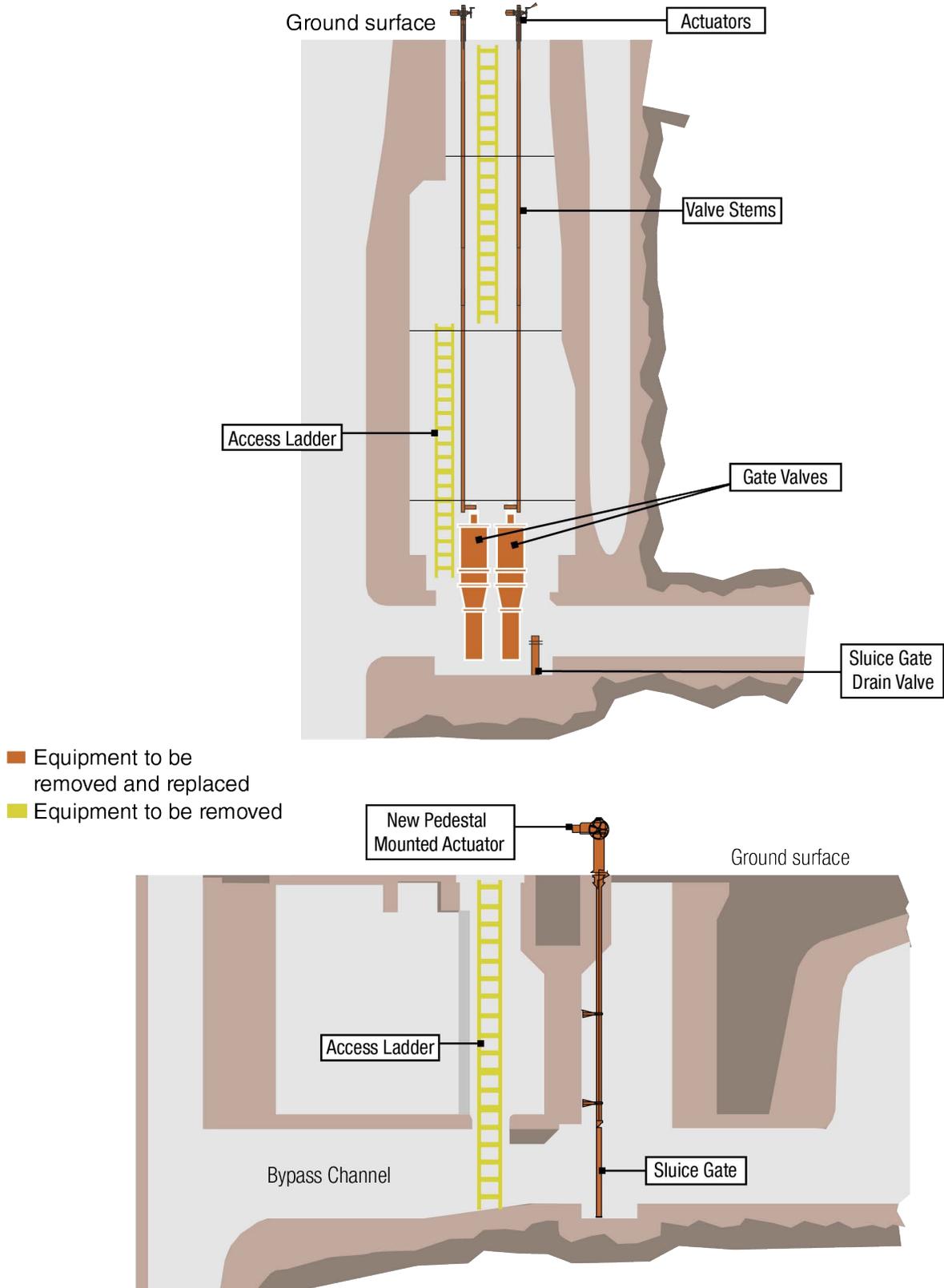


Figure 9.2-18: Croton Lake Downtake Chamber Repairs



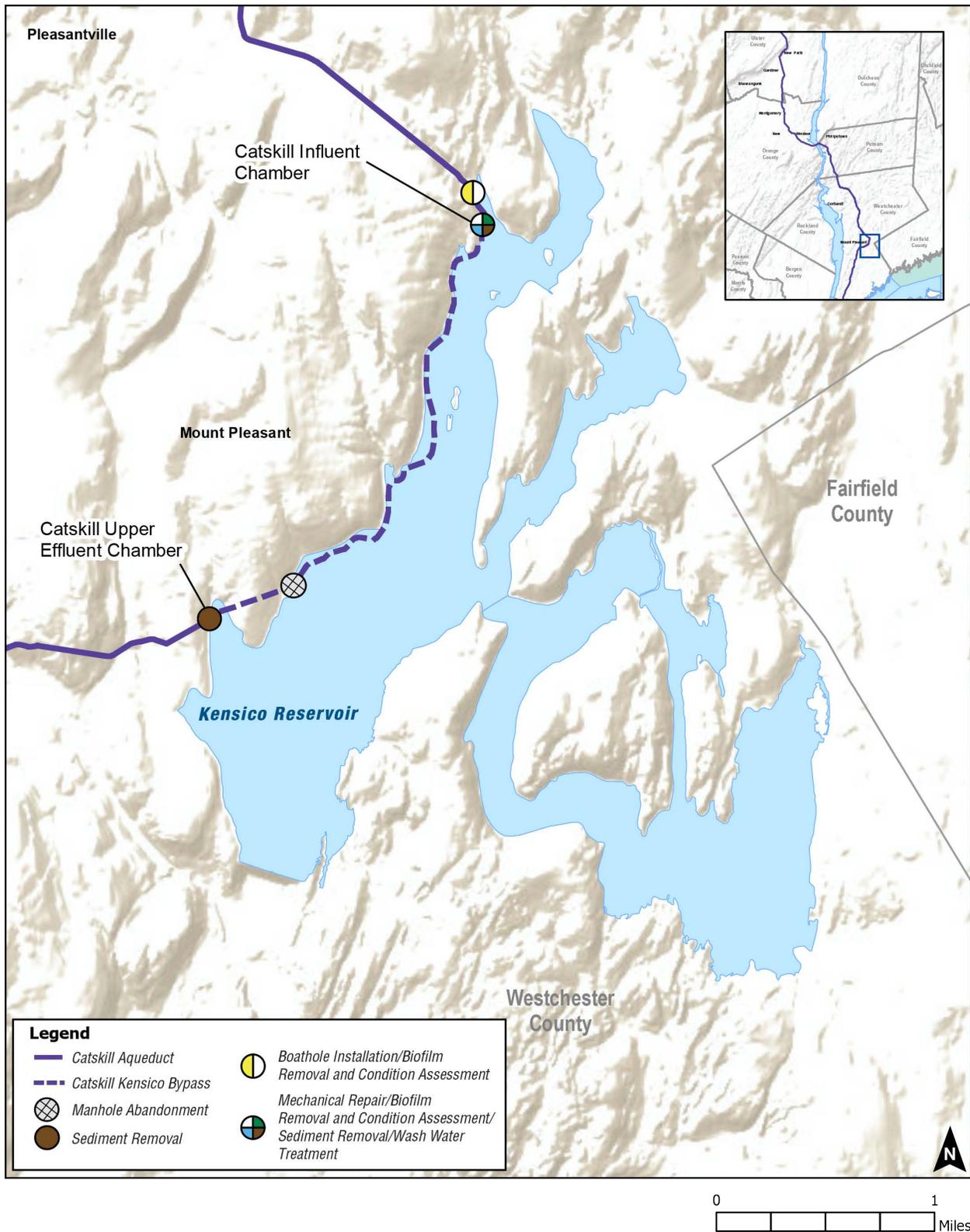


Figure 9.2-19: Catskill Kensico Bypass Location



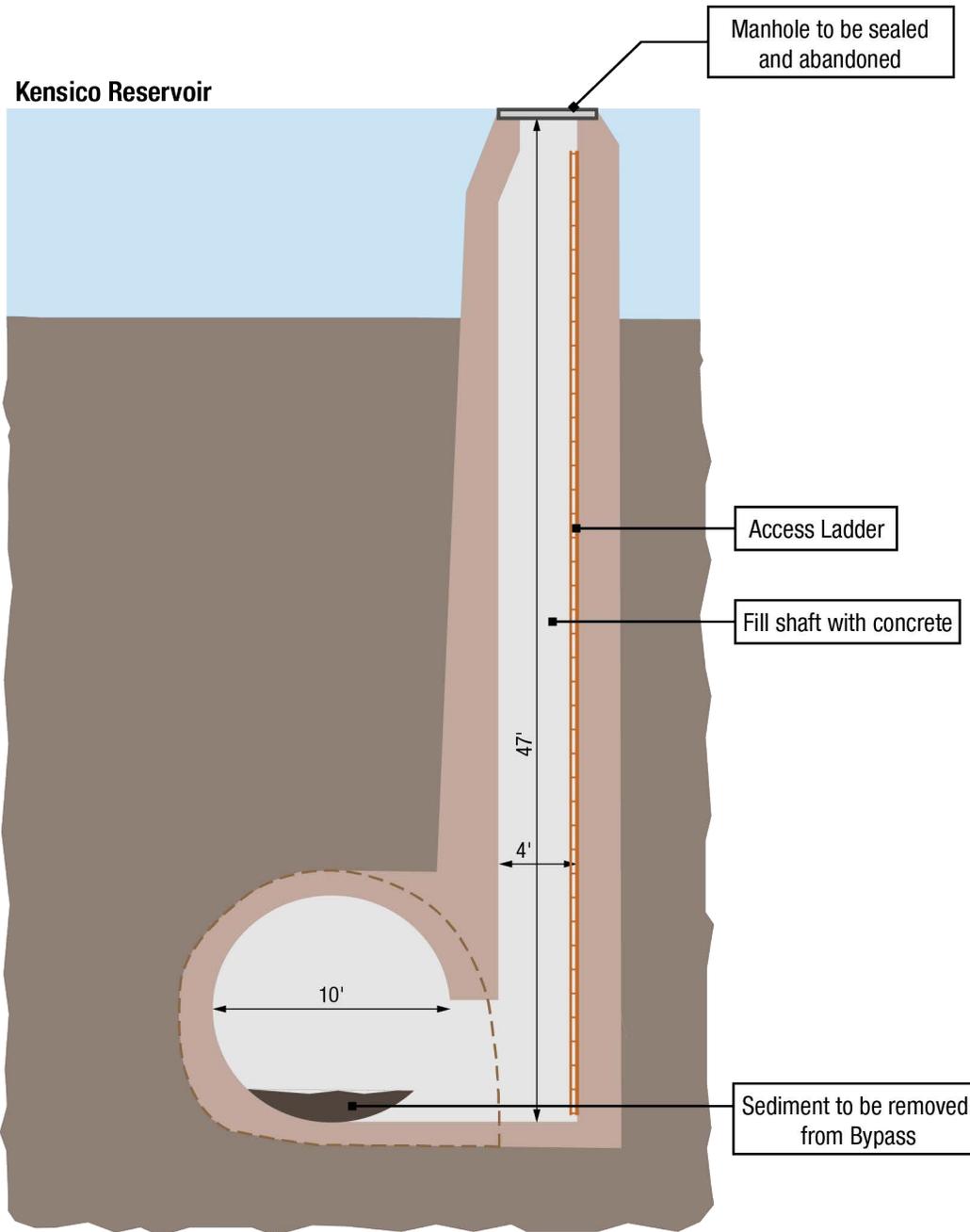


Figure 9.2-20: Catskill Kensico Bypass Sediment Removal and Manhole Abandonment



Sediment removal would require excavation by a mini track loader that would be lowered into the bypass tunnel via the Catskill Influent Chamber located upstream. The sediment could be extracted from the Catskill Influent Chamber, or be transported to an extraction point at either an access manhole or the Kensico Upper Effluent Chamber by the mini loader or a muck container hauled by a small electric or diesel powered vehicle. Vacuum trucks at the surface would suction the sediment from within the tunnel to be carted off site for treatment and disposal. Access to the tunnel to perform this work would be provided by the Catskill Influent Chamber, manhole, and/or the Catskill Upper Effluent Chamber. Following sediment removal, a detailed condition assessment of the bypass tunnel interior would be performed to identify required repairs.

In addition, abandoning this access manhole is required to ensure long-term structural safety of the Catskill Kensico Bypass. The access manhole was originally located on the shore of Kensico Reservoir between the Catskill Influent Chamber and the Catskill Upper Effluent Chamber. However, wind-induced shoreline erosion has resulted in the shoreline migrating landward, and the manhole is now located several feet into the reservoir. Due to its position in the reservoir, the manhole is not easily accessible, nor is the manhole required for access or maintenance any longer. As part of the repair and rehabilitation, this manhole would be permanently sealed by filling the shaft with concrete and leaving the bypass intact. If feasible, the reservoir would potentially be lowered to facilitate this work. Similar to the reservoir drawdown during Catskill Influent Chamber Concrete Repairs, the reservoir would be drawn down approximately 2 feet lower than the maximum operating surface water elevation of 355 feet to an elevation of 353 feet (North American Vertical Datum of 1988) to facilitate this work. This drawdown would be within the normal operating range for the reservoir, and would last approximately 1 month during fall 2019, to briefly expose the manhole's infrastructure to facilitate these repairs. However, if this is determined not to be feasible, the manhole abandonment work would be performed with a cofferdam in place.

9.2.6.5 Biofilm Removal and Condition Assessment

Biofilm removal, the primary activity that would restore the aqueduct's capacity during the RWBT temporary shutdown, is the final work activity that would occur as part of the repair and rehabilitation. In addition to restoring the aqueduct's capacity during the RWBT temporary shutdown, biofilm removal would provide an opportunity to conduct a full condition assessment and, if feasible, conduct repairs that would help ensure the longevity of the aqueduct. Access to the aqueduct for biofilm removal would be provided by access manholes, new and existing batholes, downtake chambers, and other locations that allow entry into the aqueduct.

Once unwatering is complete and access to the tunnel is established, crews would enter the interior of the aqueduct where biofilm removal is proposed, including along cut-and-cover, grade tunnels, and steel pipe siphons. Potential methods of biofilm removal include scraping, vacuuming, or pressure washing. Pressure washing is assumed in the analysis, as removal and treatment of wash water used in the biofilm removal presents the reasonable worst-case scenario. Workers would proceed with the removal process in segments that would be isolated from the upstream and downstream areas of the aqueduct through installation of temporary dams. These temporary dams would be placed immediately upstream and downstream of each work segment to control any residual aqueduct water, groundwater infiltration, or biofilm wash water used within the segment,

if any (see **Figure 9.2-21**). Any of the upstream water which is not required for biofilm removal would be conveyed downstream using a pipe to bypass the work area. Alternately, the upstream source water would be allowed to enter the work segment to use as wash water, if required for use during biofilm removal. After biofilm is removed from the aqueduct walls, it would be collected at the same locations that were used to access the aqueduct. To collect the biofilm removed from the aqueduct interior, wash water would be used to carry the biofilm downstream to the next (downstream) collection point. Alternately, if wash water is not used, a small vehicle would be loaded with the biofilm and transported within the aqueduct to the next downstream collection point (see **Figure 9.2-21**). The biofilm could then be lifted from the interior of the aqueduct to the ground surface using various methods, including pumping, an industrial vacuum, or a mobile crane. The biofilm would then be hauled to a registered, permitted, or otherwise authorized disposal facility. Based on previous testing, the biofilm material is considered non-hazardous.

As biofilm is being collected from the aqueduct, treatment of any water used during the removal process would occur at one of five proposed large-scale wash water treatment locations. Each of these treatment locations would be located before the start of a pressure tunnel or Kensico Reservoir: Peak Road Boathole, Wallkill Downtake Chamber, Moodna Downtake Chamber, Croton Lake Downtake Chamber, and Catskill Influent Chamber. These treatment systems would all be located in the vicinity of proposed boatholes within areas of flat, cleared land. Alternatively, wash water could be treated at one of the small-scale wash water treatment systems located at each of the 10 steel pipe siphons and certain boatholes. At access points that do not coincide with one of these treatment locations, wash water would either be hauled or routed through a bypass pipe to the nearest downstream treatment location.

Treated wash water would be discharged back into the aqueduct downstream of the wash water removal operation, or into nearby waterbodies. The temporary treatment systems would treat wash water to meet water quality standards for both scenarios. Furthermore, if discharged to nearby streams, treated wash water discharge flows are not anticipated to result in erosion or scouring to the bed or banks of the receiving watercourse, primarily because streambank restoration and protection measures would be in place.

Once the biofilm in a given active work segment (typically 300 feet long) has been removed, crews would move downstream to the next segment. It is anticipated that biofilm would be removed from two 300-foot work segments per day, or approximately 600 feet of tunnel per 12-hour shift. Following biofilm removal of each tunnel segment, a condition assessment would be performed within the same aqueduct segment. Each segment would be evaluated to document defects including any water inflow, spalling and/or root penetration, and to categorize repair areas. If feasible, repairs would be undertaken as part of the repair and rehabilitation.

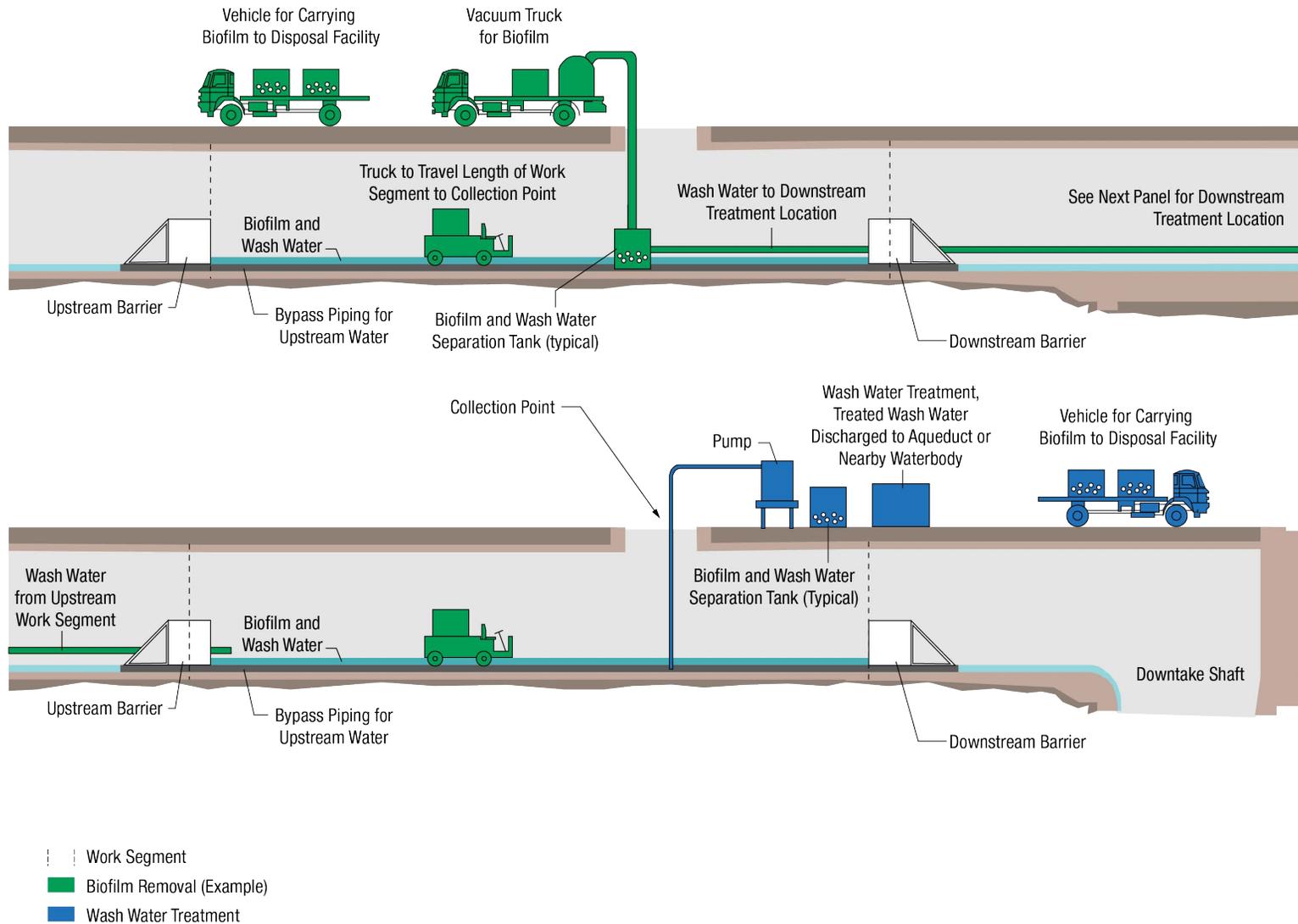


Figure 9.2-21: Example Biofilm Removal and Wash Water Treatment Sequence of Activities



9.2.7 CATSKILL AQUEDUCT REPAIR AND REHABILITATION STUDY AREAS AND ACTIVITIES

The potential impacts associated with the repair and rehabilitation activities would take place in 37 study areas along the length of the upper Catskill Aqueduct. The project spans 14 municipalities in 4 counties: 5 in Ulster County, 2 in Orange County, 2 in Putnam County, and the remaining 5 in Westchester County (see **Figure 9.2-7**). The activities evaluated within these study areas and described above include: construction of staging areas and permanent access roads to select sites, construction and operation of a chlorination facility at Ashokan Screen Chamber and a dechlorination facility at Pleasantville Alum Plant; leak repairs and installation and temporary operation of local dechlorination systems; sediment removal to restore capacity of the Catskill Kensico Bypass; mechanical and structural repairs to restore systems used in unwatering the aqueduct; air vent installation; construction of new boatholes; rehabilitation of bridge structures; and biofilm removal and treatment. A description of the study areas and activities within each study area are included in Section 9.4, “Town of Olive,” through Section 9.17, “Village of Pleasantville.”

9.3 SCREENING ASSESSMENT AND IMPACT ANALYSIS METHODOLOGY

The purpose of the repair and rehabilitation is to increase and maintain the Catskill Aqueduct's capacity during the temporary shutdown of the Rondout-West Branch Tunnel (RWBT) and rehabilitate the aqueduct to increase its serviceable life. The repair and rehabilitation would occur at multiple locations in multiple towns along the approximate 74-mile stretch of the upper Catskill Aqueduct. For this reason, individual study areas were defined around work sites warranting analysis. A total of 37 study areas were identified for the proposed repair and rehabilitation activities (see **Figure 9.3-1**). Because the proposed work activities and environment differ among study areas, a screening assessment was conducted to determine which environmental resources have the potential to be affected by the proposed activities at each study area. This section describes how the study areas were identified, the screening assessment methodology and results, and the methodology applied to assess each impact category identified as requiring an analysis.

Many activities associated with increasing the Catskill Aqueduct's capacity in advance of the RWBT temporary shutdown period would be temporary. The activities with temporary effects would include: developing construction staging areas; biofilm removal and condition assessment; construction and use of the chlorination facility at Ashokan Screen Chamber to remove and inhibit the regrowth of biofilm; and construction and use of a dechlorination facility at Pleasantville Alum Plant and dechlorination systems at locations where repairs to leaks are not feasible or completely successful.

Other activities to support the capacity enhancements and rehabilitation of the aqueduct would have permanent effects. These include improving access roads (e.g., tree removal, grading, culvert repairs), repairing specific leaks, completing mechanical repairs, constructing new structures or rehabilitating existing structures including air vents, boatholes, bridge crossing structures, restoring systems used in unwatering the tunnel, and restoring functionality of the Catskill Kensico Bypass.

Three analysis periods were analyzed to determine the potential effects from construction and operation of the repair and rehabilitation. These include the period of construction and two separate operating conditions, defined as temporary chlorination and operation (see **Table 9.3-1**). Construction associated with the repair and rehabilitation would occur from 2017 through 2020, and potential impacts were analyzed for the timeframe in which the proposed work would occur. For example, leak repairs would occur during the first 10-week shutdown in 2017, whereas biofilm removal and condition assessment would occur during the third 10-week shutdown in 2019. Temporary chlorination refers to the period from 2019 through 2023 when the aqueduct would be chlorinated to inhibit biofilm growth. This would encompass operating the chlorination facility at Ashokan Screen Chamber and dechlorination facility at Pleasantville Alum Plant and operating the local dechlorination systems. Operation refers to the period following 2023, when operation of the Catskill Aqueduct would return to baseline conditions and the aqueduct would no longer be chlorinated. Therefore, the potential temporary effects resulting from construction, temporary chlorination, and the potential long-term operational effects resulting from the permanent cessation of leaks and permanent enhancements were evaluated. With the exception

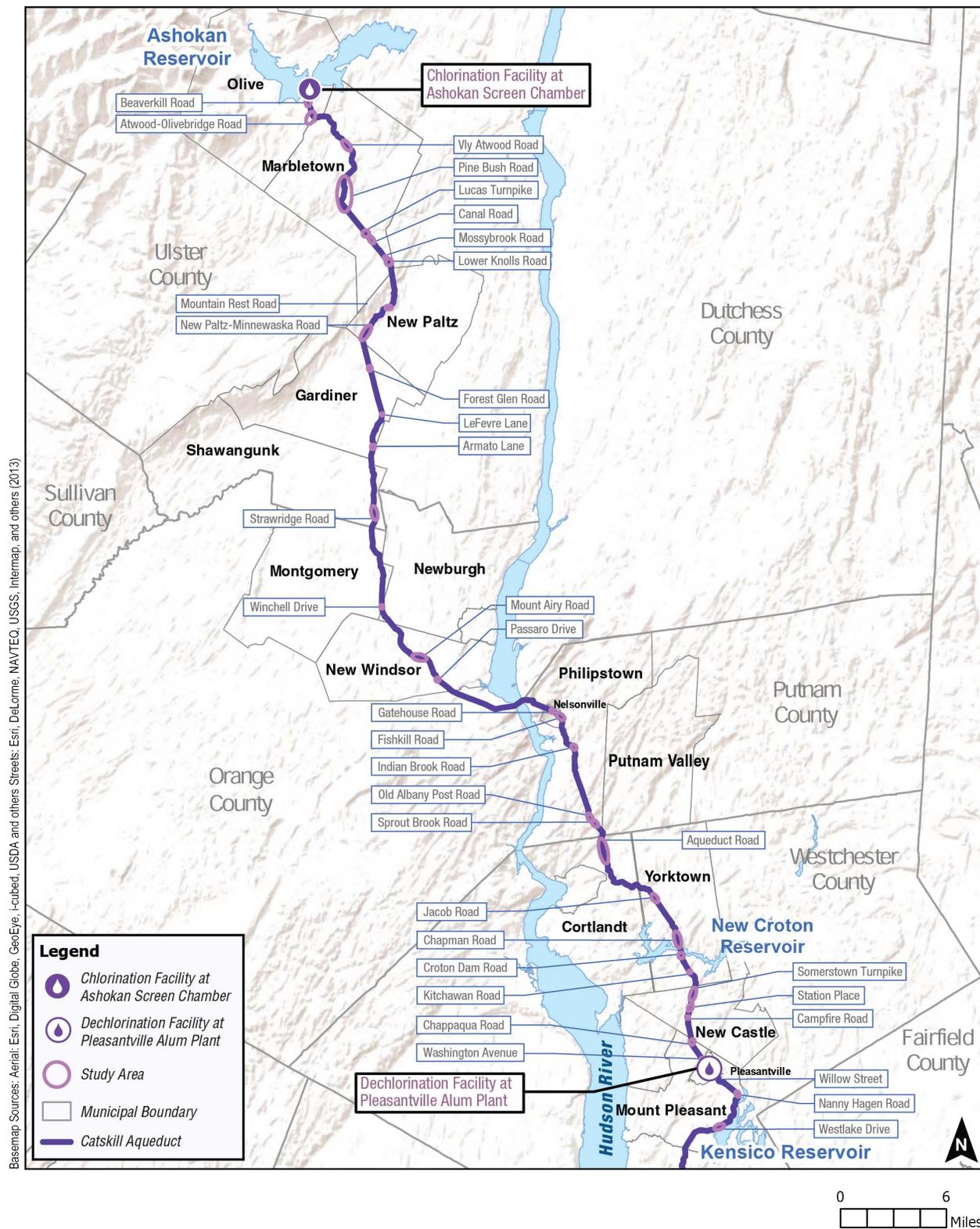


Figure 9.3-1: Catskill Aqueduct Repair and Rehabilitation Study Areas



Table 9.3-1: Repair and Rehabilitation Construction and Operational Analysis Periods

Activity	Construction	Temporary Chlorination	Operation
Site Access Improvements and Staging Areas	2017 to 2020	Not applicable	2020: All temporary construction areas returned to baseline conditions
Chlorination and Dechlorination	2017 to 2018	2019 to 2023	Not applicable
Leak Repair	2017 (During first 10-week shutdown)	Not applicable	2017: Leak cessation
Local Dechlorination	2018 (Prior to second 10-week shutdown)	2019 to 2023	Not applicable
Mechanical and Structural Repairs	2018 (Prior to and during second 10-week shutdown)	Not applicable	2018
Biofilm Removal and Condition Assessment	2019 (During third 10-week shutdown)	Not applicable	Not applicable

of permanent repairs, long-term operation of the Catskill Aqueduct would be consistent with baseline conditions and construction areas temporarily disturbed (e.g., staging areas, local dechlorination systems) would be restored following construction and temporary chlorination.

9.3.1 DEFINITION OF STUDY AREAS

Because the repair and rehabilitation would occur at multiple locations in multiple towns along the approximate 74-mile stretch of the Catskill Aqueduct, study areas were circumscribed around work sites warranting analysis. One study area was circumscribed around multiple sites where several activities would occur within a close geographic area within the same municipality, and where activities would occur from workers traveling between work sites along the aqueduct. Within each study area, the potential for impacts was evaluated for the following types of repair and rehabilitation work activities (see **Table 9.3-2**):

- Chlorination and dechlorination facilities, new air vents, new boatholes, leak repair and/or local dechlorination systems, bridge repair, mechanical repairs with external modifications, and wash water treatment systems.
- Primary and secondary staging areas where workers from multiple sites would converge before traveling to the work sites. For example, the Armato Lane Study Area, described further in Section 9.7.5, “Armato Lane Study Area Impact Analysis,” would be the location of a primary staging area for the duration of construction (2017 to 2020) even though clearing or grading is not anticipated at this location.

Table 9.3-2: Repair and Rehabilitation Impact Categories with Screening Assessment and/or Impact Analyses

Impact Categories	Screening Assessment and/or Impact Analyses per Study Area																																							
	Town of Olive			Town of Marbletown							Town of New Paltz		Town of Gardiner			Town of Shawangunk		Town of Montgomery		Town of New Windsor		Village of Nelsonville		Town of Philipstown			Town of Cortlandt	Town of Yorktown					Town of New Castle		Town of Mount Pleasant			Village of Pleasantville		
	Ashokan Screen Chamber	Beaverkill Road	Atwood-Olivebridge Road	Vly Atwood Road	Pine Bush Road	Lucas Turnpike	Canal Road	Mossybrook Road	Lower Knolls Road	Mountain Rest Road	New Paltz-Minnebraska Road	Forest Glen Road	Le Fevre Lane	Armato Lane	Strawridge Road	Winchell Drive	Mount Airy Road	Passaro Drive	Gatehouse Road	Fishkill Road	Indian Brook Road	Old Albany Post Road	Sprout Brook Road	Aqueduct Road	Jacob Road	Chapman Road	Croton Dam Road	Kitchawan Road	Somerstown Turnpike	Station Place	Campfire Road	Chappaqua Road	Nanny Hagen Road	Westlake Drive	Washington Avenue	Pleasantville Alum Plant	Willow Street			
Land Use, Zoning and Public Policy	✓ ¹	✓ ¹	✓ ¹	✓	✓ ¹	✓	✓ ¹	✓	✓	✓ ¹	✓	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓ ¹		
Socioeconomic Conditions	-	-	-	✓	-	✓	-	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	
Community Facilities and Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Open Space and Recreation	-	✓	✓	-	-	✓	✓	-	-	✓	✓	✓	-	-	-	✓	-	✓	✓	-	-	-	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓
Critical Environmental Areas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Shadows	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Historic and Cultural Resources	-	-	-	-	-	-	-	-	✓	-	✓	-	-	-	-	-	-	-	-	✓	-	✓	-	-	✓	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	
Visual Resources	✓	✓	✓	-	-	✓	✓	-	✓	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓
Natural Resources ²	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Hazardous Materials	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water and Sewer Infrastructure	✓ ³	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	✓ ²	▲ ⁴	✓ ²	-	▲ ⁴	▲ ⁴	▲ ⁴	-	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	▲ ⁴	-	▲ ⁴	✓ ³	▲ ⁴	
Solid Waste and Sanitation Services	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Energy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transportation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Air Quality	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Greenhouse Gas Emissions and Climate Change	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Noise	✓ ⁵	-	-	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵	✓ ⁵		
Neighborhood Character	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Public Health	▲	▲	▲	▲	▲	✓	▲	✓	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	

Notes:
 - = Screening assessment. Does not warrant an impact analysis.
 ✓ = Impact analysis conducted for the study area.
 ▲ = Impact analysis conducted on a project-wide basis.
 NA = Not Applicable. Does not warrant an impact analysis.
¹ Land use and zoning screen out and do not warrant an analysis. An impact analysis was conducted for public policy and/or town codes.
² Cumulative effects to water resources and aquatic and benthic resources were analyzed on a project-wide basis for most study areas. See Table 9.3-8 for additional detail.
³ Wastewater infrastructure was analyzed on a project-wide basis.
⁴ An assessment of stormwater infrastructure screens out and does not warrant an analysis. A project-wide impact analysis was conducted for water supply and/or wastewater infrastructure.
⁵ Mobile noise screens out and does not warrant an analysis. An impact analysis was conducted for stationary noise.

- Limits of construction that represent the outermost area of disturbance during construction including, but not limited to, access roads and staging areas requiring improvements, tree removal, excavation and grading, and temporary or permanent stream crossings.
- Work locations with special construction constraints such as where temporary lane closures would be required (e.g., Taconic State Parkway) and where in-water disturbance is required (e.g., Catskill Influent Chamber, Catskill Kensico Bypass).

From this, a total of 37 study areas were defined around work sites along the Catskill Aqueduct that warrant assessment. The impact analysis specifically assesses those repair and rehabilitation work activities that would temporarily or permanently alter the natural environment or otherwise have the potential for environmental impacts. Other activities related to maintenance and replacement in kind would be short in duration, limited in scope, would not involve substantial change to existing structures or function, and would therefore not warrant analysis. As an example, permanently sealing select culvert drain sluice gates would not disturb or result in discharges to the environment because all work would be completed from the tunnel interior. Because the sluice gates are not currently operated, sealing these structures would not alter water supply or affect the aqueduct's function.

For each impact category, the screening assessment identifies those work activities that warrant analysis as well as those where an analysis was not warranted per the *City Environmental Quality Review (CEQR) Technical Manual*.

For repair and rehabilitation work activities, a 400-foot radius was circumscribed surrounding the limits of construction. Per the *CEQR Technical Manual*, a 400-foot radius study area allows for a proposed project's immediate effects on an area to be determined. These boundaries are also inclusive of downstream resources potentially influenced by leaks.

In addition to the general criteria for establishing study areas, the *CEQR Technical Manual* allows study areas to vary for specific impact categories, as appropriate. It was appropriate to establish impact category-specific study areas at appropriate work sites for public policy, visual resources, natural resources, and stationary noise assessments for the following reasons:

- Since local public policies would not vary for study areas within the same town, public policies were evaluated within those study areas on a town-wide basis.
- NYSDEC guidance recommends evaluating impacts to visual resources that are within 5 miles of large projects. However, since the repair and rehabilitation would not involve construction that would be considered large-scale, the study area boundaries for the visual resources screening assessments and impact analyses were the same as the general study area boundary, with additional view corridors that extend beyond the study area as required.
- Natural resources study area boundaries for the screening assessments and applicable impact analyses were typically smaller than the DEIS study area boundaries. These study areas were focused on the immediate areas surrounding the work sites that could be

directly or indirectly affected by the repair and rehabilitation. These included locations of new facilities and structures, access and staging area improvements, discharges of treated water, and changes in flow due to leak repair and any land, water, or habitat that could be affected by this work.

- The boundaries of study areas for the stationary noise screening assessments and applicable impact analyses were based on a 1,500-foot radius surrounding the work sites containing one or more of the aforementioned conditions. Per the *CEQR Technical Manual*, receptors within a 1,500-foot radius from the work sites that would have a direct line of sight of the proposed project should be considered for a stationary noise analysis.

9.3.2 SCREENING ASSESSMENT APPROACH

For the purposes of this EIS, screening assessments were conducted to form an initial characterization of baseline conditions, including an inventory of relevant data and environmental resources within the repair and rehabilitation study areas, to determine which impact categories warranted an impact analysis. The screening assessments primarily relied on desktop evaluations (e.g., review of ArcGIS data, maps, aerial imagery, online databases, and local agency consultations). These desktop evaluations, and any supplementary field visits, are referenced or summarized in each screening assessment below. In addition, a review of potentially applicable State and local public policies informed many of the screening assessments to determine whether the repair and rehabilitation would be consistent with these policies. Those public policies that the repair and rehabilitation could be inconsistent with warranted an impact analysis and were identified relative to the applicable impact category.

Several impact categories did not warrant an assessment as per *CEQR Technical Manual* guidance, and were thus screened out of the impact analysis. A shadows assessment is not applicable because the repair and rehabilitation would not result in new structures or additions to existing structures greater than 50 feet tall, or be located adjacent to, or across from a sunlight-sensitive resource. Similarly, a solid waste and sanitation services assessment is not applicable because the repair and rehabilitation would not result in the generation of 50 tons per week or more of solid waste. In addition, a greenhouse gas emissions and climate change assessment is not applicable because the repair and rehabilitation would not result in any significant generation of greenhouse gases. Finally, a Critical Environmental Area assessment is not applicable because the repair and rehabilitation work sites are not located in any Critical Environmental Areas.

For the purposes of this chapter, the screening assessment included a preliminary analysis of potential impacts, described below. In those instances where a more detailed analysis was required, the results are described in Sections 9.4, “Town of Olive,” through 9.18, “Project-Wide Impact Analysis.” Impact categories that screened out based on the assessment below, and thus did not warrant an impact analysis include: energy; air quality; and mobile noise. Impact categories that did not screen out, and therefore required an impact analysis include: land use, zoning, and public policy; socioeconomic conditions; community facilities and services; open space and recreation; historic and cultural resources; visual resources (an urban design assessment is not needed since the repair and rehabilitation is not located in an urban setting); natural resources; hazardous materials; water and sewer infrastructure; transportation; stationary

noise; neighborhood character; and public health. See **Table 9.3-2** for a summary of the impact categories and whether there is a screening assessment or impact analysis presented herein. See Sections 9.3.3, “Land Use, Zoning, and Public Policy,” through 9.3.17, “Public Health,” for the screening assessments and impact analysis methodologies and Sections 9.4, “Town of Olive,” through 9.18, “Project-Wide Impact Analysis,” for the impact analyses.

9.3.2.1 Methodology and Impact Analysis

For each impact category that did not screen out, an impact analysis was conducted that included an evaluation of baseline conditions, future conditions without the repair and rehabilitation, and future conditions with the repair and rehabilitation, as described further below.

As part of the impact analyses, baseline conditions applicable to each impact category were generally established by compiling data gleaned from a review of desktop information (e.g., hydrologic data, maps, plans, aerial imagery, topographic maps, ArcGIS layers), as well as observations made during field visits conducted between late 2012 and 2016. Pursuant to the *CEQR Technical Manual*, future conditions for each impact category both with and without the repair and rehabilitation were evaluated for the three analysis periods: the construction period of the repair and rehabilitation (between 2017 and 2020), the period of temporary chlorination of the repaired and rehabilitated Catskill Aqueduct (between 2019 and 2023), and the operational period (with the cessation of leaks in 2017, temporary construction areas returned to baseline conditions in 2020, and temporary chlorination ending in 2023). Future conditions without the repair and rehabilitation were based on typical operations during the same time periods and ongoing leaking of the Catskill Aqueduct. The potential for significant adverse impacts for each applicable impact category were then determined by comparing future conditions with and without the repair and rehabilitation.

For each applicable impact category, impacts were analyzed by study area, on a town-wide basis, or on a project-wide basis. Both the town-wide and project-wide analyses consider the environmental impacts within the established study areas, but these sections differ in how the study areas are aggregated. Using the example described above, public policies were evaluated on a town-wide basis by assessing the aggregate of all study areas within that town. Similarly, the overall combined effect of the repair and rehabilitation across the 37 study areas that comprise the overall project was analyzed for certain impact categories on a project-wide basis. Impact categories potentially resulting in comparable impacts spanning multiple locations were best analyzed project-wide, rather than on an individual basis by town or study area. In addition to the above-noted analyses, the potential for impacts from the repair and rehabilitation to result in cumulative impacts is included as part of a cumulative assessment for Upstate Water Supply Resiliency. Chapter 12, “Cumulative Impacts,” presents the cumulative assessment addressing energy, greenhouse gas emissions and climate change, socioeconomic conditions, and public health.

The following sections summarize the screening assessments and impact analysis methodologies for each of the impact categories.

9.3.3 LAND USE, ZONING, AND PUBLIC POLICY

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in direct effects to, and non-compatible conditions with, existing land use and zoning, public policies, and town codes within the surrounding study areas from activities at the work sites. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. These activities include biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities would not alter the land or compatibility and consistency with surrounding uses and zoning, and did not warrant further review.

9.3.3.1 Screening Assessment

The repair and rehabilitation work activities would entail work primarily on New York City Department of Environmental Protection (DEP)-owned sites, with some limited activities that would occur on private property. This screening assessment was conducted to determine whether activity would occur on private property in the study area, and if the acquisition of an easement would be required to implement the repair and rehabilitation.

The acquisition of land/easements on private properties would not be required within the following study areas: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Pine Bush Road, Canal Road, Mountain Rest Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Strawridge Road, Winchell Drive, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Old Albany Post Road, Sprout Brook Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Nanny Hagan Road, Westlake Drive, Pleasantville Alum Plant, and Willow Street. At these study areas, the repair and rehabilitation work activities would be short-term in nature, consistent with existing public service/utility land use, and would not affect the surrounding study area land uses. Furthermore, the repair and rehabilitation activities would not require a change in zoning of the work sites or alter existing zoning within the surrounding study areas. Following construction and temporary chlorination, operation of the Catskill Aqueduct would be consistent with baseline conditions. As a result, the repair and rehabilitation would not physically displace existing land uses or alter existing land uses or zoning within these study areas. Therefore, a land use and zoning impact analysis for these study areas is not warranted.

The acquisitions of land/easements on private properties were identified within the Vly Atwood Road, Lucas Turnpike, Mossybrook Road, Lower Knolls Road, New Paltz-Minnewaska Road, Indian Brook Road, Aqueduct Road, and Washington Avenue study areas. The potential for land use and zoning impacts to occur within these study areas was evaluated in the respective "Land Use and Zoning" sections using the methodology described below. For informational purposes, a basic description of existing land use and zoning is provided for each study area.

For all study areas, the repair and rehabilitation would be required to be compatible with public policy, including county and local plans and town codes. The following plans contain policies and/or goals relevant to the repair and rehabilitation impact analysis: Ulster County Open Space Plan (Ulster County 2007), Orange County Supplemental Open Space Plan (Orange County 2003), Town of Philipstown Comprehensive Plan (Philipstown 2006), Westchester 2025 Plan (Westchester 2008), Town of New Castle Comprehensive Plan (New Castle 2016), and Village of Pleasantville Master Plan (Pleasantville 1995). County and local plans applicable to the repair and rehabilitation for each municipality are provided in **Table 9.3-3**. With the exception of the Village of Nelsonville, which is not subject to any town or county plan, the potential for impacts associated with the repair and rehabilitation's compatibility with applicable public policies within the study areas was evaluated in the respective town impact analyses sections using the methodology described below.

9.3.3.2 Impact Analysis Methodology

The impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing land uses, zoning districts, and relevant public policies, including adopted State, county, neighborhood, and community plans; (2) establishing future conditions without the repair and rehabilitation by identifying anticipated updates to land use, zoning, and public policies planned and programmed for implementation within the study area by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential for impacts from the repair and rehabilitation by evaluating whether the proposed project would result in direct or indirect displacement or alteration of land uses or zoning districts, would preclude future development of the land, or would potentially be non-compatible with applicable public policies.

Below is a summary of the applicable plans for which compatibility with the repair and rehabilitation were analyzed in the respective Public Policy sections.

Ulster County Open Space Plan (2007)

The Ulster County Open Space Plan established a framework for the management and protection of open space resources identified by Ulster County, including: protected open space, water resources, working landscapes, landforms and natural features, ecological communities, cultural and historic resources, and recreational resources. To provide guidance on these open space resources, Ulster County established the 10 "Principles of the Open Space Plan" that seek to safeguard the open space values of Ulster County. Of those 10 principles, the following two are applicable to the repair and rehabilitation:

- *Preserve and protect open space, unique natural areas and heritage areas and sites, wetlands, water and woodland resources, scenic views, areas of natural beauty and the rural character of Ulster County; and*
- *Protect and enhance the county's most valuable open space landforms and natural features with coordinated planning and safeguard policies.*

Table 9.3-3: Municipalities and Corresponding Public Policies Applicable to the Repair and Rehabilitation

Town/Village	Ulster County Open Space Plan	Orange County Open Space Plan	Town of Philipstown Comprehensive Plan	Westchester 2025 Plan	Town of New Castle Comprehensive Plan	Village of Pleasantville Master Plan
Town of Olive	✓	-	-	-	-	-
Town of Marbletown	✓	-	-	-	-	-
Town of New Paltz	✓	-	-	-	-	-
Town of Gardiner	✓	-	-	-	-	-
Town of Shawangunk	✓	-	-	-	-	-
Town of Montgomery	-	✓	-	-	-	-
Town of New Windsor	-	✓	-	-	-	-
Village of Nelsonville	-	-	-	-	-	-
Town of Philipstown	-	-	✓	-	-	-
Town of Cortlandt	-	-	-	✓	-	-
Town of Yorktown	-	-	-	✓	-	-
Town of New Castle	-	-	-	✓	✓	-
Town of Mount Pleasant	-	-	-	✓	-	-
Village of Pleasantville	-	-	-	✓	-	✓

Notes:
 - = Not applicable to the municipality. Does not warrant an impact analysis.
 ✓ = Applicable to the municipality; impact analysis was conducted.

Orange County Supplemental Open Space Plan (2003)

The Orange County Supplemental Open Space Plan was adopted in 2003 to support goals within the Orange County Comprehensive Plan and designed to define the uniqueness and environmental characteristics of Orange County as they relate to: quality of life, defining future open space needs, and recommending priority actions needed to protect key open spaces. The potential effects of the repair and rehabilitation within the applicable study areas were evaluated relative to compatibility with the following Plan recommendations:

- *Water Resources*
 - *Permanent Protection of County Reservoir Lands*
- *Biological Diversity*
 - *Protect and Enhance Priority Aquatic Systems*

Town of Philipstown Comprehensive Plan (2006)

The Town of Philipstown Comprehensive Plan is a plan to help guide the Town and its future growth, development, and protection. Recommendations found in the Comprehensive Plan broadly address topics in order to maintain and enhance the traditional qualities of the Town. The Comprehensive Plan does not discuss issues related to construction of individual projects or specific parcels or tracts of land. However, the Comprehensive Plan cites Foundry Brook as an environmentally sensitive area. A portion of the Fishkill Road Study Area is within the Town of Philipstown, and repairs to the aqueduct bridge crossing at Foundry Brook are proposed; therefore, the potential effects of the repair and rehabilitation within the Fishkill Road Study Area were evaluated relative to compatibility with the following:

- *Protect Philipstown's natural resources:*
 - *Protect environmentally sensitive areas, including:*
 - i. *Cold Spring Reservoir and Foundry Brook*

Westchester 2025 Plan (2008)

Westchester County's Westchester 2025 Plan is a framework to assist the 45 municipalities within the county to develop comprehensive plans that achieve a balance between economic and environmental concerns, while serving the future needs of the local communities within Westchester County. The policies outlined in the Plan include those recommended by the Westchester County Planning Board to municipalities as guidance for their own decision-making. The potential effects of the repair and rehabilitation within the applicable study areas were evaluated relative to compatibility with the following Plan recommendation:

- *Preserve natural resources: Preserve and protect the county's natural resources and environment, both physical and biotic. Potential impacts on water resources (waterbodies, wetlands, coastal zones and groundwater), significant land resources (unique natural areas, steep slopes, ridgelines and prime agricultural land) and biotic resources (critical habitat, plant communities and biotic corridors) require careful consideration as part of land management and development review and approval.*

Town of New Castle Comprehensive Plan (2016)

The Town of New Castle Comprehensive Plan is a guide for the future growth and development of the Town, through a series of coordinated goals, policies, and strategies. The 2016 Comprehensive Plan is an update of the Town Development Plan, which was originally written in 1989. The Comprehensive Plan is organized according to plan principles put forth by the American Planning Association, which include: Livable Built Environment Harmony with Nature, Resilient Economy, Healthy Community, and Responsible Regionalism. Each chapter sets forth various goals that address the issues outlined in the chapter. Goals are followed by strategies, which are specific policy statements aimed at achieving the Comprehensive Plan's goals. The potential effects of the repair and rehabilitation within the applicable study areas were evaluated relative to compatibility with the following Comprehensive Plan recommendations:

- *Livable Built Environment*
 - Goal 5. Preserve and protect historic resources
- *Harmony with Nature*
 - Goal 1. Protect and maintain the Town's environmentally sensitive areas and resources (watersheds, wetlands, streams, steep slopes, floodplains, viewsheds, etc.)
 - Goal 4. Protect and manage open spaces and undeveloped lands
- *Responsible Regionalism*
 - Goal 4. Evaluate regional impacts (traffic, environmental, population, etc.) of major land use and infrastructure projects

Village of Pleasantville Master Plan (1995)

The Village of Pleasantville Master Plan Update was adopted in 1995 in order to re-visit and reiterate the goals established in the 1961 and 1973 Master Plans. Updates to the Village of Pleasantville Master Plan were the result of a collaboration between the Master Plan Advisory Committee, Planning Commission, and Village board and staff. Recommended actions and implementation strategies included in the Master Plan Update are intended to address the needs and opportunities within the Village of Pleasantville and address issues such as land use, housing, and infrastructure. The potential effects of the repair and rehabilitation within the applicable study areas were evaluated relative to compatibility with one Plan recommendation:

- *Infrastructure:*
 - Drainage

9.3.3.3 Town Codes

In addition to local and county plans, several town codes would apply to the repair and rehabilitation study areas, respective to their individual locations. The following is a summary of the applicable town codes.

Town of Olive Codes

Relevant sections of the Town of Olive codes that apply to the Town of Olive study areas, including Ashokan Screen Chamber, Beaverkill Road, and Atwood-Olivebridge Road study areas, are described as follows:

Chapter 89, Environmental Quality Review

The criteria for whether an action may have a significant effect on the environment shall include the following, in addition to any criteria listed in Part 617:

- A. Any action which causes a substantial adverse change to air quality, water quality, noise level, solid waste production, drainage, erosion, flooding.*
- B. Any action which removes or destroys large quantities of vegetation or fauna or interferes with habitat or movement of any fish or wildlife.*

§89-8. Exempt Actions

- C. Maintenance or repair involving no substantial changes in an existing structure or facility.*

The repair and rehabilitation is undergoing an environmental review in compliance with the State Environmental Quality Review Act (SEQRA). As such, the repair and rehabilitation is compliant with the Town of Olive code related to Environmental Quality Review. Additional discussions related to the Town of Olive regulating activities within watercourses and wetlands are provided in Section 9.3.9.2, “Water Resources,” and the water resources sections in the respective “Natural Resources” sections in Section 9.4, “Town of Olive,” where applicable.

Chapter 97, Flood Damage Prevention

The Town Board of the Town of Olive finds that the potential and/or actual damages from flooding and erosion may be a problem to the residents of the Town of Olive and that such damages may include destruction or loss of private and public housing, damage to public utilities, both publicly and privately owned, and injury to and loss of human life. In order to minimize the threat of such damages and to achieve the purposes and objectives hereinafter set forth, this chapter is adopted.

Repair and rehabilitation work activities within the Town of Olive study areas were evaluated for compliance with the Town of Olive code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources.”

Chapter 155, Zoning

The Town of Olive regulates the use of land and any structures. The comprehensive zoning plan for the Town of Olive is set forth in text, maps and schedules within Chapter 155. The purpose of the zoning code is for the protection and promotion of public health, safety, convenience, morals, aesthetics and general welfare of the community.

The Catskill Aqueduct land within the Town of Olive is an existing permitted use as listed under the Town of Olive Zoning Code. The repair and rehabilitation activities within the Ashokan Screen Chamber, Beaverkill Road, and Atwood-Olivebridge Road study areas in the Town of Olive would not alter existing zoning or require a change in existing zoning. Therefore, the repair and rehabilitation activities within these study areas would be compliant with Chapter 155, Zoning.

Town of Marbletown Codes

Relevant sections of the Town of Marbletown codes that apply to the Town of Marbletown study areas, including Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, and Lower Knolls Road study areas, are described as follows:

Chapter 3: Agricultural, Clean Water and Open Space Preservation and Acquisition

§3-2, Purpose, A. Purpose.

- (1) The purpose of this chapter is to provide mechanisms to protect assets of the Town that provide Marbletown's residents with:

 - a. Water that is clean, plentiful and sustainable;*
 - b. Farm and forestry industries that are strong and sustainable;*
 - c. Habitats for diverse plants and animals;*
 - d. Recreational opportunities that are harmonious with the land's natural state;*
 - e. Historical, cultural and scenic assets and variety; and*
 - f. Educational and research opportunities about the natural world and the role that agriculture plays in the local and regional economy.**
- (2) The activities and mechanisms outlined in this chapter protect these assets generally, through the purchase of interests in property, and through ongoing management and stewardship of interests in property acquired by or entrusted or given to the Town.

 - B. Voluntary nature. The activities described in this chapter for the purchase Interests in Property described herein shall be purely voluntary. Under no circumstances shall any landowner be coerced into participation in these activities.**

C. Need for vigilance in monitoring. Through this chapter, the Town of Marbletown will expend its tax revenues, and in some cases forgo ongoing tax revenues, in order to acquire interests in property. These acquisitions become assets of the Town and are valuable to Town residents. It is incumbent on the Town to safeguard these assets by monitoring their condition and, where necessary, taking action to preserve the rights that it has acquired, including rights acquired in perpetuity.

Repair and rehabilitation work activities within the Town of Marbletown study areas were evaluated for compliance with the Town of Marbletown code related to open space preservation in Section 9.3.6, “Open Space and Recreation,” and the respective “Land Use and Zoning” and “Open Space and Recreation” sections in Section 9.5, “Town of Marbletown,” where applicable.

§115-12, Flood Development Permit

A. Purpose. A floodplain development permit is hereby established for all construction and other development to be undertaken in areas of special flood hazard in this community for the purpose of protecting its citizens from increased flood hazards and ensuring that new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertake any development in an area of special flood hazard, as shown on the Flood Insurance Rate Map enumerated in §115-6, without a valid floodplain development permit. Application for a permit shall be made on forms furnished by the local administrator and may include, but not be limited to, plans, in duplicate, drawn to scale and showing the nature, location, dimensions, and elevations of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities, and the location of the foregoing.

§115-13, Flood Management, Protections

Alteration of watercourses. The local administrator shall be responsible for:

- (1) Notification to adjacent communities and the New York State Department of Environmental Conservation prior to permitting any alteration or relocation of a watercourse, and submittal of evidence of such notification to the Regional Director, Region II, Federal Emergency Management Agency.*
- (2) Determining that the permit holder has provided for maintenance within the altered or relocated portion of said watercourse so that the flood-carrying capacity is not diminished. A floodplain development permit is hereby established for all construction and other development to be undertaken in areas of special flood hazard in this community for the purpose of protecting its citizens from increased flood hazards and ensuring that new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertake any development in an area of special flood hazard, as shown on the Flood Insurance Rate Map enumerated in §115-6, without a valid floodplain development permit.*

Repair and rehabilitation work activities within the Town of Marbletown study areas were evaluated for compliance with the Town of Marbletown code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources.”

Chapter 128, Heritage and Preservation

The Town of Marbletown requires that landmarks and historic districts which represent distinctive elements of the Town’s historic, architectural and cultural heritage be preserved. Protection of these resources is intended to:

- A. Protect and enhance the landmarks and historic districts which represent distinctive elements of Marbletown's historic, architectural, and cultural heritage;*
- B. Foster civic pride in the accomplishments of the past;*
- C. Protect and enhance Marbletown's attractiveness to visitors and the support and stimulus to the economy thereby provided; and*
- D. Ensure the harmonious, orderly, and efficient growth and development of the Town.*

Repair and rehabilitation work activities within the Town of Marbletown study areas were evaluated for compliance with the Town of Marbletown code related to heritage and preservation in Section 9.3.7, “Historic and Cultural Resources,” Section 9.3.8, “Visual Resources,” and the respective “Historic and Cultural Resources” and “Visual Resources” sections in Section 9.5, “Town of Marbletown,” where applicable.

Chapter 167, Stormwater Management and Erosion and Sediment Control

All land development activities not subject to review as stated in §167-3C shall be required to submit a SWPPP to the Town Engineer and Building Inspector, who shall approve the SWPPP if it complies with the requirements of this chapter.[4]

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, a SWPPP would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Chapter 200, Zoning

The zoning code of the Town of Marbletown regulates the use of land and any structures. Chapter 200, Zoning has been adopted for the protection of the residents and property owners of the Town of Marbletown, by means of regulating and restricting the location, construction, alteration, occupancy and use of buildings and structures and the use of land in the Town of Marbletown and for said purposes division of the Town into zoning districts.

The Catskill Aqueduct land within the Town of Marbletown is an existing permitted use as listed under the Town of Marbletown Zoning Code. The repair and rehabilitation activities within the Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, and Lower Knolls Road study areas in the Town of Marbletown would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 200, Zoning.

§200-53 Stormwater Management and Erosion and Sediment Control

The Town of Marbletown requires approval of a Stormwater Pollution Prevention Plan (SWPPP) prepared in accordance with the specifications listed under §200-53 and in Chapter 167, Stormwater Management and Erosion and Sediment Control, of the Town of Marbletown code.

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, a SWPPP would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

§200-89, Wetlands, Designated

- A. Wetlands designated by, or eligible for designation by, the New York State Department of Environmental Conservation under Article 24 of the New York Environmental Conservation Law; or*
- B. Wetlands that are determined to satisfy the criteria set forth in Section 404 of the Federal Clean Waters Act.*

Repair and rehabilitation work activities within the Town of Marbletown study areas were evaluated for compliance with the Town of Marbletown code related to wetlands in the wetlands section of Section 9.3.9.2, “Water Resources,” and the respective “Natural Resources” sections in Section 9.5, “Town of Marbletown,” where applicable.

§A206-18 Excavation, filling and rough grading.

- A. The developer shall complete the shaping of the road right-of-way, streams and ditches and easement areas to the line and grade as shown on the approved plans and as otherwise may be directed by the Town Superintendent of Highways. In the construction of the roadway all topsoil, loam, rocks and organic material shall be removed until a satisfactory subbase is established. In fills of less than three feet, all topsoil shall be excavated and removed. In some cases, where soil conditions warrant, the Town Engineer and/or the Town Highway Superintendent may require undercutting and/or more than 12 inches of subbase in order to insure a stable subgrade.*
- B. All fills shall be made with acceptable material as approved by the Town Superintendent of Highways. Such fills shall be made in layers of not more than*

- 12 inches each and properly compacted with a ten-ton roller or equivalent. If excessive cuts and/or fills are required, it may be necessary for the right-of-way to be wider than normally required. The right-of-way shall extend two feet beyond the top of the cut or toe of the fill.*
- C. The proposed road improvements shall be graded for its full width generally centered on the highway and shall be of such character and alignment that complies with design, grades and alignment as hereinafter provided and shown on the approved plat. Such grading shall be of such character and alignment that additional work of this nature by the Town will not be necessary.*
 - D. The subgrade shall be shaped to line and grade with no depressions. The subgrade shall be stable in all respects to the satisfaction of the Town Superintendent of Highways and/or the Town Engineer before the foundation course is laid. No large stones or rock ledges shall protrude into the foundation course.*
 - E. Also, before the foundation course is laid, all storm and sanitary sewers and all utilities, including house connections for existing and future homes, and hydrants shall have been installed to the satisfaction of the Town Superintendent of Highways and/or the Town Engineer. All slopes and sidewalk areas shall be graded before the foundation course is made and all loose and exposed stones will be removed.*

Repair and rehabilitation work activities within the Town of Marbletown study areas were evaluated for compliance with the Town of Marbletown code related to excavation, filling and rough grading in Section 9.3.9.1, “Geology and Soils.”

Town of New Paltz Codes

Relevant sections of the Town of New Paltz codes that apply to the Town of New Paltz study areas, including Mountain Rest Road and New Paltz-Minnewaska Road study areas are described as follows:

§115-13, Flood Damage Prevention

It is the purpose of this chapter to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- A. Regulate uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;*
- B. Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;*
- C. Control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of floodwaters;*

- D. Control filling, grading, dredging and other development which may increase erosion or flood damages;*
- E. Regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands; and*
- F. Qualify for and maintain participation in the National Flood Insurance Program.*

Repair and rehabilitation work activities within the Town of New Paltz study areas were evaluated for compliance with the Town of New Paltz code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources.”

Chapter 100, Noise

The Noise Code of the Town of New Paltz prevents unreasonably loud, disturbing and unnecessary noise and to reduce noise levels within the Town so as to preserve, protect and promote the public health, safety and welfare and to foster convenience, peace and quiet within the Town by the inhabitants and transients thereof. The New Paltz Town Board finds that every person is entitled to have maintained noise levels which are not detrimental to life, health and the enjoyment of property and that excessive and unnecessary noise within the Town of New Paltz affects and is a menace to public health, safety, welfare and the comfort of the people of the Town.

§100-3 Prohibited Noises

(B) Specific prohibitions: The following acts are prohibited and declared to be a violation of this section, said enumeration not to be deemed exclusive:

- (15) Construction work: in the process of any building operations between the hours of 8 PM and 7 AM, to operate or use any pile driver, steam shovel, pneumatic hammer, derrick, steam or electrical hoist or other apparatus, the use of which is attended by loud or unusual noise, except by authorization pursuant to a resolution of the Town Board and then only granted in the event of an emergency.*

§100-4 Exceptions

§100-4 states that noise generated by a municipality carrying out the operation of their franchises will not be in violation of Chapter 100 – Noise.

Repair and rehabilitation work activities within the Town of New Paltz study areas were evaluated for compliance with the Town of New Paltz codes related to noise in the respective “Noise” sections in Section 9.6, “Town of New Paltz.”

Chapter 130, Tree Conservation

The Town of New Paltz prevents the cutting, removal, or killing of any tree unless said person shall be in possession of a permit issued pursuant to chapter §130-3.

Repair and rehabilitation work activities within the Town of New Paltz study areas were evaluated for compliance with the Town of New Paltz code related to tree conservation in Section 9.3.9.4, "Terrestrial Resources," and the terrestrial resources section in the respective "Natural Resources" sections in Section 9.6, "Town of New Paltz," where applicable.

Chapter 139, Wetland and Watercourse Protection

This chapter shall be known as the "Wetland and Watercourse Protection Law of the Town of New Paltz." The purpose of this chapter is to protect the health, safety and well-being of the citizens of the Town of New Paltz and of property therein by preventing the despoliation and destruction of wetlands, waterbodies and watercourses, and associated buffer areas, collectively referred to in §139-5 herein as "regulated areas," recognizing their varying ecological, water quality, and recreational values. The Town of New Paltz hereby regulates activities that may cause a substantial adverse effect on the function served by regulated areas or the benefits derived therefrom.

§139-10B: Activities Allowed Without Permits

Activities, other than those specifically exempted in §§139-9 and §139-10 of this chapter, that have the potential to cause substantial adverse effect in regulated areas, as described in §139-5 of this chapter, include those prescribed in 6 NYCRR 663.2, as well as, but not limited to, the following:

- A. Any form of mining, dredging or excavation and any grading or removal of soil, mud, sand, gravel, peat, silt or any other earth material from any regulated area, either directly or indirectly;*
- B. Any form of dumping, filling or depositing of any soil, stones, sand, gravel, mud, rubbish or fill of any kind in any regulated area, either directly or indirectly;*
- D. Placing any other obstructions within any regulated area, channelization or berming, as defined in §139-4 of this chapter, whether or not the same affect the ebb and flow of water;*
- F. Draining or ditching within any regulated area;*
- J. Clearing, as defined in §139-4 of this chapter, within any regulated area, except routine maintenance or landscaping, as defined in §139-4 of this chapter. Any activity regulated pursuant to Chapter 130, Tree Conservation, of the Code of the Town of New Paltz shall be regulated under this chapter as well if such activity occurs in a regulated area;*
- L. Any other activity that is determined by the Wetlands Inspector, with concurrence by the Planning Board, to have the potential for substantial adverse effects on the regulated areas.*

Repair and rehabilitation work activities within the Town of New Paltz study areas were evaluated for compliance with the Town of New Paltz code related to wetland and watercourse protection in Section 9.3.9.2, “Water Resources,” and the water resources section in the respective “Natural Resources,” sections in Section 9.6, “Town of New Paltz,” where applicable.

Chapter 140, Zoning

The zoning code of the Town of New Paltz regulates the use of land and any structures. Chapter 140, Zoning regulates and restricts the location, construction, alteration, occupancy and use of buildings and structures and the use of land in the Town of New Paltz and, for said purposes, divides the Town into zoning districts.

The Catskill Aqueduct land within the Town of New Paltz is an existing permitted use as listed under the Town of New Paltz Zoning Code. The repair and rehabilitation activities within the Mountain Rest Road and New Paltz-Minnewaska Road study areas in the Town of New Paltz would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 140, Zoning.

§140-2, Environmental Quality Review

The Town of New Paltz requires compliance with the SEQRA.

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of New Paltz code related to Environmental Quality Review.

Town of Gardiner Codes

Relevant sections of the Town of Gardiner codes that apply to the Town of Gardiner study areas, including Forest Glen Road, Le Fevre Lane, and Armato Lane study areas, are described as follows:

Chapter 110, Environmental Quality Review

The Town of Gardiner requires compliance with the SEQRA.

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of Gardiner code related to Environmental Quality Review.

Chapter 220, Zoning

Chapter 220, Zoning regulates the location, design, construction, alteration, occupancy, and use of structures and the use of land in the Town of Gardiner, dividing the Town into land use districts. This chapter is conformance with the updated Town of Gardiner Comprehensive Plan, adopted by the Town Board in December 2004, to advance the goals of the Town of Gardiner Comprehensive Plan.

The Catskill Aqueduct land within the Town of Gardiner is an existing permitted use as listed under the Town of Gardiner Zoning Code. The repair and rehabilitation activities within the Forest Glen Road, Le Fevre Lane, and Armato Lane study areas in the Town of Gardiner would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 220, Zoning.

§220-35, Excavation, Grading, And Clearcutting

- A. Excavation and grading necessary for the construction of a structure for which a building permit has been issued shall be permitted, provided that it does not adversely affect water quality, natural drainage, or structural safety of buildings or lands, cause erosion or sedimentation, or create any noxious conditions or hazard to public health or safety.*
- E. No excavation or grading and no clear cutting of 10,000 square feet or more in preparation for site development shall be undertaken prior to the grant of any special permit, site plan, or subdivision approval required for such development.*
- F. Excavation or grading of any area exceeding 2,000 square feet and/or clear cutting of any area exceeding three acres shall require a zoning permit from the Building Inspector, unless such excavation or clear cutting is performed pursuant to an approved site plan, special permit, subdivision, or building permit, or as a normal and customary activity in conjunction with a farm operation (as defined in Article XII).*
- G. Excavation and grading shall comply with applicable requirements for erosion and sediment control.*

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, a SWPPP would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.” Repair and rehabilitation work activities within the Town of Gardiner study areas were evaluated for compliance with the Town of Gardiner codes related to clearcutting in Section 9.3.9.4, “Terrestrial Resources.”

§220-35, Wetland and Watercourse Protection

The Town of Gardiner regulates activities with the policies outlined within Chapter 179, Freshwater Wetlands, Waterbodies, and Watercourses. Within 150 feet of the top of the bank of any stream classified as AA, A, B, or C(t) by the DEC, the Planning Board shall ensure that any development subject to its approval:

- (1) Will not result in erosion or stream pollution from surface or subsurface runoff. In making such determination, the Planning Board shall consider slopes, vegetation, drainage patterns, water entry points, soil erosivity, depth to bedrock and high water table, and other relevant factors;*

- (2) *Will not result in impervious surface coverage exceeding 2% of the regulated area (i.e., the land lying within 150 of the stream bank);*
- (3) *Will provide an adequate vegetated buffer along the stream to prevent adverse impacts on the stream; and*
- (4) *Will maintain existing tree canopy over the stream and the stream bank.*

E. Required setbacks.

- (1) *The following shall not be located within 100 feet of the top of the bank of a stream classified as AA, A, B or C(t) by the DEC or, in the absence of a clear bank, from the outer edge of the riparian wetland adjacent to the stream:*
 - (a) *Principal and accessory structures 200 square feet or larger in footprint area.*
 - (b) *Septic systems, leach fields, and wells.*
 - (c) *Driveways, roads, and parking lots, except as otherwise provided in Subsection E(3) below.*
 - (d) *Excavation and fill areas.*
 - (e) *Herbicide and fertilizer applications.*
 - (f) *Storage of chemicals.*
 - (g) *Vegetation removal, except as necessary to allow hiking trails and structures permitted by Subsection E(2).*

Repair and rehabilitation work activities within the Town of Gardiner study areas were evaluated for compliance with the Town of Gardiner codes related to wetlands and watercourses in Section 9.3.9.2, "Water Resources," and the water resources section in the respective "Natural Resources" sections in Section 9.7, "Town of Gardiner," where applicable.

§220-40, Environmental Performance Standards

The Town of Gardiner requires compliance with performance standards in order to set specific controls on potentially objectionable external aspects of all uses.

B.(2): Control noise and light perceptible beyond the boundaries of the site of the use.

C.(2): Sound levels shall be determined at the property line of the lot from which the noise is emitted. Sound measurements shall be accomplished through a sound level meter having an A-weighted filter and constructed in accordance with specifications of the American National Standards Institute or other generally accepted standard for the measurement of sound:

- (a) *Seventy decibels on the A-weighted scale between the hours of 7 AM and 8 PM; and*
- (b) *Sixty decibels on the A-weighted scale between the hours of 8 PM and 7 AM.*

C.(4): The following shall be exempt from the noise level regulations:

- (a) *Noises emanating from construction and maintenance activities between 8 AM and sunset.*
- (b) *The noises of safety signals, warning devices, emergency pressure-relief valves or other emergency warning signals.*

L.(1): No use shall produce glare so as to cause illumination beyond the boundaries of the property on which it is located in excess of 0.5-footcandle. All exterior lighting, including security lighting, in connection with all buildings, signs or other uses shall be directed away from adjoining streets and properties. The Planning Board may require special efforts to reduce the impacts of exterior lighting, such as limiting hours of lighting, planting screening vegetation, or installing light shields to alleviate the impact of objectionable or offensive light and glare on neighboring residential properties and public thoroughfares.

L.(2): Exterior lighting fixtures shall be shielded and directed downward to prevent light from shining directly onto neighboring properties or public ways or upward into the night sky. Light standards shall not exceed 20-feet in height.

Repair and rehabilitation work activities within the Town of Gardiner study areas were evaluated for compliance with the Town of Gardiner codes related to environmental performance standards for lighting and noise control in Section 9.3.8, “Visual Resources,” and the respective “Noise” sections in Section 9.7, “Town of Gardiner.”

Town of Shawangunk Codes

Relevant sections of the Town of Shawangunk codes that apply to the Town of Shawangunk study area, namely the Strawridge Road Study Area, are described as follows:

Chapter 177, Zoning

The zoning code of the Town of Shawangunk regulates the use of land and any structures. Under the Town of Shawangunk zoning code, except as hereinafter otherwise provided, no building shall be erected and no existing building shall be moved, altered, added to or enlarged, nor shall any land or building be designed, used or intended to be used, for any purpose or in any manner other than specified among the uses hereinafter listed as allowed in the district in which such building or land is located.

§177-43. Zoning, Environmental Considerations

177-43(B). Applicants for building permits in those areas mapped by the New York State Department of Environmental Conservation as freshwater wetlands shall comply with Article 24 and Title 23 of Article 71 of the Environmental Conservation Law, as amended.

177-43(D). Review of applications for building permits in the vicinity of Shawangunk Kill shall take into account the provisions of Part 666 of NYCRR and of Article 15 of the Environmental Conservation Law. NYCRR. Title 6. Chapter X. Subchapter A. Article 1.666.

The Catskill Aqueduct land within the Town of Shawangunk is an existing permitted use as listed under the Town of Shawangunk Zoning Code. The repair and rehabilitation activities within the Strawridge Road Study Area in the Town of Shawangunk would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within this study area would therefore be compliant with Chapter 177, Zoning.

§177-44(D) Performance Standard Regulations

(1) The following uses and activities shall be exempt from these noise regulations:

(a) Temporary construction noise between the hours of 8 AM and 6 PM.

Repair and rehabilitation work activities within the Strawridge Road Study Area were evaluated for compliance with the Town of Shawangunk code related to noise in Section 9.8.3.6, “Noise.”

§177-79, Stormwater Pollution Prevention Plans.

A. Stormwater Pollution Prevention Plan Requirement: No application for approval of a Land Development Activity shall be deemed complete until the appropriate board and the Stormwater Management Officer have received a Stormwater Pollution Prevention Plan prepared in accordance with the specifications in this local law. The applicant also shall provide a copy of the SWPPP to the Ulster County Department of Planning and any other involved county agency.

At the Strawridge Road Study Area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study area in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Town of Montgomery Codes

Relevant sections of the Town of Montgomery codes that apply to the Town of Montgomery study area, namely the Winchell Drive Study Area, are described as follows:

Chapter 218, Trees

§218-3: No person shall destroy or cause any act which might reasonably be expected to destroy or impair the health and characteristics or commit any act which causes the destruction or cessation of life functions of any tree as defined by this chapter, including, without limitation, the substantial alteration or any excavation of the terrain within the drip line of any such tree without first having obtained a permit issued therefor as prescribed by this chapter.

§218-2 TREE: A living, perennial, woody plant, including its branches, its root system and its trunk, which tree shall be within 30 points of the point score for the state champion tree for the particular species involved as ascertained by a qualified forester with reference to the list of Big Trees of New York State as set forth in Section 11 of this chapter or any tree or stand of trees having particular historic significance as ascertained by resolution or order of any federal, state or local government board, bureau or agency.

Repair and rehabilitation work activities within the Winchell Drive Study Area were evaluated for compliance with the Town of Montgomery codes related to trees in Section 9.3.9.4, “Terrestrial Resources.”

Chapter 235, Zoning

The zoning code of the Town of Montgomery regulates the use of land and any structures. This Zoning Law is adopted for the purpose of promoting the health, safety, morals and the general welfare of the community and in furtherance of the following related and more specific objectives as defined within Chapter 235, Zoning.

The Catskill Aqueduct land within the Town of Montgomery is an existing permitted use as listed under the Town of Montgomery Zoning Code. The repair and rehabilitation activities within the Winchell Drive Study Area in the Town of Montgomery would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within this study area would therefore be compliant with Chapter 235, Zoning.

§235-9.1, Prohibited Uses Enumerated

In all districts, no building structure or lot shall be used in whole or in part for any of the following uses:

- (A) Any trade, business, industry or process which is noxious or offensive by reason of the production or emission of smoke, noise, gas, odor, dust, refuse matter, vibration or excessive light beyond the limits of its lot so as to be dangerous or prejudicial to the public health, safety or general welfare.*

Repair and rehabilitation work activities within the Winchell Drive Study Area were evaluated for compliance with the Town of Montgomery code related to noise in Section 9.9.3.6, "Noise."

§235-10.6 Stormwater Pollution Prevention Plans

- A. *Stormwater pollution prevention plan requirement. No application for approval of a land development activity and/or building permit shall be approved until the appropriate board or the Building Department has received a stormwater pollution prevention plan (SWPPP) prepared in accordance with the specifications in this §235-10.*

Stormwater within the Winchell Drive Study Area would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, for the duration of construction. As applicable, a SWPPP would be prepared for the study area in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, "Water and Sewer Infrastructure."

§235-15.4 Special exception uses (Planning Board)

The Town of Montgomery requires compliance with the SEQRA.

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of Montgomery code related to Environmental Quality Review.

Town of New Windsor Codes

Relevant sections of the Town of New Windsor codes that apply to the Town of New Windsor study areas, including Mount Airy Road and Passaro Drive study areas are described as follows:

Chapter 130, Environmental Quality Review

The Town of New Windsor requires compliance with the SEQRA.

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of New Windsor code related to Environmental Quality Review.

Chapter 151, Flood Damage Prevention

151-12.A. A floodplain development permit is hereby established for all construction and other development to be undertaken in areas of special flood hazard in this community for the purpose of protecting its citizens from increased flood hazards and ensuring that new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertake any development in an area of special flood hazard, as shown on the Flood Insurance Rate Map enumerated in §151-6, without a valid floodplain development permit. Application for a permit shall be made on forms furnished by the local administrator and may include, but not be limited to, plans, in duplicate, drawn to scale and showing the nature, location, dimensions, and elevations of

the area in question; existing or proposed structures, fill, storage of materials, drainage facilities, and the location of the foregoing.

Repair and rehabilitation work activities within the Town of New Windsor study areas were evaluated for compliance with the Town of New Windsor code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources.”

Chapter 156, Freshwater Wetlands

The Town of New Windsor requires compliance with §24-0501 of the New York State Freshwater Wetlands Act (Article 24 of the New York Environmental Conservation Law).

Repair and rehabilitation work activities within the Town of New Windsor study areas were evaluated for compliance with the Town of New Windsor code related to freshwater wetlands in the wetland section of Section 9.3.9.2, “Water Resources,” and the water resources section in the respective “Natural Resources” sections in Section 9.10, “Town of New Windsor,” where applicable.

Chapter 249, Stormwater Management

The Town of New Windsor requires completion of a SWPPP for projects that disturbed more than one acre of land.

§249-4, Applicability

Unless exempted pursuant to Subsection B, soil erosion and sediment control flow and/or a SWPPP must be submitted and approved before:

(2) *An existing drainage system is altered, rerouted, deepened, widened, enlarged, decreased or obstructed; or*

(4) *Site plan or special use permit granted by the Planning Board;*

B. Exemptions. The following development activities are exempt from the stormwater management plan requirements:

(1) *Developments which do not disturb more than one acre (43,560 square feet).*

(a) *For projects which disturb between 10,000 square feet and 43,560 square feet, an erosion and sediment control plan shall be implemented and maintained as directed by the Stormwater Management Officer.*

(3) *Any maintenance, alteration, use or improvement to an existing structure not changing or affecting quality, rate or location of surface water discharge.*

(5) *Routine maintenance activities that disturb less than one acre and are performed to maintain the original line and grade, hydraulic capacity or original purpose of a facility.*

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Chapter 300, Zoning

The zoning code of the Town of New Windsor regulates the use of land and any structures. The Zoning Law for the Town of New Windsor is set forth in text and map that constitute Chapter 300. The Zoning Law is adopted for the purposes set forth in the interest of the protection and promotion of the public health, safety and welfare.

The Catskill Aqueduct land within the Town of New Windsor is an existing permitted use as listed under the Town of New Windsor Zoning Code. The repair and rehabilitation activities within the Mount Airy Road and Passaro Drive study areas in the Town of New Windsor would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 300, Zoning.

Article X Performance Standards

§300-71, Noise and Illumination Control

D.(1) Maximum sound levels; measurement standards.

Except for noise emanating from the operation of motor vehicles on public highways and private roads, the permissible intensity of noise for the foregoing between the hours of 8 AM to 10 PM and 10 PM to 8 AM, respectively, whether such noise is intermittent, impulsive, sporadic or continuous, is as follows [the maximum sound-pressure level, i.e., A-scale reading of standard calibrated sound meter, instrument calibration frequency of 1,000 cycles per second (hertz)]:

(a) In the residential zoning districts of the Town:

[1] From 8 AM to 9 PM: 65 decibels

[2] From 9 PM to 8 AM: 56 decibels

(b) In the non-residential zoning districts of the Town:

[1] From 8 AM to 10 PM: 80 decibels

[2] From 10 PM to 8 AM: 70 decibels

H.(5) The following are also exempted from the limitations of this section:

- (b) *Sounds created by construction activities during the period 7AM to 7 PM weekdays and 8 AM to 6 PM Saturdays. No construction sounds are permitted on Sundays and legal holidays.*

G.(4) Illumination Standards states that the time of illumination on non-residential premises shall be the minimum necessary to provide for the security of the property and the safety and welfare of the public.

Repair and rehabilitation work activities within the Town of New Windsor study areas were evaluated for compliance with the Town of New Windsor codes related to performance standards to noise and illumination control in Section 9.3.8, “Visual Resources,” and the respective for noise” sections in Section 9.10, “Town of New Windsor.”

Village of Nelsonville Codes

Relevant sections of the Village of Nelsonville codes that apply to the Village of Nelsonville study areas, including Gatehouse Road and Fishkill Road study areas are described as follows:

Chapter 129 Noise,

§129-1, Declaration of Policy.

It is hereby declared to be the policy of the Trustees to prevent any unreasonable, loud, disturbing and unnecessary noise. Noise of such character, intensity and duration as to be detrimental to the life or health of any individual or contrary to the public welfare is prohibited.

§129-3, Noise

L. The operation of any machinery, equipment, pump, fan, exhaust fan, attic fan, air conditioner apparatus or similar mechanical devise in such a manner as to create any unreasonable and unnecessary noise which shall disturb the comfort and repose of any person in the vicinity.

Repair and rehabilitation work activities within the Village of Nelsonville study areas were evaluated for compliance with the Village of Nelsonville codes related to noise in the respective “Noise” sections in Section 9.11, “Village of Nelsonville.”

§188-29 Standards by district.

B. Lot area, frontage and shape. Each lot shall have the minimum area as specified on Schedule B. Each lot shall have frontage on a street as specified on Schedule B. Where applicable, each lot shall be of such shape that a square with the minimum dimension specified on Schedule B will fit on the lot. The following additional requirements and exceptions are applicable to lots:

(1) Environmentally constrained land. Area consisting of ponds, lakes and other water bodies, freshwater wetlands, lands located within the one-hundred-year floodplain and

areas of steeply sloped land may be counted for compliance with the minimum lot area standard specified on Schedule B only for such portion of the requirement that exceeds forty thousand (40,000) square feet. A required minimum square on the lot specified on Schedule B shall not include any such water body or wetlands or steeply sloped land.

§99-5, Freshwater Wetlands: Regulated activities; permit required

99-5 B. Each lot shall have frontage on a street as specified on Schedule B. Where applicable, each lot shall be of such shape that a square with the minimum dimension specified on Schedule B will fit on the lot. The following additional requirements and exceptions are applicable to lots:

B(1) Environmentally constrained land. Area consisting of ponds, lakes and other water bodies, freshwater wetlands, lands located within the one-hundred-year floodplain and areas of steeply sloped land may be counted for compliance with the minimum lot area standard specified on Schedule B only for such portion of the requirement that exceeds forty thousand (40,000) square feet. A required minimum square on the lot specified on Schedule B shall not include any such water body or wetlands or steeply sloped land.

B(8): Regulated activity: Destroying or permitting the destruction of any trees or other plant life within twenty (20) feet of the edge of any watercourse (these actions shall be reviewed by the administering authority so as to determine if such acts affect the prevailing surface water runoff conditions, directly or indirectly).

99-5 C. Exclusions. The following activities are excluded from regulation under this chapter:

C(6): The trimming, pruning and bracing of trees, decorative landscaping, including the addition of trees and plants, and incidental removal of trees and bushes.

§168-43, Erosion and sediment control

168-43 B: Erosion and sediment control - Wherever feasible, natural vegetation shall be retained and protected and only the smallest practical area of land shall be exposed at any one (1) time during construction.

Repair and rehabilitation work activities within the Village of Nelsonville study areas were evaluated for compliance with the Village of Nelsonville codes related to watercourses and wetlands in Section 9.3.9.2, “Water Resources,” and the water resources section in the respective “Natural Resources” sections in Section 9.11, “Village of Nelsonville,” where applicable. At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Chapter 188 Zoning,

The zoning code of the Village of Nelsonville regulates the use of land and any structures. The Zoning Law for the Village of Nelsonville is enacted in accordance with a Comprehensive Plan for the Village of Nelsonville for the purposes defined in Chapter 188, Zoning.

§188-23, Zoning: Prohibited uses in all districts

Any use not included on Schedule A as a permitted use in a district is prohibited in such district. To assist in the interpretation of Schedule A, the following uses, the listing of which is not intended to be exhaustive, are specifically prohibited.

E. The excavation, grading, deposit or removal of earth, loam, topsoil, sand, gravel, clay or quarry stone on any lot in an amount exceeding twenty-five (25) cubic yards in any calendar year, except as an adjunct to a bona fide building construction project, or the installation of a site development plan or subdivision plat improvements, for which a permit or other approval has been granted by the Village of Nelsonville.

§188-22, Permitted uses

Schedule A, Permitted Uses by District, is hereby declared to be a part of this chapter. Land, buildings and other structures in a district may be used for one (1) or more of the uses, and no other, specified on Schedule A as permitted in the district. Uses listed on Schedule A are permitted or prohibited in accordance with the following designation and procedure.

B-7: Underground public utility company electric, gas and water transmission lines. [Permitted in all districts]

B-8: Community water supply wells, reservoirs, storage facilities, pump stations and treatments and maintenance facilities. [Subject to approval in all districts]

B-9: Accessory uses customary with and incidental to any aforesaid permitted use, including signs as provided in §188-44 through §188-51, subject to approval of a site development plan if required for such permitted use.

The Catskill Aqueduct land within the Village of Nelsonville is an existing permitted use as listed under the Village of Nelsonville Zoning Code. The repair and rehabilitation activities within the Gatehouse Road and Fishkill Road study areas in the Village of Nelsonville would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 188, Zoning.

§188-35, General Standards

F. Erosion and sedimentation. Provision shall be made for control of erosion and sedimentation and for avoiding siltation of streams and wetlands, both during construction and upon completion thereof, in accordance with the criteria of the

Erosion and Sedimentation Control handbook of the United States Department of Agriculture, Soil Conservation Service.

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

§188-26, Noise.

- A. *Without limitation to the provisions in §188-25, it shall be unlawful for the owner, occupant and/or any person causing or permitting sound or noise to project within the boundary of a use district which exceeds the limiting noise level set forth in Table No. 1 below. Whenever an applicable federal, state or county statute sets a different limit than specified in this chapter, the lower limitation shall apply.*

All districts except Commercial (C): Maximum Noise Level (dBA): 60

Commercial (C): Maximum Noise Level (dBA): 65

- B. *The measurement of sound or noise shall be made with a sound level meter meeting the standards prescribed by the American National Standards Institute made at or beyond the property line of the property on which such noise is generated and shall be taken at least four feet from ground level.*

Repair and rehabilitation work activities within the Village of Nelsonville study areas were evaluated for compliance with the Village of Nelsonville code related to noise in the respective “Noise” sections in Section 9.11, “Village of Nelsonville.”

Town of Philipstown Codes

Relevant sections of the Town of Philipstown codes that apply to the Town of Philipstown study areas, including Indian Brook Road, Old Albany Post Road, and Sprout Brook Road study areas, are described below. In addition, a portion of the Fishkill Road Study Area is within the Town of Philipstown, and repairs to the aqueduct bridge crossing at Foundry Brook are proposed. Therefore, the potential effects of the repair and rehabilitation within the Fishkill Road Study Area were evaluated relative to the applicable Town of Philipstown codes.

Chapter 84, Environmental Quality Review

The Town of Philipstown requires compliance with the SEQRA.

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of Philipstown code related to Environmental Quality Review.

Chapter 90, Flood Damage Prevention

§90-11. A floodplain development permit is hereby required for all construction and other development to be undertaken in areas of special flood hazard in this community for the purpose of protecting its citizens from increased flood hazards and insuring that new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertake any development in an area of special flood hazard, as shown on the Flood Insurance Rate Map enumerated in §90-6, without a valid floodplain development permit. Application for a permit shall be made on forms furnished by the local administrator and may include, but not be limited to, plans, in duplicate, drawn to scale and showing the nature, location, dimensions, and elevations of the area in question, existing or proposed structures, fill, storage of materials, drainage facilities, and the location of the foregoing. Such forms shall be prescribed by and may be amended by resolution of the Town Board.

Repair and rehabilitation work activities within the Town of Philipstown study areas were evaluated for compliance with the Town of Philipstown code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources,” the respective “Natural Resources” sections in Section 9.12, “Town of Philipstown,” where applicable, and Section 9.11.3.6, “Natural Resources” for the Fishkill Road Study Area.

§93-5, Regulated Activities

Activities regulated under this chapter are:

- (A) Dredging or excavation; grading; and removal of soil, mud, sand, gravel, silt, earth material and other aggregate, either directly or indirectly.*
- (C) Construction or installation of any structure or facility, including but not limited to roads, buildings, driveways, parking facilities, swimming pools, tennis courts, bridges, pipes or conduits; installation of sewage disposal systems or sewer outfall; drilling of wells; placing of other obstructions; or driving of pilings.*
- (D) Alteration or diversion of any flow of watercourse or wetland. This includes but is not limited to docks, dams, pilings and bridges.*

§93-9, Application Procedures

No person shall undertake, permit, conduct or cause to be undertaken, permitted or conducted a regulated activity in a controlled area without applying for and obtaining a wetlands permit therefor as provided in this chapter. All wetlands permits shall be written, issued, and enforced by the Natural Resources Review Officer/Wetlands Inspector. Applications for minor projects shall be reviewed only by the Natural Resources Review Officer/Wetlands Inspector. For major projects, the Natural Resources Review Officer shall transmit the application to the Conservation Board for plan review. Once the Conservation Board has approved a plan for a wetlands permit, with appropriate conditions as deemed necessary, the Natural Resources Review Officer shall

issue the wetlands permit subject to the conditions adopted by the Conservation Board in its plan approval.

Repair and rehabilitation work activities within the Town of Philipstown study areas were evaluated for compliance with the Town of Philipstown code related to regulated activities within watercourses and wetlands in Section 9.3.9.2, “Water Resources,” the water resources section in the respective “Natural Resources” sections in Section 9.12, “Town of Philipstown,” where applicable, and Section 9.11.3.6, “Natural Resources” for the Fishkill Road Study Area.

§159-5, Timber Harvesting Permit Required

All trees or timber cut, removed or harvested from any property or lot in the Town of Philipstown shall only be cut, removed or harvested as provided by this chapter, except for exempt operations as set forth in this chapter.

§159-6, Exempt Operations

A timber harvesting permit is not required for the following operations:

- (A) The cutting, removal or harvesting of trees or timber from an area of 40,000 square feet or less in size on any lot or from a contiguous area of two acres or less in size on adjacent lots.*

Repair and rehabilitation work activities within the Town of Philipstown study areas were evaluated for compliance with the Town of Philipstown code related to timber harvesting in Section 9.3.9.4, “Terrestrial Resources,” the terrestrial resources section in the respective “Natural Resources” sections in Section 9.12, “Town of Philipstown,” where applicable, Section 9.11.3.6, “Natural Resources” for the Fishkill Road Study Area.

Chapter 175, Zoning

The zoning code of the Town of Philipstown regulates the use of land and any structures. Chapter 175, Zoning regulates the location, design, construction, alteration, occupancy, and use of structures and the use of land in the Town of Philipstown, dividing the Town into land use districts. This chapter is enacted in accordance with the updated Town of Philipstown Comprehensive Plan, adopted by the Town Board on March 9, 2006, in order to implement the community's goals as expressed in the Town of Philipstown Comprehensive Plan.

§175-14, Cold Spring Reservoir Watershed Overlay District

D(10): Prohibited uses and practices: Clearing of more than 2,000 sf of vegetation within 200 feet of Foundry Brook or either of the Cold Spring reservoirs.

Clear cutting - defined as a method of cutting, removal or harvesting that removes 75% or more of the trees of six inches in diameter or greater at breast height (dbh) in either a stand of trees in an area of more than two acres, or in any area of more than two acres.

The Catskill Aqueduct land within the Town of Philipstown is an existing permitted use as listed under the Town of Philipstown Zoning Code. The repair and rehabilitation activities within the Fishkill Road, Indian Brook Road, Old Albany Post Road, and Sprout Brook Road study areas in the Town of Philipstown would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 175, Zoning.

§175-40, Environmental Performance Standards

C. Noise. The following standards apply to noise.

- (2) No person, firm, or corporation shall allow the emission of sound which, as measured at the property lines, has a sound level in excess of:
 - (a) Fifty decibels on the A-weighted scale between the hours of 7 AM and 8 PM; or*
 - (b) Forty decibels on the A-weighted scale between the hours of 8 PM and 7 AM; or*
 - (c) Five decibels above the ambient noise at the point on the boundary of the lot where measured whichever is greater.**
- (4) The following shall be exempt from the noise level regulations:
 - (b) Noises emanating from construction and maintenance activities between 8 AM and sunset, Monday through Friday.**

E. Smoke, dust, and other atmospheric pollutants

- (4) Maximum permitted emission of dust.
 - (b) There shall be no measurable emission of dust or other particulate matter not related to combustion for indirect heating.*
 - (c) Properties shall be suitably improved and maintained with appropriate landscaping, paving, or other materials to minimize windblown dust and other particulate matter.**

L. Exterior illumination and glare.

Specific guidance on illumination is provided and includes shielding lighting from neighboring properties, height of lighting equipment and maximum lumens allowable.

Repair and rehabilitation work activities within the Town of Philipstown study areas were evaluated for compliance with the Town of Philipstown codes related to environmental performance standards for noise, smoke, dust and other atmospheric pollutants, and exterior illumination and glare in the respective “Noise” sections in Section 9.12, “Town of Philipstown,”

Section 9.11.3.9 “Noise” for the Fishkill Road Study Area, Section 9.3.14, “Air Quality,” and Section 9.3.8, “Visual Resources.”

Chapter 147A, Stormwater Management and Erosion and Sediment Control

The Town of Philipstown requires completion of a SWPPP for projects that disturbed more than one acre of land.

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Town of Cortlandt Codes

Relevant sections of the Town of Cortlandt codes that apply to the Town of Cortlandt study area, namely the Aqueduct Road Study Area, are described as follows:

Chapter 175, Flood Damage Prevention

It is the purpose of this chapter to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- A. Regulate uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities.*
- B. Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction.*
- C. Control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of floodwaters.*
- D. Control filling, grading, dredging and other development which may increase erosion or flood damages.*
- E. Regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.*
- F. Qualify for and maintain participation in the National Flood Insurance Program.*

Repair and rehabilitation work activities within the Aqueduct Road Study Area were evaluated for compliance with the Town of Cortlandt code related to flood damage prevention in the floodplains section of Section 9.13.3.7, “Natural Resources.”

Chapter 179 Freshwater Wetlands, Waterbodies, and Watercourses

The Town of Cortlandt requires compliance with the policies outlined within Chapter 179, Freshwater Wetlands, Waterbodies, and Watercourses. The overall intent of this Town code is to provide a balance between property owners to the free use of property and those in future generations, while protecting the quality, integrity, biodiversity and prevent the loss of wetlands, waterbodies and watercourses.

§179-5, Determination of boundaries; compliance required; permit application and procedures

The boundaries of a wetland/watercourse shall be determined by field inspection and delineation by a qualified environmental professional, subject to approval by the approval authority and subsequent survey and mapping by a New York State licensed land surveyor unless such is waived by the approving authority. As a policy, the determination and delineation of wetlands will only be conducted during the growing season which is usually April 2 to November 30. Wetland delineations must be re-evaluated every 24 months (or two years) to the satisfaction of the approving authority.

Repair and rehabilitation work activities within the Aqueduct Road Study Area were evaluated for compliance with the Town of Cortlandt code related to freshwater wetlands, waterbodies and watercourses in Section 9.3.9.2, “Water Resources,” and the water resources section of Section 9.13.3.7, “Natural Resources.”

§179-8 Applicability; more protective standards to prevail

The Town of Cortlandt requires compliance with the State Environmental Quality Review Act (SEQRA).

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of Cortlandt code related to Environmental Quality Review.

Chapter 197, Noise

§197-14 Residential Districts

§197-14 states that during the hours of 8 AM to 6 PM, noise levels within any residentially zoned district shall not exceed sixty-five (65) dB(A)'s and during the hours of 6 PM to 8 AM, noise levels within any residentially zoned district shall not exceed fifty-five (55) dB(A)'s.

§197-16 Construction Activities

No person shall conduct or permit to be conducted construction activities in a manner so as to produce a sound level exceeding the limitations in this section: (A) The use and operation of construction machinery and equipment in connection with the excavation

and filling of land and the demolition, rehabilitation and construction of buildings between the hours of 7 PM and 7 AM, Monday through Saturday, and all day Sunday and national holidays, so as to be audible to the human ear beyond the property line of the property upon which such excavation, filling, demolition, rehabilitation or construction operations are being undertaken, provided that this subsection shall not apply to operations of an emergency nature undertaken by governmental entities or public service corporations during the prohibited hours set forth above.

Repair and rehabilitation work activities within the Aqueduct Road Study Area were evaluated for compliance with the Town of Cortlandt code related to noise in Section 9.13.3.10, "Noise."

Chapter 262, Stormwater Management and Erosion and Sediment Control

The Town of Cortlandt requires completion of a SWPPP for projects that disturb more than one acre of land.

Stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, "Water and Sewer Infrastructure."

§283-3, Cutting or Destruction of Trees Restricted; regulated Activities

§283-3 A(1): cut down, kill, clear cut, top or otherwise destroy, or commit any act which will lead to the eventual destruction of, any tree in violation of this chapter.

§283-3C-2: Any property owner applying for subdivision approval and/or site plan approval and/or building permit whose plans would require the removal of four or more trees on said property shall submit a tree inventory within the 50 feet of the proposed area of disturbance. This inventory shall be compiled by an ISA-certified arborist or state licensed forester appointed by the Town but paid for by the applicant, and it must include a comprehensive list of all individual trees on said property, depicting size, genus, species and cultivar. The property owner must also produce a tree protection plan.

§283-9A: All persons who remove, or cause to be removed, trees without a permit shall restore the affected area by backfilling holes and creating acceptable grade and plantings. Any tree damaged during construction shall either be replaced in kind or with multiple trees.

§283-9B (2): All replanted over story trees shall be at least 6 ft tall and have a trunk not less than 2 caliper inches. Replanted understory trees shall be at least 4 ft tall or have a trunk not less than one caliper inch.

§283-9B (3): In lieu of an on-site restoration, the permitting authority may, with the advice of an ISA arborist, allow the purchase of trees or require planting of trees on public land in lieu of on-site restoration at a ratio of 1 1/2 times the number (rounded up) of trees removed.

Topographical Alteration 283-4: A permit as specified by this chapter shall also be required for all on-site soil movements of 100 cubic yards or greater on any individual lot with a vertical dimension greater than 12 inches or more than six inches of fill within the critical root zone of a tree.

Repair and rehabilitation work activities within the Aqueduct Road Study Area were evaluated for compliance with the Town of Cortlandt code related to trees in the terrestrial resources section of Section 9.13.3.7, “Natural Resources.”

Chapter 301, Diversion of Watercourses

Pursuant to §64, Subdivision 10-a, of the Town Law, the Town Board of the Town of Cortlandt does hereby enact this chapter to provide for control of the filling and diversion of streams and watercourses within the Town of Cortlandt, except when authorized by a state or federal agency, by requiring that any person, firm or corporation shall secure a permit from the Town Board before filling or diverting any stream or watercourse. The Town Board may, in its discretion, deny a permit if it determines that the proposed filling or diversion is detrimental in the drainage or welfare of the town.

Repair and rehabilitation work activities within the Aqueduct Road Study Area were evaluated for compliance with the Town of Cortlandt code related to watercourses in the water resources section of Section 9.13.3.7, “Natural Resources.”

Chapter 307: Zoning

The zoning code of the Town of Cortlandt regulates the use of land and any structures. The purpose of Chapter 307, Zoning is to promote the health, safety, morals and general welfare of the community by establishing regulations and restrictions with respect to height, number of stories and size of buildings and other structures, the percentage of lot that may be occupied, the sizes of yards and other open spaces, the density of population and the location and use of structures and land.

The Catskill Aqueduct land within the Town of Cortlandt is an existing permitted use as listed under the Town of Cortlandt Zoning Code. The repair and rehabilitation activities within the Aqueduct Road Study Area in the Town of Cortlandt would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within this study area would therefore be compliant with Chapter 307, Zoning.

Town of Yorktown Codes

Relevant sections of the Town of Yorktown codes that apply to the Town of Yorktown study areas, including Jacob Road, Chapman Road, Croton Dam Road, and Kitchawan Road study areas, are described as follows:

Chapter 161, Environmental Quality Review

The Town of Yorktown requires compliance with the SEQRA.

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of Yorktown code related to Environmental Quality Review.

Chapter 216, Peace and Good Order

§216-2, Unreasonable, unnecessary or excessive noise

D. The provisions of this section shall not apply to the following:

- (4) Noise generated by construction equipment or lawn maintenance equipment, provided that such operation or use does not occur between the hours of 11 PM and 7 AM, prevailing time, from Sunday evenings, through and including Friday mornings; between 10 PM Friday evenings and 8 AM, Saturday mornings, prevailing time; and between 10 PM Saturday evenings and 8 AM Sunday mornings, prevailing time.*

Repair and rehabilitation work activities within the Town of Yorktown study areas were evaluated for compliance with the Town of Yorktown code related to noise in the respective “Noise” sections in Section 9.14, “Town of Yorktown.”

Chapter 175, Flood Damage Prevention

It is the purpose of this chapter to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- G. Regulate uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities.*
- H. Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction.*
- I. Control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of floodwaters.*
- J. Control filling, grading, dredging and other development which may increase erosion or flood damages.*
- K. Regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.*
- L. Qualify for and maintain participation in the National Flood Insurance Program.*

Repair and rehabilitation work activities within the Town of Yorktown study areas were evaluated for compliance with the Town of Yorktown code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources,” and the respective “Natural Resources” sections in Section 9.14, “Town of Yorktown,” where applicable.

Chapter 178, Freshwater Wetlands

This chapter shall be known as the "Freshwater Wetlands and Watercourse Protection Law of the Town of Yorktown." It is a chapter regulating the dredging, filling, deposition or removal of materials; diversion or obstruction of water flow; and placement of structures and other uses in the ponds, lakes, reservoirs, watercourses and wetlands in the Town of Yorktown.

§178-9.B(11), Prohibited, regulated and permitted acts

Freshwater wetlands within the same one-acre area, the cutting of more than three trees which are over six inches in diameter at a point 4 1/2 feet from ground level within a twelve-month period.

Repair and rehabilitation work activities within the Town of Yorktown study areas were evaluated for compliance with the Town of Yorktown code related to freshwater wetlands in the wetland section of Section 9.3.9.2, "Water Resources," and the respective "Natural Resources" sections in Section 9.14, "Town of Yorktown," where applicable.

§200-6, General Standards for Exterior Lighting

Construction site lighting. Care should be taken in the use of temporary lighting on all construction sites to reduce light trespass and glare onto adjacent roadways and properties. All temporary lighting, for security purposes or otherwise, should be directed towards the construction site and shielded when possible. Only security lights shall be permitted to be operated 24 hours a day. All other temporary lighting must be extinguished when the site is inactive.

§200-7, Lighting Plan Approval

A lighting plan shall be submitted and approved by the approval authority for all new and amended site plan or parking plan applications.

Repair and rehabilitation work activities within the Town of Yorktown study areas were evaluated for compliance with the Town of Yorktown codes related to lighting in Section 9.3.8, "Visual Resources."

Chapter 247, Illicit Storm Sewer Discharges and Connections

§247-5, Discharge Prohibitions

Applicable to all water entering the MS4 generated on any developed and undeveloped lands unless explicitly exempted by an authorized enforcement agency. Any person subject to an industrial or construction activity SPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the Town of Yorktown prior to the allowing of discharges to the MS4.

Chapter 249, Stormwater Management

The Town of Yorktown requires completion of a SWPPP for projects that disturbed more than one acre of land.

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Chapter 270, Trees

§270-4, Definitions

Protected Tree: Any tree, either deciduous or coniferous, having a dbh of six inches or greater and a minimum height of 25 feet. The term "protected tree" includes a tree of significance.

Regulated Buffer Zone: For all nonresidential property: (1) Ten feet measured from the side property lines toward the interior; and (2) Thirty feet measured from the rear property line toward the interior.

*Specimen Tree: Any tree with a dbh of 18 inches or greater; any tree of the species American chestnut (*Castanea dentata*), copper beech (*Fagus sylvatica*), flowering dogwood (*Cornus florida*).*

§270-7, Regulated Activities

The provisions of this section shall apply to all property in Town, whether privately owned, publicly owned, or held in common by homeowners' associations.

B. The following regulated activities require a tree removal permit:

(1) Woodlands and woodlots:

(a) The removal of more than 30% of any combination of the three layers of woodland vegetation (i.e., canopy trees, shrub layer, ground layer) existing on any property as measured cumulatively since the baseline date.

(b) Any land conversion in a woodland or woodlot.

(2) Regulated buffer zones: in a period of 12 consecutive months:

(a) Removal of more than two protected trees within the entire regulated buffer zones on properties equal to or less than four acres;

- (b) *On properties greater than four acres, removal of more than two protected trees within any buffer zone, except where a buffer zone exceeds 750 feet in length, removal of more than two protected trees for each 750 feet or part thereof.*
- (3) *Individual trees:*
 - (a) *In a period of 12 consecutive months, the removal of more than 10 protected trees in a five-thousand-square-foot area.*
 - (b) *Removal of any tree of significance, whether living, diseased, or damaged.*
 - (c) *Removal of any protected tree located on a slope greater than 15% as determined by Town topographic maps.*
 - (d) *In a period of 12 consecutive months, removal of more than three protected trees within a one-acre area in a wetlands or wetlands buffer as defined in Chapter 178.*
- C. *Exceptions. No tree removal permit shall be required for:*
 - (1) *Removal of a dead, manifestly diseased and dying, or uprooted tree.*
 - (2) *Removal of a hazardous condition.*
 - (3) *Removal of an invasive species.*
 - (4) *Normal maintenance of trees.*
 - (5) *Tree removal that is necessary to maintain a public or private utility, provided that such removal is conducted according to lawful easements, statutory requirements, franchise agreements, and New York State Public Service Commission orders regarding transmission and distribution vegetation management plans and activities, and provided that the utility files with the Town Supervisor and Town Highway Superintendent a plan showing the areas of removal at least 30 days before commencing such operations, except when emergency removal makes such filing impractical.*
 - (6) *Tree removal that is necessary to maintain public or private rights-of-way held under New York City permits or under easements, and public rights-of-way, provided that with respect to public rights-of-way, the Highway Superintendent files with the Town Engineer a plan showing the areas of removal at least 30 days before commencing such operations, except when emergency removal makes such filing impractical.*
 - (7) *Tree removal that is necessary to maintain established trails in nature preserves and public parks, provided that a plan is filed with the Town Engineer at least 30 days before commencing tree removal operations.*

- (8) *Removal of trees within 10 feet of any component of an existing or approved septic system as required by the Westchester County Health Department or within 10 feet of a subsurface sewer structure.*
- (9) *Removal of trees in a woodland or woodlot in accordance with a forest management or stewardship plan or as part of an agricultural activity. A tree removal permit will be required for any land conversion activities, whether or not undertaken as part of a forest stewardship plan.*
- (10) *Tree removal on landscaped property as defined in this chapter, so long as the Planning Board approves an amended site plan.*
- (11) *Tree removal as part of wildlife habitat management in accordance with a specific forest stewardship plan, prepared by a qualified ecologist and approved by the Conservation Board.*
- (12) *Tree removal for a purpose not regulated pursuant to §270-7B, above, and not otherwise prohibited.*

Repair and rehabilitation work activities within the Town of Yorktown study areas were evaluated for compliance with the Town of Yorktown code related to trees in the terrestrial resources sections of the respective “Natural Resources” sections in Section 9.14, “Town of Yorktown.”

Chapter 300, Zoning

The zoning code of the Town of Yorktown regulates the use of land and any structures. The comprehensive zoning plan for the Town of Yorktown is set forth in the text, maps and schedules which constitute Chapter 300. Said plan is adopted for the protection and promotion of the public health, safety, morals and general welfare of the community.

The Catskill Aqueduct land within the Town of Yorktown is an existing permitted use as listed under the Town of Yorktown Zoning Code. The repair and rehabilitation activities within the Jacob Road, Chapman Road, Croton Dam Road, and Kitchawan Road study areas in the Town of Yorktown would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 300, Zoning.

§300-67 Watershed and Water Supply Facilities

The Town of Yorktown requires compliance with the codes outlined in Section §300-67. This section discusses requirements that need to be met before watershed, water supply and/or water filtration can be implemented. While not providing specific guidelines for noise and illumination, this section states that exterior lighting shall be minimized and installed so that light is diverted only where needed and so that there is no loss of light to the surrounding environment. In addition, the facility shall not be operated so as to cause noise to surrounding and neighboring properties with proper mitigation provided to avoid adverse noise impacts.

Repair and rehabilitation work activities within the Town of Yorktown study areas were evaluated for compliance with the Town of Yorktown codes related to watershed and water supply facilities lighting and noise control in Section 9.3.8, “Visual Resources,” and the respective “Noise” sections in Section 9.14, “Town of Yorktown.”

Town of New Castle Codes

Relevant sections of the Town of New Castle codes that apply to the Town of New Castle study areas, including the Somerstown Turnpike, Station Place, and Campfire Road study areas, are described as follows:

Chapter 60, Zoning

The zoning code of the Town of New Castle regulates the use of land and any structures. Chapter 60 has been prepared and enacted for the purpose of promoting the health, safety, morals and the general welfare of the Town of New Castle and is in accordance with a carefully studied and considered Comprehensive Plan intended to guide the future growth and development of the Town of New Castle in such a way as to encourage the most beneficial and appropriate relationships among land uses and to accomplish the specific purposes identified within Chapter 60.

The Catskill Aqueduct land within the Town of New Castle is an existing permitted use as listed under the Town of New Castle Zoning Code. The repair and rehabilitation activities within the Somerstown Turnpike, Station Place, and Campfire Road study areas in the Town of New Castle would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 60, Zoning.

Chapter 70, Floodplain Development

§70-11.A. A floodplain development permit is hereby established for all construction and other development to be undertaken in areas of special flood hazard in this community for the purpose of protecting its citizens from increased flood hazards and ensuring that new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertake any development in an area of special flood hazard, as shown on the Flood Insurance Rate Map enumerated in §70-6, without a valid floodplain development permit. Application for a permit shall be made on forms furnished by the local administrator and may include but not be limited to plans, in duplicate, drawn to scale and showing the nature, location, dimensions and elevations of the area in question, existing or proposed structures, fill, storage of materials, drainage facilities and the location of the foregoing. All permit applications and all documents accompanying the application shall also be submitted in an electronic file format.

Repair and rehabilitation work activities within the Town of New Castle study areas were evaluated for compliance with the Town of New Castle code related to floodplain development in the floodplains section of Section 9.3.9.2, “Water Resources.”

Chapter 121, Tree Preservation

The Town of New Castle regulates the removal of trees within the Town. Except as provided in §121-4, *Activities permitted by right, or as otherwise described below, it shall be unlawful to conduct, directly or indirectly, any of the following activities within the territory of the Town of New Castle, unless and until a tree removal permit shall have been obtained pursuant to §121-5:*

- A. *Any clearing.*
- B. *Within the regulated landscape buffer zone, any removal of a tree.*
- C. *Outside of the regulated landscape buffer zone, any removal of a tree with a dbh of eight inches or more.*
- D. *Any removal of a specimen tree.*
- E. *Any removal of a tree on the Town's List of Significant Trees.*
- F. *Removal of any street tree within the Town's designated right-of-way.*
- G. *Work to be conducted on or within the critical root zone of any street tree.*

Repair and rehabilitation work activities within the Town of New Castle study areas were evaluated for compliance with the Town of New Castle code related to tree preservation in Section 9.3.9.4, “Terrestrial Resources,” and the terrestrial resources sections of the respective “Natural Resources” sections in Section 9.15, “Town of New Castle,” where applicable.

Chapter 76, Historic Preservation

The protection of historic resources in the Town of New Castle is a public policy pursuant to Municipal Home Rule Law §10 and General Municipal Law §96-a. Chapter 76, Historic Preservation seeks to accomplish the protection, enhancement and perpetuation of such historic properties, in order to safeguard the Town's historic, aesthetic and cultural heritage; to stabilize and improve property values; to ensure the harmonious, orderly and efficient growth in development of the Town; to foster civic pride in the accomplishments of the past; to protect and enhance the Town's attractiveness to visitors; and to provide an educational service to the community.

Repair and rehabilitation work activities within the Town of New Castle study areas were evaluated for compliance with the Town of New Castle code related to historic preservation in Section 9.3.7, “Historic and Cultural Resources,” and the respective “Historic and Cultural Resources” sections in Section 9.15, “Town of New Castle,” where applicable.

Chapter 90, Noise

§90-6: Permitted and Regulated Noises

- B. *Any building or construction activity, including the clearing and removal of trees or other site preparation work which is audible outside of a building or structure, is permitted only as follows:*

- (1) *Monday, Tuesday, Wednesday, Thursday and Friday, except holidays, during the hours of 7:30 AM to 8 PM;*
- (2) *Saturday, Sunday and holidays during the hours of 10 AM. to 5 PM, except that blasting is not permitted on Saturday, Sunday and holidays and is further regulated by Chapter 44, Blasting, of the Town Code; or*
- (3) *As may be permitted by a use variance granted by the Zoning Board of Appeals in accordance with §60-540 et seq.*

Repair and rehabilitation work activities within the Town of New Castle study areas were evaluated for compliance with the Town of New Castle code related to noise in the respective “Noise” sections in Section 9.15, “Town of New Castle.”

Chapter 108A, Stormwater Management

The Town of New Castle requires completion of a SWPPP for projects that disturbed more than one acre of land.

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Chapter 121, Tree Preservation

The Town of New Castle has declared that the preservation of trees within the Town is necessary to protect the health, safety, and general welfare due to the ability of trees to shade, impede soil erosion, aid in water absorption and retention, inhibit excess runoff and flooding, enhance air quality, offer a natural barrier to noise, provide a natural habitat for wildlife, provide screening, enhance property values and add to the aesthetic quality of the community. Except as provided in §121-4, it is unlawful to perform any of the following activities unless a permit pursuant to §121-5 has been obtained:

- A. *Any clearing.*
- B. *Within the regulated landscape buffer zone, any removal of a tree.*
- C. *Outside of the regulated landscape buffer zone, any removal of a tree with a dbh of eight inches or more.*
- D. *Any removal of a specimen tree.*
- E. *Any removal of a tree on the Town's List of Significant Trees.*
- F. *Removal of any street tree within the Town's designated right-of-way.*
- G. *Work to be conducted on or within the critical root zone of any street tree.*

Repair and rehabilitation work activities within the Town of New Castle study areas were evaluated for compliance with the Town of New Castle code related to tree preservation in Section 9.3.9.4, “Terrestrial Resources,” and the respective terrestrial resources section in the “Natural Resources” sections in Section 9.15, “Town of New Castle,” where applicable.

Chapter 135, Watercourses

The Town of New Castle requires compliance with the local “Watercourse Protection Law of the Town of New Castle.” This law protects streams, lakes, ponds, swamps, marshes and other watercourses in the Town of New Castle from detrimental use of such watercourses and to conserve the watershed area of the town and to prevent the contamination and pollution of same, all for the health, safety and welfare of the public.

Chapter 137, Wetlands

The Town of New Castle requires compliance with the local Chapter 137, Wetlands of the Town Code in order to preserve, protect and conserve its wetlands, including waterbodies and watercourses, and the benefits derived therefrom, to prevent despoliation and destruction and to regulate the use and development thereof and to secure the natural benefits of wetlands, waterbodies and watercourses consistent with the general welfare and beneficial economic and social development of the town.

Repair and rehabilitation work activities within the Town of New Castle study areas were evaluated for compliance with the Town of New Castle codes related to watercourses and wetlands in Section 9.3.9.2, “Water Resources,” and the water resources section in the respective “Natural Resources” sections in Section 9.15, “Town of New Castle,” where applicable.

Chapter 161, Environmental Quality Review

The Town of New Castle requires compliance with SEQRA.

The repair and rehabilitation is undergoing an environmental review in compliance with SEQRA. As such, the repair and rehabilitation is compliant with the Town of New Castle code related to Environmental Quality Review.

Town of Mount Pleasant Codes

Relevant sections of the Town of Mount Pleasant codes that apply to the Town of Mount Pleasant study areas, including Chappaqua Road, Nanny Hagen Road, and Westlake Drive study areas, are described as follows:

Chapter 90, Excavation and Topsoil Removal

The Town of Mount Pleasant requires the preservation of natural topography of the Town. Chapter 90, Excavation and Topsoil Removal seeks to protect various features such as topsoil and other natural resources that constitute the land, the shape or contour of the land, the plant life and wildlife that is fostered on the land and the water or the

flow thereof upon the land, are of prime concern to the welfare of the people of the Town of Mount Pleasant, and no changes shall be permitted in such topography.

Repair and rehabilitation work activities within the Town of Mount Pleasant study areas were evaluated for compliance with the Town of Mount Pleasant code related to excavation and topsoil removal in Section 9.3.9.1, “Geology and Soils.”

Chapter 108, Flood Damage Prevention

The Town Board of the Town of Mount Pleasant finds that the potential and/or actual damages from flooding and erosion may be a problem to the residents of the Town of Mount Pleasant and that such damages may include destruction or loss of private and public housing, damage to public facilities, both publicly and privately owned, and injury to and loss of human life. In order to minimize the threat of such damages and to achieve the purposes and objectives hereinafter set forth, this chapter is adopted.

Repair and rehabilitation work activities within the Town of Mount Pleasant study areas were evaluated for compliance with the Town of Mount Pleasant code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources,” and the respective “Natural Resources” sections in Section 9.16, “Town of Mount Pleasant,” where applicable.

Chapter 111, Freshwater Wetlands

The Town Board hereby finds and declares that the public interest and general welfare of the residents of the Town of Mount Pleasant will be served through the creation of procedures for the preservation, proper maintenance and utilization of natural resources within the Town of Mount Pleasant and for the protection of said natural resources from encroachment upon, spoiling, pollution or elimination resulting from population growth attended by commercial development, housing, roads and other construction.

Repair and rehabilitation work activities within the Town of Mount Pleasant study areas were evaluated for compliance with the Town of Mount Pleasant code related to freshwater wetlands in the wetlands section of Section 9.3.9.2, “Water Resources,” and the respective “Natural Resources” sections in Section 9.16, “Town of Mount Pleasant,” where applicable.

Chapter 124, Illicit Storm Sewer Discharges and Connections

This chapter establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) process. This chapter shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by the Superintendent.

Construction Activity: Activities subject to NPDES construction permits. These include construction projects resulting in land disturbance of one acre or more. Such activities include but are not limited to clearing and grubbing, grading, excavating and demolition."

Repair and rehabilitation work activities within the Town of Mount Pleasant study areas were evaluated for compliance with the Town of Mount Pleasant code related to illicit storm sewer discharges and connections in Section 9.3.11, “Water and Sewer Infrastructure.”

Chapter 139, Noise

§139-18: Construction Activities

No person shall conduct or permit to be conducted construction activities in a manner so as to produce a sound level exceeding the limitations in this section.

- A. Residential-zoned districts. During the hours of 8 AM to 6 PM, noise levels from a construction site shall not exceed an L_{10} of 70 db(A)'s when measured at a distance of 400 feet from the construction site; during the hours of 6 PM to 8 AM, noise levels shall not exceed an L_{10} of 55 db(A)'s when measured at a distance of 400 feet from the construction site.*
- B. All other zoned districts. During normal business hours, noise levels shall not exceed an L_{10} of 75 db(A)'s when measured at a distance of 400 feet from the construction site; during other than normal business hours, noise levels shall not exceed an L_{10} of 80 db(A)'s when measured at a distance of 400 feet from the construction site.*
- C. Notwithstanding the provisions of Subsection A and B above, no person shall conduct or permit to be conducted construction activities between the hours of 5 PM and 8 AM in any zoning district in the Town of Mount Pleasant; except that in the event of urgent necessity or in the interest of safety, the Building Inspector may issue a permit for such construction activity.*

Repair and rehabilitation work activities within the Town of Mount Pleasant study areas were evaluated for compliance with the Town of Mount Pleasant code related to noise in the respective “Noise” sections in Section 9.16, “Town of Mount Pleasant.”

Chapter 183, Stormwater Management and Erosion and Sediment Control

The Town of Mount Pleasant requires completion of a SWPPP for projects that disturb more than one acre of land.

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure.”

Chapter 185, Streams and Watercourses

It shall be the duty and obligation of every owner of real property abutting a natural stream or watercourse to keep and maintain, free and clear of any and all debris, trash,

rubbish and similar substances which, by their nature, cause or tend to cause stoppage or blockage of natural stream flow, that portion of the real property which constitutes the shore or bank of the stream as well as that portion of the stream bed which abuts the real property within straight lines drawn at right angles between the side lines of the real property on the shore and the center line of the stream. Any construction or improvements done adjacent to or abutting a stream shall be done so as not to change the flow of water in the stream in such a manner as to be detrimental to the lands of others adjacent to or abutting the stream.

Repair and rehabilitation work activities within the Town of Mount Pleasant study areas were evaluated for compliance with the Town of Mount Pleasant code related to streams and watercourses in the surface water section of the respective “Natural Resources” sections in Section 9.16, “Town of Mount Pleasant.”

Chapter 201, Trees

A permit is required for trees on public land or streets. Additional guidelines apply to privately owned land, including vacant land, redevelopment projects on land to be cleared of structures, conservation development, conventional subdivisions and plans for new one- and two-family houses.

Tree - defined as any woody plant having at least one well-defined trunk at least four inches in diameter measured at a height of four feet above the natural grade and having a clearly defined crown.

§201-11B, Review of Development Applications

For Site Plan Approval the applicant shall provide the approving agency with a tree protection, preservation and reforestation plan containing at least the following information unless deemed not pertinent or necessary by the agency approving the plan: (a) An inventory of existing trees showing type, location, size and condition. The inventory shall include specimen trees, protected trees and specimen tree stands. (b) An integrated site plan showing the trees to be saved and those to be removed, utilities to be installed, grading, the approximate location of all structures, driveways and curb cuts and proposed tree plantings and other landscaping. (c) A detailed plan to protect and preserve trees before, during and for a period of two years after construction. This shall include a written statement setting forth those steps to be taken to protect trees, roots and crowns from damage during site clearance, excavation, grading, installation of utilities, paving and construction.

§201-12, Protection of Trees:

- A. All trees on any street or other publicly owned property near any excavation or construction of any building, structure or street work shall be guarded with a good substantial fence, frame or box not less than four feet high and eight feet square or at a distance in feet from the tree equal to the diameter of the trunk in inches (dbh),*

whichever is greater, and all building material, dirt or other debris shall be kept outside the barrier.

- B. No person shall excavate any ditches, tunnels or trenches or lay any drive within a radius of 10 feet from any public tree without first obtaining a written permit from the Town Arborist.*
- C. No person shall deposit, place, store or maintain upon any public place of the municipality any stone, brick, sand, concrete or other material which may impede the free passage of water, air and fertilizer to the roots of any tree growing therein, except by written permit of the Town Arborist.*

§201-6, Permits required for Trees on Streets or Town Property

§201-6(1) A. No person shall remove, prune, or otherwise disturb any tree on Town-owned property without filing an application and procuring a permit from the Town Arborist.

§201-6(1) B. Application for permits must be made at the Town Arborist's office at least 48 hours before work.

§201-6 D(2) No person or property owner shall remove a tree from the treelawn for the purpose of construction or for any other nonhazardous reason without first filing an application and procuring a permit from the Municipal Arborist and without replacing the removed tree or trees in accordance with the adopted Arboricultural Specifications. Such replacement shall meet the standards of size, species and placement as provided for in a permit issued by the Municipal Arborist. The person or property owner shall bear the cost of removal and replacement of all trees removed. Standards are provided in 201-211 C(5).

Repair and rehabilitation work activities within the Town of Mount Pleasant study areas were evaluated for compliance with the Town of Mount Pleasant code related to trees in Section 9.3.9.4, “Terrestrial Resources,” and the terrestrial resources section in the respective “Natural Resources” sections in Section 9.16, “Town of Mount Pleasant,” where applicable.

Chapter 218, Zoning

The zoning code of the Town of Mount Pleasant regulates the use of land and any structures. A Comprehensive Zoning Plan for the Town of Mount Pleasant is set forth in the text, maps and schedule which constitute Chapter 218. Said plan is adopted for the purposes set forth for the protection and promotion of the public health, safety and welfare, as identified within the chapter.

The Catskill Aqueduct land within the Town of Mount Pleasant is an existing permitted special use as listed under the Town of Mount Pleasant Zoning Code. The repair and rehabilitation activities within the Chappaqua Road, Nanny Hagen Road, and Westlake Drive study areas would be performed in compliance with the zoning requirements for watershed and water supply facilities; specifically suitable fencing would be installed surrounding the work sites, as

necessary, and following construction there would be no outdoor storage of materials. The repair and rehabilitation activities within these study areas would therefore be compliant with Chapter 218, Zoning.

Village of Pleasantville Codes

Relevant sections of the Village of Pleasantville codes that apply to the Village of Pleasantville study areas, including Washington Avenue, Pleasantville Alum Plant, and Willow Street study areas, are described as follows:

Chapter 104, Flood Damage Prevention

The Village of Pleasantville regulates properties within areas of the special flood hazard.

Repair and rehabilitation work activities within the Town of Village of Pleasantville study areas were evaluated for compliance with the Village of Pleasantville code related to flood damage prevention in the floodplains section of Section 9.3.9.2, “Water Resources,” and the respective “Natural Resources” sections in Section 9.17, “Village of Pleasantville,” where applicable.

Chapter 123, Noise

The permitted noise levels vary by time and zoning district. §123-7 states that municipal vehicles in the course of providing municipal services shall be exempt of Chapter 123 - Noise.

However, no mention of construction noise levels are discussed in Chapter 123: Noise.

Repair and rehabilitation work activities within the Village of Pleasantville study areas were evaluated for compliance with the Village of Pleasantville code related to noise in the respective “Noise” sections in Section 9.17, “Village of Pleasantville.”

Chapter 153, Stormwater Management and Erosion and Sediment Control

The Village of Pleasantville requires completion of a SWPPP for projects that disturb more than one acre of land.

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, for the duration of construction. As applicable, SWPPPs would be prepared for the study areas in accordance with applicable regulations. Further information regarding stormwater management is provided in Section 9.3.11, “Water and Sewer Infrastructure,” and in the respective “Water and Sewer Infrastructure” sections in Section 9.17, “Village of Pleasantville,” as applicable.

Chapter 182, Wetlands

The Village Board of Trustees hereby finds and declares that the public interest and general welfare of the residents of the Town of Mount Pleasant will be served through the creation of procedures for the preservation, proper maintenance and utilization of natural resources within the Village of Pleasantville and for the protection of said natural resources from encroachment upon, spoiling, pollution or elimination resulting

from population growth attended by commercial development, housing, roads and other construction.

Repair and rehabilitation work activities within the Village of Pleasantville study areas were evaluated for compliance with the Village of Pleasantville code related to wetlands in the wetlands section of Section 9.3.9.2, “Water Resources.”

Chapter 185, Zoning

The zoning code of the Village of Pleasantville regulates the use of land and any structures. A Comprehensive Zoning Plan for the Village of Pleasantville is set forth in the text, schedules and map that constitute Chapter 185. This chapter is adopted in the interest of the protection and promotion of the public health, safety and welfare of the Village of Pleasantville.

The Catskill Aqueduct within the Village of Pleasantville is an existing permitted use as listed under the Village of Pleasantville Zoning Code. The repair and rehabilitation activities within the Washington Avenue, Pleasantville Alum Plant, and Willow Street study areas in the Village of Pleasantville would not alter existing zoning or require a change in existing zoning. The repair and rehabilitation activities within this study area would therefore be compliant with Chapter 185, Zoning.

9.3.4 SOCIOECONOMIC CONDITIONS

This section presents the screening assessment of the potential for the repair and rehabilitation to result in direct or indirect effects to factors that influence the socioeconomic conditions or character of the study areas, including land use, population, housing, and economic activity, from activities at the work sites. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. These activities include biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities would not result in direct or indirect effects to factors that influence the socioeconomic conditions or character of the area and did not warrant further review.

9.3.4.1 Screening Assessment

The repair and rehabilitation work activities would entail work primarily on DEP-owned sites, with some limited activities that would occur on private property. This screening assessment was conducted to determine whether private property occurs in the study area and the acquisition of an easement would be required to implement the repair and rehabilitation.

The acquisition of easements/rights on private properties would not be required within the following study areas: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Pine Bush Road, Canal Road, Mountain Rest Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Strawridge Road, Winchell Drive, Mount Airy Road, Passaro Drive, Gatehouse Road,

Fishkill Road, Old Albany Post Road, Sprout Brook Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Nanny Hagan Road, Westlake Drive, Pleasantville Alum Plant, and Willow Street. For these study areas, the repair and rehabilitation work activities would not result in changes to socioeconomic conditions of residences, businesses, or industry within the study areas or preclude future land development. Following construction, staging areas would be restored to baseline conditions. Operation of the Catskill Aqueduct would be consistent with baseline conditions. Therefore, a socioeconomic impact analysis within these study areas is not warranted.

The acquisition of easements/rights on private properties were identified within the Vly Atwood Road, Lucas Turnpike, Mossybrook Road, Lower Knolls Road, New Paltz-Minnewaska Road, Indian Brook Road, Aqueduct Road, and Washington Avenue study areas. The potential for socioeconomic impacts to occur within these study areas was evaluated in the respective “Socioeconomic Conditions” sections using the methodology described below.

9.3.4.2 Impact Analysis Methodology

The impact analysis consisted of: (1) establishing and describing the baseline conditions within the study areas by identifying the existing socioeconomic conditions within the relevant parcels; (2) establishing future conditions without the repair and rehabilitation by identifying anticipated changes due to proposed development and changes to specific industries within the study area that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential for impacts from the repair and rehabilitation to create a socioeconomic change by affecting the tax base, precluding future development of the land, or directly or indirectly displacing businesses (or employees), residences, or specific industries not necessarily tied to the study area.

9.3.5 COMMUNITY FACILITIES AND SERVICES

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to community facilities and services within the study areas from activities at the work sites that could physically displace or alter community facilities and services within the study areas. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. These activities include biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities pose no threat of displacing or altering community facilities and did not warrant further review.

9.3.5.1 Screening Assessment

The screening assessment included a desktop evaluation and a windshield survey to verify the local community facilities and service providers within the study areas. With the exception of the Passaro Drive, Old Albany Post Road, and Station Place study areas, community facilities were

not identified within the remaining study areas, and a community facilities and services impact analysis within these study areas is not warranted.

Within the Passaro Drive Study Area, there is one community facility, the Hudson Valley Developmental Disabilities Service Offices, operated by New York State Office for People with Developmental Disabilities. The facility is located along a private road, Passaro Drive, off Riley Road. DEP shares use of Passaro Drive for access to the Moodna Downtake Chamber through an existing agreement. An impact analysis is warranted because the repair and rehabilitation work activities have the potential to indirectly affect this facility. The potential for impacts to the community facility within the Passaro Drive Study Area was evaluated in Section 9.10.4.3, “Community Facilities and Services,” using the methodology described below.

One community facility, the Mount of Atonement Monastery, was identified within the Old Albany Post Road Study Area. Repair and rehabilitation work activities within the Old Albany Post Road Study Area would occur on a DEP-owned site, with the nearest limits of construction occurring on the east side of Old Albany Post Road, near the rear boundaries of the Mount of Atonement Monastery. No structures are located within the study area boundaries. Per the *CEQR Technical Manual*, religious and cultural facilities are analyzed only if the facility itself is the subject of the proposed project or would be physically displaced or altered by the project. The Mount of Atonement Monastery near the Old Albany Post Road work area would remain open and there is no shared driveway or activity that would impede those visiting the monastery. Since the repair and rehabilitation would not interrupt the use of this community facility, a community facilities and services impact analysis within the Old Albany Post Road Study Area is not warranted.

Millwood Fire Company Station 1, a community facility, was identified within the Station Place Study Area. Repair and rehabilitation work activities within the Station Place Study Area would occur on a DEP-owned site, with the nearest limits of construction occurring north of the Millwood Fire Company, on Shingle House Road. This would be the access point to reach the Millwood North Cut-and-Cover Tunnel at the southern end of the study area. Per the *CEQR Technical Manual*, fire protection services are analyzed only if the facility itself is the subject of the proposed project or would be physically displaced or altered by the project. The Millwood Fire Company would remain open and the delivery of service would not be interrupted. Since the repair and rehabilitation would not interrupt the use of this community facility, a community facilities and services impact analysis within the Station Place Study Area is not warranted.

9.3.5.2 Impact Analysis Methodology

The impact analysis for the Passaro Drive Study Area identified above consisted of:

(1) establishing and describing the baseline conditions within the study area by identifying the local community facilities and services; (2) establishing future conditions without the repair and rehabilitation by identifying anticipated changes to community facilities and services planned and programmed for implementation within the study area that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential for impacts from the repair and rehabilitation to those community facilities and services due to the physical displacement or alteration of land occupied by a community facility or service, increased

demands on community facilities and services, or disruption of operations of the community facility or services.

9.3.6 OPEN SPACE AND RECREATION

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to open space and recreation within the study area from activities at the work sites that could alter the quality or availability of open spaces for continued public and private recreational uses within the study areas. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. These activities include biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities would not affect utilization of existing open space resources or specific recreational users and did not warrant further review.

9.3.6.1 Screening Assessment

The open space and recreation screening assessment included characterizing existing and potential future open space uses at the State, county, and local level within the study areas that would potentially be affected by the repair and rehabilitation.

This screening assessment was performed using ArcGIS data. Field visits provided further information about open space in the study area. Open spaces were not identified within the following study areas: Vly Atwood Road, Pine Bush Road, Mossybrook Road, Lower Knolls Road, Le Fevre Lane, Armato Lane, Strawridge Road, Winchell Drive, Passaro Drive, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, Jacob Road, and Washington Avenue. Therefore, an open space and recreation impact analysis within these study areas is not warranted.

Open spaces were identified within the remaining study areas, as shown on **Table 9.3-4**. The potential for impacts to open space and recreational resources within these study areas were evaluated in the respective “Open Space and Recreation” sections using the methodology described below.

9.3.6.2 Impact Analysis Methodology

The impact analysis for the study areas identified in **Table 9.3-4** consisted of: (1) establishing and describing the baseline conditions within the applicable study area by mapping existing uses of open space and recreational resources, including those identified in local open space plans; (2) establishing future conditions without the repair and rehabilitation by identifying plans to expand or create new open spaces or recreational resources within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential for impacts from the repair and rehabilitation on open space and recreational resources by evaluating if the proposed project would potentially restrict public access to or displace open spaces and recreational resources.

Table 9.3-4: Open Spaces within the Repair and Rehabilitation Study Areas

Town/Village	Study Area	Open Space
Town of Olive	Ashokan Screen Chamber	Ashokan Day Use Area
	Beaverkill Road	Acorn Hill DEP Watershed Recreational Land
	Atwood-Olivebridge Road	Acorn Hill DEP Watershed Recreational Land
Town of Marbletown	Lucas Turnpike	Marbletown O&W Rail Trail
	Canal Road	Rondout Creek
Town of New Paltz	Mountain Rest Road	Mohonk Preserve
	New Paltz-Minnewaska Road	Mohonk Preserve
		Glory Hill Trail
Town of Gardiner	Forest Glen Road	Walkkill River
Town of New Windsor	Mount Airy Road	Silver Stream Reservoir/Brown's Pond
Village of Nelsonville	Gatehouse Road	Hudson Highlands State Park Preserve
		Village of Nelsonville Open Space
		Nelsonville Trail
	Fishkill Road	Hudson Highlands State Park Preserve
		Lone Star Trail
Town of Cortlandt	Aqueduct Road	Hollowbrook Golf Course
		Common Land Homeowners Association-owned Open Space
		Assumption Cemetery
Town of Yorktown	Chapman Road	Turkey Mountain West, DEP Recreational Land DEP Watershed Lands of New Croton Reservoir
	Croton Dam Road	New Croton Reservoir with DEP Watershed Lands of New Croton Reservoir
		Teatown-Kitchawan Trail
	Kitchawan Road	Teatown Lake Preserve
Town of New Castle	Somerstown Turnpike	Town Open Space
	Station Place	North County Trailway
	Campfire Road	Gedney Park
Gedney Park Hiking Trail (Red Trail)		
Town of Mount Pleasant	Chappaqua Road	Edith Macy Conference Center, Girl Scouts of America
	Nanny Hagen Road	Kensico Reservoir with DEP Watershed Lands of Kensico Reservoir
	Westlake Drive	Kensico Reservoir with DEP Watershed Lands of Kensico Reservoir
Village of Pleasantville	Pleasantville Alum Plant	Banks Cemetery
		Mount Pleasant Tennis Club
		United Methodist Cemetery
	Willow Street	Banks Cemetery

9.3.7 HISTORIC AND CULTURAL RESOURCES

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to historic and cultural resources within the study areas from activities at the work sites that could alter the integrity of historic and cultural resources. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. These activities include biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities would not result in any in-ground disturbance or alter the visual prominence of known historic resources and did not warrant further review.

9.3.7.1 Screening Assessment

The historic and cultural resources assessments were conducted in accordance with the New York State Historic Preservation Act (SHPA) of 1980, as set forth in Section 14.09 of the New York State Parks, Recreation, and Historic Preservation Law. The assessments have also been prepared in accordance with Section 106 of the National Historic Preservation Act of 1966. These laws, respectively, require that federal and state agencies consider the effects of their proposed actions on any properties listed on or determined eligible for listing on the National and State Registers of Historic Places.

The screening assessment was performed by conducting a review of the original construction methods for the Catskill Aqueduct and characterizing the types of work activities proposed for each study area. In particular, the limits of previous site disturbance associated with construction of the Catskill Aqueduct were compared to the limits of potential for ground disturbance associated with repair and rehabilitation to determine if the proposed project could affect cultural or archeological resources. In addition, the screening assessment included characterizing sites listed or eligible for listing on the National and/or State Register of Historic Places within the study areas.

As shown on **Table 9.3-5**, study areas were identified as containing sites listed or eligible for listing on the National and/or State Register of Historic Places. There is a two-story building owned by DEP, a bridge, and four siphon chambers that are eligible for listing on the National Register of Historic Places. The Ben Nesin Laboratory, located at the Ashokan Screen Chamber, is the central facility for DEP offices for the Catskill Section of Western Operations Division. The building was constructed in 1961, is more than 50 years old, and maintains all the architectural treatments consistent with original construction. The temporary construction staging and repairs would occur in the vicinity of these DEP facilities, but would not affect the former laboratory building. The grounds surrounding the Ben Nesin Laboratory have served as construction staging areas for most DEP projects conducted in the vicinity of the Ashokan Reservoir.

Table 9.3-5: Historic Resources within the Repair and Rehabilitation Study Areas

Town/Village	Study Area	Historic Resource	Analysis Required
Town of Olive	Ashokan Screen Chamber	Ben Nesin Laboratory (Eligible)	-
	Beaverkill Road	Waste Channel Bridge (Eligible)	-
Town of Marbletown	Lower Knolls Road	Lake Mohonk Mountain House Complex	✓
Town of New Paltz	New Paltz-Minnewaska Road	Lake Mohonk Mountain House Complex	✓
Village of Nelsonville	Gatehouse Road	Foundry Brook North Siphon Chamber (Eligible)	-
	Fishkill Road	Montrest	✓
		Montrest E Todd Residence (within Montrest)	✓
		E Todd Residence	✓
Town of Philipstown	Old Albany Post Road	Old Albany Post Road	✓
		Sprout Brook North Siphon Chamber (Eligible)	-
Town of Cortlandt	Aqueduct Road	Peekskill North Siphon Chamber (Eligible)	-
		Peekskill South Siphon Chamber (Eligible)	-
Town of Yorktown	Chapman Road	Taconic State Parkway	✓
	Croton Dam Road	Taconic State Parkway	✓
Town of New Castle	Station Place	Sarles' Tavern	✓
Notes:			
- = Screens out. Does not warrant an impact analysis.			
✓ = Impact analysis conducted.			

The Waste Channel Bridge is located on State Route 28A and spans the relic channel of Esopus Creek. The bridge is located on the eastern boundary of the Beaverkill Road Study Area and would be used by construction vehicles, but would not otherwise be affected. None of the permanent repairs within the study area would be visible from the bridge.

The steel pipe siphon chamber structures are eligible for architecture and engineering as contributing features of the Catskill Aqueduct, and would not be altered in appearance or structural integrity by the repair and rehabilitation. The siphon chambers would be used to access the aqueduct's tunnel interior similar to typical operation and maintenance activities. Therefore, the structures within the Ashokan Screen Chamber, Beaverkill Road, Gatehouse Road, Old Albany Post Road, and Aqueduct Road study areas do not warrant an impact analysis. The remaining study areas identified as containing sites listed on the National and/or State Register of Historic Places, including the Lower Knolls Road, New Paltz-Minnewaska Road, Fishkill Road, Old Albany Post Road, Chapman Road, Croton Dam Road, and Station Place, were further evaluated, as discussed below.

As part of the screening assessment for cultural and archeological resources, the review of the original construction methods for the Catskill Aqueduct identified a majority of the proposed ground disturbance would occur in areas of documented previous disturbance. The upper Catskill Aqueduct consists of approximately 74 miles of aqueduct traversing a variety of geologic features and terrain within changing topography and subsurface conditions. Various methods of construction were used to build the appropriate tunnel section types. The original construction methods generally fall into two categories: open trenching and drilling and blasting.

Open trenching created the greatest surface disturbance as soil was excavated to achieve the required depth for the Catskill Aqueduct. The depth and width of the trench varied depending on the terrain. Aqueduct tunnel types that were constructed by open trenching included cut-and-cover, steel pipe siphons, and bridge crossing structures. The repair and rehabilitation work activities would be within the zone of previous disturbance for sites that overlap with open trenching tunnel types.

Drilling and blasting techniques used to construct grade tunnels and pressure tunnels limited surface disturbance to access points where material was removed to awaiting rail carts for disposal. The repair and rehabilitation work activities associated with these grade and pressure tunnels generally would not be within an area of previous disturbance. The exception would be in the existing access point areas, such as boatholes and manholes, and shaft tunnels.

The locations and areas of disturbance where open trenching methods were employed during original construction, as well as existing access points, were well documented in as-built drawings. Additionally, these disturbances are still clearly visible within the landscape. As a result, the New York State Historic Preservation Office (SHPO) at the New York State Office of Parks, Recreation, and Historic Preservation (NYSOPRHP), in a response letter dated July 6, 2015, concluded that repair and rehabilitation work activities occurring within areas of open trenching, such as cut-and-cover tunnels, steel pipe siphons, and special construction siphons, as well as areas of surface disturbance associated with drill and blast techniques do not have the potential to affect historic properties because these areas are previously disturbed. NYSOPRHP concurred with DEP's recommendation that activities that overlap with areas of previous disturbance from these original constructions be categorically excluded from review under Section 106 of the National Preservation Historic Act. Repair and rehabilitation work activities within these areas would not significantly alter the integrity of historic or cultural resources, either individually or cumulatively.

In locations not subject to the categorical exclusion, repair and rehabilitation work activities that would have the potential for ground disturbance in native soil were further reviewed. Of these sites, access and staging areas would require placing fill to level storage areas or improve existing roads, and such activities would not have the potential to disturb historic or cultural resources with soil excavation. DEP submitted information on these sites, and in response letters dated April 17, 2015, November 18, 2015, March 29, 2016, and August 1, 2016, NYSOPRHP stated that no additional archeological investigations were warranted given the minor subsurface disturbance proposed.

The remaining repair and rehabilitation work activities with the potential to disturb historic and cultural resources would entail minor grading associated with access and staging primarily on DEP-owned sites, with some limited activities that would occur on private property. These

limited activities on private property would include temporary construction staging and/or creating permanent access areas. No new access areas would be created in the vicinity of properties listed or eligible for listing on the National and/or State Register of Historic Places, and therefore would not affect these listed resources. However, these access and staging areas may not overlap with previously disturbed areas and therefore warranted further review.

As a result of this screening assessment, the following study areas would consist of work activities in locations that have been categorically excluded from further consultation or determined by NYSOPRHP to not have the potential to disturb historic or cultural resources: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, Mountain Rest Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Strawridge Road, Winchell Drive, Mount Airy Road, Passaro Drive, Gatehouse Road, Indian Brook Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Kitchawan Road, Somerstown Turnpike, Campfire Road, Chappaqua Road, Nanny Hagen Road, Westlake Drive, Washington Avenue, Pleasantville Alum Plant, and Willow Street. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to historic and cultural resources discussed in Section 9.3.3.3, “Town Codes.” Therefore, a historic and cultural resources impact analysis within these study areas is not warranted.

The potential for impacts to historic and cultural resources within the following study areas were evaluated in the respective “Historic and Cultural Resources” sections using the methodology described below: Lower Knolls Road, New Paltz-Minnewaska Road, Fishkill Road, Old Albany Post Road, Chapman Road, Croton Dam Road, and Station Place.

9.3.7.2 Impact Analysis Methodology

The impact analysis consisted of: (1) describing existing historic and cultural resources; (2) establishing and describing the baseline conditions within the applicable study area by identifying historic resources, previous disturbance areas and activities; (3) establishing future conditions without the repair and rehabilitation by identifying whether any changes to existing historic or potential archeological resources are likely to occur by the analysis year; (4) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (5) analyzing the potential for impacts from the repair and rehabilitation on historic and cultural resources by evaluating if the repair and rehabilitation would potentially disturb or alter the integrity of historic and cultural resources.

9.3.8 VISUAL RESOURCES

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to views to or from visual resources or within view corridors with aesthetic value within the study areas that could be altered from activities at the work sites. The potential effects to nearby sensitive resources due to nighttime lighting were also assessed. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. Work activities include biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements or altering

existing structures. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities would not affect the view corridors with aesthetic value and did not warrant further review.

9.3.8.1 Screening Assessment

CEQR considers how a project may affect the experience of a pedestrian in a project area. An assessment of urban design and visual resources is needed when a project may have an effect on one or more of the elements that contribute to the pedestrian experience.

No assessment is needed if a project would be constructed within existing zoning envelopes and would not result in changes beyond the bulk and form permitted as-of-right. Bulk regulations and form would not be affected because these sites would not alter the lot size, floor area ratio, lot coverage, or other controls that determine the maximum size and placement of a building, and as such would comply with all applicable zoning regulations such that no discretionary action or approvals would be necessary. A review of the zoning requirements revealed that the repair and rehabilitation would occur within the existing zoning envelopes for all study areas. Therefore, a visual resources impact analysis within the study areas is not warranted under CEQR.

NYSDEC provides a list of 15 categories of State aesthetic and visual resources that should be included in an evaluation of potential for impacts to visual resources as identified in **Table 9.3-6**. In addition, local resources are considered in this analysis, such as parks, historic structures and landmarks, and the Hudson River as an American Heritage River. American Heritage Rivers are designated by federal Executive Order 13061 to protect natural resources and the environment, support economic revitalization, and to preserve historic and cultural resources. The visual resources screening assessment included characterizing existing visual resources within the study areas based on these categories that may be affected by the repair and rehabilitation. This was performed using ArcGIS data. Field visits provided further information about these visual resources, as necessary. Aesthetic and visual resources were not identified within the following study areas: Vly Atwood Road, Pine Bush Road, Mossybrook Road, Strawridge Road, Winchell Drive, Passaro Drive, Sprout Brook Road, Jacob Road, and Washington Avenue. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to visual resources discussed in Section 9.3.3.3, “Town Codes.” Therefore, a visual resources impact analysis within these study areas is not warranted.

As shown in **Table 9.3-6**, a review of the inventory of aesthetic and visual resources in the study areas revealed aesthetic/visual resources categories within the study areas as shown in **Table 9.3-7**. The potential for impacts to the visual resources within the following study areas was evaluated in the respective “Visual Resources” sections using the methodology described below: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Lucas Turnpike, Canal Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Mount Airy Road, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Aqueduct Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Nanny Hagen Road, Westlake Drive, Pleasantville Alum Plant, and Willow Street.

Table 9.3-6: Repair and Rehabilitation Visual Resources Screening Assessment Summary

Aesthetic and Visual Resource	Description	Analysis Required
National/State Register of Historic Places	Listed or eligible for listing on the National or State Register of Historic Places (sites, districts, buildings, structures, and objects that are deemed worthy of preservation).	Yes, within the Ashokan Screen Chamber, Beaverkill Road, Lower Knolls Road, New Paltz-Minnewaska Road, Gatehouse Road, Fishkill Road, Old Albany Post Road, Aqueduct Road, Chapman Road, Croton Dam Road, and Station Place study areas
State Parks	Defined by New York State Parks, Recreation and Historic Preservation Law §3.09 to encourage, promote, and provide recreational opportunities.	Yes, within Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Gatehouse Road, and Fishkill Road study areas
Heritage Areas	Designated by New York State as special places to honor history, celebrate the present, and plan the future of our communities.	No
State Forest Preserve/State Forests	State Forest Preserves are designated by the New York State Legislature with Constitution Article XIV, and protected as “forever wild.” State Forests are lands acquired and managed by NYSDEC as Reforestation Areas, Multiple-Use Areas, Unique Areas, and State Nature and Historic Preserves, as authorized by the 1929 State Reforestation Act.	No
National/State Wildlife Refuge, State Wildlife Management Areas	National Wildlife Refuges are designated public lands and waters given special protection by the National Wildlife Refuge System Administration Act 16 U.S. Code (USC) 668dd-668ee and amended by Public Law 105-57 to conserve fish, wildlife, and plants. State Game Refuges are designated by NYSDEC’s Environmental Conservation Law §11-2105 as lands for the protection of fish, wildlife, and State Wildlife Management Areas are owned by the State under the control and management of NYSDEC’s Division of Fish, Wildlife, and Marine Resources for the protection and promotion of fish and wildlife resources.	No
National Natural Landmark	Designated by the Secretary of the Interior and defined by 36 CFR Part 62 as conservation sites that contain outstanding biological and geological resources, including both public and private lands, and are selected for their condition, illustrative value, rarity, diversity, and value to science and education.	No

Table 9.3-6: Repair and Rehabilitation Visual Resources Screening Assessment Summary

Aesthetic and Visual Resource	Description	Analysis Required
National Park and System, Recreation Areas, Seashores, Forests	Established by an act of Congress and defined by 16 USC §1c to identify Parks, Preserves, Battlefields, Memorials, Recreation Areas, Seashores, Monuments, Rivers, Parkways, and Cemeteries as significant resources.	No
National/State Wild, Scenic or Recreational Rivers	Established by an act of Congress and defined by Public Law 90-542 under the Wild and Scenic Rivers Act and New York State Wild, Scenic, and Recreational Rivers System Act, defined under NYSDEC's ECL §15-27 for outstanding natural, cultural, and recreational values in a free-flowing condition.	No
Scenic site, area, lake, reservoir, or highway	Designated and defined by NYSDEC's ECL Article 49, Protection of Natural and Man-Made Beauty or highways designated by the U.S. Department of Transportation Federal Highway Administration or the New York State Department of Transportation as scenic roads and byways.	Yes, within Ashokan Screen Chamber, Beaverkill Road, Lucas Turnpike, Le Fevre Lane, Armato Lane, Chapman Road, Croton Dam Road study areas
Scenic Areas of Statewide Significance	Designated by the NYSDOS to identify the scenic qualities of coastal landscapes that possess inherent scenic qualities, including the presence of water, dramatic shorelines, expansive views, historic landings, working landscapes, and great estates.	Yes, within the Gatehouse Road, Fishkill Road, and Indian Brook Road study areas
National/State Trails	Federal trails, as defined by 16 USC Chapter 27 and designated by the Secretary of the Interior or the Secretary of Agriculture and State trails, as part of New York State Parks, Historic Sites, and Forests to provide a variety of outdoor recreation uses.	No
Adirondack Park Scenic Vistas	Identified in the Adirondack Park State Land Master Plan as scenic pull-offs within the Adirondack Park, as established by an act of the State Legislature and defined by Adirondack Park Agency and NYSDEC.	No
State Nature and Historic Preserve Areas	Designated by the State Legislature and defined by Section 4 of Article XIV of the State Constitution for the protection of natural resources, development of agricultural lands, and to conserve and protect its natural resources and scenic beauty and encourage the development and improvement of its agricultural lands for the production of food and other agricultural products.	No

Table 9.3-6: Repair and Rehabilitation Visual Resources Screening Assessment Summary

Aesthetic and Visual Resource	Description	Analysis Required
Palisades Interstate Park	The Palisades Interstate Park Commission operates the Park in New Jersey and the State Parks and Historic Sites that comprise the State's Palisades Region. Palisades Interstate Park Commission's mission is to support, protect, and educate the public and raise awareness of the natural and cultural resources of the parks and historic sites of the Palisades Interstate Park system.	No
Bond Act Properties	Bond Act properties are properties purchased under the "exceptional scenic beauty" or "open space" category of the Environmental Bond Act of 1986, established by the State Legislature.	No
American Heritage River	The American Heritage Rivers Protection Program, created by an Executive Order 13061, and designated by the U.S. Environmental Protection Agency to advance three objectives: natural resource and environmental protection, economic revitalization, and historic and cultural preservation.	No
Local	Defined and/or designated by regional planning entities, such as counties, and local communities, such as municipalities.	Yes, within the Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Lucas Turnpike, Canal Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Mount Airy Road, Gatehouse Road, Aqueduct Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Nanny Hagen Road, Westlake Drive, Pleasantville Alum Plant, and Willow Street study areas

Table 9.3-7: Visual Resources within the Repair and Rehabilitation Study Areas

Town/Village	Study Area	Visual Resource
Town of Olive	Ashokan Screen Chamber	Ben Nesin Laboratory (eligible historic) Catskill Park Catskill Mountain Scenic Byway (proposed) Ashokan Day Use Area
	Beaverkill Road	Catskill Park Catskill Mountain Scenic Byway (proposed) Waste Channel Bridge (eligible historic) Acorn Hill DEP Watershed Recreational Land
	Atwood-Olivebridge Road	Catskill Park Acorn Hill DEP Watershed Recreational Land
Town of Marbletown	Lucas Turnpike	Marbletown O&W Rail Trail Shawangunk Mountains Scenic Byway
	Canal Road	Rondout Creek
	Lower Knolls Road	Lake Mohonk Mountain House Complex
Town of New Paltz	Mountain Rest Road	Mohonk Preserve
	New Paltz-Minnewaska Road	Lake Mohonk Mountain House Complex Mohonk Preserve Glory Hill Trail
Town of Gardiner	Forest Glen Road	Wallkill River
	Le Fevre Lane	Shawangunk Mountains Scenic Byway
	Armato Lane	Shawangunk Mountains Scenic Byway
Town of New Windsor	Mount Airy Road	Silver Stream Reservoir/Brown's Pond
Village of Nelsonville	Gatehouse Road	Hudson Highlands State Park Preserve Hudson Highland Scenic Area of Statewide Significance Village of Nelsonville Open Space Nelsonville Trail Foundry Brook North Siphon Chamber (eligible historic)
	Fishkill Road	Montrest (including one individual structure) E Todd Residence Hudson Highlands State Park Preserve Lone Star Trail Two (2) Hudson Highland Scenic Areas of Statewide Significance
Town of Philipstown	Indian Brook Road	Hudson Highland Scenic Area of Statewide Significance
	Old Albany Post Road	Old Albany Post Road Sprout Brook North Siphon Chamber (eligible historic)

Table 9.3-7: Visual Resources within the Repair and Rehabilitation Study Areas

Town/Village	Study Area	Visual Resource
Town of Cortlandt	Aqueduct Road	Hollowbrook Golf Course Common Land Homeowners Association-owned Open Space Assumption Cemetery Peekskill North Siphon Chamber (eligible historic) Peekskill South Siphon Chamber (eligible historic)
Town of Yorktown	Chapman Road	Taconic State Parkway DEP watershed lands surrounding the New Croton Reservoir Turkey Mountain Unit West
	Croton Dam Road	Taconic State Parkway DEP watershed lands surrounding the New Croton Reservoir Teatown-Kitchawan Trail
	Kitchawan Road	Teatown Lake Preserve
Town of New Castle	Somerstown Turnpike	Town Open Space
	Station Place	Sarles' Tavern North Country Trailway
	Campfire Road	Gedney Park with Gedney Park Hiking Trail
Town of Mount Pleasant	Chappaqua Road	Edith Macy Conference Center, Girl Scouts of America
	Nanny Hagen Road	Kensico Reservoir
	Westlake Drive	Kensico Reservoir
Village of Pleasantville	Pleasantville Alum Plant	Banks Cemetery Mount Pleasant Tennis Club United Methodist Cemetery
	Willow Street	Banks Cemetery

Additionally, changes in views to and from visual resources could occur from the use of nighttime lighting. A screening assessment of the potential for visual resources impacts associated with the nighttime lighting from the repair and rehabilitation was conducted, including the consistency of the repair and rehabilitation with town codes as they pertain to lighting. The assessment considered local applicable codes, the most recent edition of the Illuminating Engineering Society Handbook, and the most recent edition of the American National Practice for Roadway Lighting (RP-8) approved by the American National Standards Institute to evaluate whether nighttime lighting has the potential to affect nearby sensitive resources. Lighting used at the repair and rehabilitation sites would be the minimal amount necessary for security and safety. All lighting over 2,000 lumens would meet the full cut-off standard of the Illuminating Engineering Society of North America. Full cut-off standards generally include shielding of the lights to avoid light spilling onto adjacent properties. Repair

and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to lighting standards discussed in Section 9.3.3.3, “Town Codes.” As visual resources are generally viewed during daytime hours, temporary nighttime lighting would not result in any significant adverse impacts to visual resources. Therefore, a visual resources impact analysis related to temporary nighttime lighting within the study areas is not warranted.

9.3.8.2 Impact Analysis Methodology

For the study areas identified in **Table 9.3-7**, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by determining existing aesthetic and visual resources, including a characterization of existing public view corridors within the study areas; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would alter views within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential for impacts from the repair and rehabilitation on visual resources through a qualitative determination of the effect to these view corridors from the repair and rehabilitation and the magnitude of change for the project to eliminate or substantially limit views which are deemed to have aesthetic value from within the study area.

9.3.9 NATURAL RESOURCES

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to natural resources from activities at the work sites that could disturb natural resources within the study areas. Natural resources include geology and soils, water resources, aquatic and benthic resources, terrestrial resources, wildlife, federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and other unlisted rare or vulnerable species. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. Work activities include biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements or altering existing structures. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities would not affect the natural environment or result in discharge of fill or wastewater and did not warrant further review.

The screening assessments were comprised of a combination of desktop evaluations and field visits. Desktop evaluations (e.g., review of maps, aerial imagery, online databases, local agency consultations) were used to form an initial characterization of baseline conditions, including an inventory of relevant environmental resources within the repair and rehabilitation study areas, and enhance subsequent field visits. Results of these visits were then used to expand upon the desktop evaluations, as necessary.

For each activity warranting a natural resources assessment, primary study areas were established based on the immediate areas surrounding the work sites, and these were identified as natural resources study areas. The natural resources study areas include all areas that could be directly or indirectly affected by the repair and rehabilitation, including locations of new facilities and structures, access and staging area improvements, discharges of treated water, and changes in flow due to leak repair.

The natural resources that were screened out in this section for all study areas and did not warrant an impact analysis are shown on **Table 9.3-8**. Per the screening assessment, there would be no significant disturbance to geology and soils, wildlife, and unlisted rare and vulnerable species associated with the repair and rehabilitation within the study areas. Therefore, an impact analysis related to these natural resources within the study areas is not warranted.

The natural resources that did not screen out for one or more study areas and therefore are included in the impact analysis include: water resources, terrestrial resources, aquatic and benthic resources, and federal/State Threatened and Endangered Species, and State Species of Special Concern. For the natural resources that did not screen out, an impact analysis was conducted based upon an evaluation of baseline conditions, future conditions without the implementation of the repair and rehabilitation, and future conditions with the implementation of the repair and rehabilitation.

9.3.9.1 Geology and Soils

This section presents the screening assessment of the potential for the repair and rehabilitation to result in a disturbance to geology and soils from activities at the work sites that could cause erosion of, instability of, or composition changes to geology and soils within the study areas.

Screening Assessment

Generally, the surficial geology is composed of unconsolidated deposits (such as glacial till or sand and gravel), while the bedrock geology is defined as the rock formations found below the unconsolidated deposits. Bedrock is occasionally exposed at the surface where the unconsolidated deposits are very thin or absent. The geology within the study areas was identified using the historic record drawings of the Catskill Aqueduct (City of New York Board of Water Supply, Catskill Water Supply Record of Construction Esopus Development 1905-1918), as well as New York State Bedrock and Surficial Geology maps, relevant United States Geological Survey (USGS) reports, and other scientific literature regarding additional details of geologic formations. Soils within the study areas were identified using the United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) Web Soil Survey. Additionally, a review of Part 622 of the USDA National Soil Survey Handbook and Agricultural Handbook No. 210 (USDA 2000; USDA 1961) provided additional soil information determined from the Land Capability Classes of soils found within each study area.

Table 9.3-8: Repair and Rehabilitation Natural Resources Screening Assessment and Impact Analysis Summary

Town/Village	Study Area	Screening Assessment and Impact Analysis Summary					
		Geology and Soils	Water Resources	Aquatic and Benthic Resources	Terrestrial Resources	Wildlife	Federal/State Threatened, Endangered Species, and Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species ¹
Town of Olive	Ashokan Screen Chamber	-	-	-	✓	-	✓
	Beaverkill Road	-	✓, ▲ ²	▲ ²	-	-	✓
	Atwood-Olivebridge Road	-	✓, ▲ ²	▲ ²	✓	-	✓
Town of Marbletown	Vly Atwood Road	-	✓, ▲ ²	▲ ²	✓	-	✓
	Pine Bush Road	-	✓, ▲ ²	-	✓	-	✓
	Lucas Turnpike	-	✓, ▲ ²	▲ ²	✓	-	✓
	Canal Road	-	✓, ▲ ²	▲ ²	-	-	✓
	Mossybrook Road	-	✓, ▲ ²	▲ ²	✓	-	✓
	Lower Knolls Road	-	-	-	✓	-	✓
Town of New Paltz	Mountain Rest Road	-	-	▲ ²	-	-	✓
	New Paltz-Minnewaska Road	-	✓, ▲ ²	-	✓	-	✓
Town of Gardiner	Forest Glen Road	-	✓, ▲ ²	▲ ²	-	-	✓
	Le Fevre Lane	-	-	-	-	-	✓
	Armato Lane	-	-	-	-	-	✓
Town of Shawangunk	Strawridge Road	-	✓, ▲ ²	-	✓	-	✓
Town of Montgomery	Winchell Drive	-	-	-	-	-	✓
Town of New Windsor	Mount Airy Road	-	✓, ▲ ²	▲ ²	✓	-	✓
	Passaro Drive	-	-	-	✓	-	✓
Village of Nelsonville	Gatehouse Road	-	-	-	✓	-	✓
	Fishkill Road	-	✓, ▲ ²	▲ ²	✓	-	✓

Table 9.3-8: Repair and Rehabilitation Natural Resources Screening Assessment and Impact Analysis Summary

Town/Village	Study Area	Screening Assessment and Impact Analysis Summary					
		Geology and Soils	Water Resources	Aquatic and Benthic Resources	Terrestrial Resources	Wildlife	Federal/State Threatened, Endangered Species, and Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species ¹
Town of Philipstown	Indian Brook Road	-	✓, ▲ ²	▲ ²	✓	-	✓
	Old Albany Post Road	-	-	-	-	-	✓
	Sprout Brook Road	-	✓, ▲ ²	▲ ²	✓	-	✓
Town of Cortlandt	Aqueduct Road	-	✓, ▲ ²	▲ ²	✓	-	✓
Town of Yorktown	Jacob Road	-	✓, ▲ ²	▲ ²	✓	-	✓
	Chapman Road	-	✓, ▲ ²	-	✓	-	✓
	Croton Dam Road	-	✓, ▲ ²	▲ ²	✓	-	✓
	Kitchawan Road	-	✓, ▲ ²	▲ ²	✓	-	✓
Town of New Castle	Somerstown Turnpike	-	✓, ▲ ²	-	✓	-	✓
	Station Place	-	✓, ▲ ²	-	✓	-	✓
	Campfire Road	-	✓, ▲ ²	-	-	-	✓
Town of Mount Pleasant	Chappaqua Road	-	✓, ▲ ²	-	-	-	✓
	Nanny Hagen Road	-	✓, ▲ ²	✓	✓	-	✓
	Westlake Drive	-	✓, ▲ ²	✓	✓	-	✓
Village of Pleasantville	Washington Avenue	-	✓, ▲ ²	▲ ²	✓	-	✓
	Pleasantville Alum Plant	-	✓, ▲ ²	-	-	-	✓
	Willow Street	-	-	-	-	-	✓

Notes:

- = Screens out. Does not warrant an impact analysis.

✓ = Impact analysis conducted for the study area.

▲ = Impact analysis conducted on a project-wide basis.

¹ Federal/State Candidate Species and unlisted rare and vulnerable species screen out and do not warrant an analysis. An impact analysis was conducted for applicable federal/State Threatened and Endangered Species, and State Species of Special Concern.

² Cumulative effects to water resources were analyzed on a project-wide basis.

Only minimal disturbance to geology and soils would occur during the work activities associated with the repair and rehabilitation. The work activities within the study areas would be short-term. During construction, soils would be stabilized to prevent erosion and maintain slope stability by installing erosion and sediment control measures such as silt fencing, hay bales, turbidity curtains, and temporary stream diversions. Access road improvements would often require fill material to be imported to the study areas for stabilization. Any temporary construction entrances or staging areas, including those stabilized by adding gravel, would be restored to baseline conditions upon completion of work activities. Grading within the study areas would consist primarily of activities that are associated with grading surficial soils to facilitate the construction of temporary facilities, such as local dechlorination systems, foundation for construction trailers and equipment storage, and to install new ventilation and boatholes. The excavated material would be stockpiled on site and reused on site for backfilling, where possible, or disposed of at a permitted facility.

During construction of the dechlorination facility at Pleasantville Alum Plant, part of a rock outcropping would be removed to construct the new building foundation. The proposed building requires removal of an approximately 4-foot high portion of bedrock outcropping to create a level surface on which to build the foundation. The depth of bedrock excavation is necessary to locate a majority of the building on existing graded land to minimize on-site excavation to the greatest extent possible. Some hydraulic drilling may be required for the foundation, and any rock removal would be accomplished through conventional excavation or hydraulic drilling to break and remove the rock. No blasting is anticipated. This excavation would be isolated to the immediate vicinity of the study area and not affect soil and geology beyond the area of excavation, and therefore does not warrant analysis.

Following construction and temporary chlorination activities, staging areas would be restored to baseline conditions. Operation of the Catskill Aqueduct would be consistent with baseline conditions. There would be no significant disturbance to geology and soils associated with the repair and rehabilitation within the study areas. Therefore, a geology and soils impact analysis within the study areas is not warranted.

9.3.9.2 Water Resources

The water resources within the study areas, including groundwater, surface water, wetlands, and floodplains, were evaluated as described below.

Groundwater

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in potential effects to groundwater from activities within the study areas.

Screening Assessment

Groundwater aquifers suitable for drinking water purposes are generally developed from two aquifer types: unconsolidated aquifers within glacial sand and gravel deposits, and bedrock aquifers. These two groundwater aquifer types are generally referred to as the unconsolidated aquifer and the bedrock aquifer, respectively, when discussing the groundwater conditions within

the study areas. Groundwater is found and transmitted within the voids and spaces between sand grains in the unconsolidated aquifer. Similarly, groundwater is found and transmitted within the breaks, fractures and other openings in the rock that were formed as a result of tectonic forces that folded and faulted the bedrock in this area. The unconsolidated aquifer is the shallower of the two aquifers while the bedrock aquifer is deeper.

Baseline conditions of groundwater resources within the study areas were characterized by: (1) reviewing the surficial geology (or unconsolidated deposits such as glacial till or sand and gravel) of the study area to identify potential unconsolidated aquifers; (2) reviewing documented thickness of surficial deposits and characterizing their applicability for potential groundwater source (i.e., thinner surficial deposits have limited viability as water sources); (3) characterizing the bedrock geology of the study area and identifying bedrock formations as potential bedrock aquifers; and (4) determining groundwater recharge potential.

Based on a review of the surficial geology, the unconsolidated aquifer in the study areas is generally thin and exhibits a limited viability as a water source. Thick highly permeable sands and gravels that would be typical of a highly productive aquifer suitable for municipal public water supply are not present in any of the study areas.

The bedrock geology of southeastern New York State generally exhibits outcrops and shallow subcrops of bedrock that have been weathered and altered by the glacial history of the area. From the standpoint of groundwater resources, the shallower portions of the bedrock aquifer are more likely to have relatively high permeability compared to the deeper portions of the bedrock that have not been exposed to similar erosional forces. Bedrock aquifers are potential sources of groundwater within each of the study areas for private residential wells if the area is not serviced by municipal water.

The screening assessment considered construction, temporary chlorination, and operation.

Construction

The repair and rehabilitation has the potential to change surface conditions that could influence the rate at which precipitation infiltrates into the ground to become groundwater recharge. Groundwater recharge rates are highly dependent on the permeability of the local soils and the specific geologic setting. Previous studies (Chazen 2006; Dutchess County Department of Planning 1985; 1980) conducted in the Hudson Valley of New York have shown that up to 21 inches of the annual precipitation becomes groundwater recharge in areas where the soils are highly permeable (sand and gravel). In areas with low-permeability soils (silt and clay), this value is significantly less, ranging from 3 to 9 inches.

To determine study area-specific annual precipitation amounts to characterize groundwater recharge, a USGS report mapping annual precipitation for the Northeastern United States was consulted (Randall 1996). USDA Soil Survey information for the applicable county was used to determine the predominant soil types and their corresponding hydrologic soil types as a factor in quantifying groundwater recharge for each study area. These results were evaluated based on the proposed work activities and the assessment revealed that baseline groundwater recharge rates within the study areas would not be affected because there would be minimal changes to the

surface conditions. During repair and rehabilitation work activities, localized dewatering of the shallow unconsolidated aquifer in portions of the construction footprint could be necessary to lower ground water levels to facilitate construction of local dechlorination systems, blow-off chamber reconstruction, and streambank restoration and protection. Any dewatering of the unconsolidated aquifer during construction would be conducted in accordance with State and local requirements.

Similarly, groundwater may infiltrate into the unwatered tunnel segments during construction. Up to 12 blow-off chamber locations and 6 culvert drain sluice gates would be operated to aid in unwatering the aqueduct during construction. Groundwater infiltration into the unwatered aqueduct was estimated at a rate of 50 to 100 gpm at each of the six culvert drain sluice gate locations. Groundwater infiltration rates are anticipated to be similar along other portions of the aqueduct, when it is unwatered. The potential for disturbance to groundwater resources when unwatering the Catskill Aqueduct would be limited to shallow, localized effects in the unconsolidated aquifer (the bedrock aquifer is generally considered deep enough to isolate it from the localized effects of construction). These conditions would be temporary, and any potential effect to the groundwater level would be localized and temporary (e.g., up to 10 weeks). Any depression of the water table would quickly recover at the conclusion of unwatering activities.

Since there is minimal potential for work activities during construction to affect groundwater recharge or the shallow unconsolidated aquifer, no further assessment is warranted.

Temporary Chlorination

Following construction, the water in the Catskill Aqueduct would be temporarily chlorinated. Leaks along the Catskill Aqueduct would be repaired to prevent chlorinated water from being released into the environment. However, where leak repair is not feasible or is unsuccessful, local passive dechlorination systems would be constructed to treat chlorinated aqueduct water as it reaches the ground surface before it is discharged into receiving waterbodies or the unconsolidated aquifer. Once the Catskill Aqueduct returns to typical operations, it would no longer be chlorinated. The passive dechlorination systems would be removed and the sites would be restored to baseline conditions.

Leak repair is not feasible at Lucas Turnpike Study Area (Leaks 3A, 3B, and 4, and the Private Well) and Mossybrook Road Study Area (Shaft 7 Leak) because the aqueduct is under pressure. Accessibility to the aqueduct is limited due to the depth of the aqueduct below the ground surface. Chlorinated water at the Lucas Turnpike and Mossybrook Road study areas could migrate from the leaks in the deep pressurized tunnel into fractures and faults in the bedrock aquifer. The chlorinated water in the bedrock could mix and react with the native groundwater in the bedrock aquifer. The groundwater resources in the unconsolidated aquifer would not be affected since this aquifer is not present in these study areas due to the shallow depth to bedrock.

Therefore, the potential for impacts to groundwater resources during temporary chlorination within the Lucas Turnpike and Mossybrook Road study areas warrants further analysis as described below.

Operation

Operation of the Catskill Aqueduct following the repair and rehabilitation would be consistent with baseline conditions and not change groundwater resources in the study areas. Internal leak repair is anticipated to occur at Canal Road and Forest Glen Road study areas and would address Leaks 5 and 6. Both leaks are currently contained within the aqueduct's existing infrastructure and do not affect groundwater resources as each leak discharges directly to a surface water.

Additional internal leak repair is expected to occur at the Vly Atwood Road, New Paltz-Minnewaska Road, Croton Dam Road, and Chappaqua Road study areas. These leaks are generally characterized as toe-of-slope leaks that flow from cracks in the cut-and-cover tunnel through the earthen berm to the ground surface. Similar to conditions during temporary chlorination, the groundwater resources in the unconsolidated aquifer would not be affected by leak repair since this aquifer is not present in these study areas due to the shallow depth to bedrock.

Since there is minimal potential for long-term operation of the Catskill Aqueduct to affect groundwater resources, no further assessment is warranted.

Based on this screening assessment, any localized groundwater changes associated with construction and shallow leak repair would not affect groundwater within the study areas. A groundwater impact analysis is only warranted for the Lucas Turnpike and Mossybrook Road study areas, both located within the Town of Marbletown. The potential for impacts to groundwater resources within the Lucas Turnpike and Mossybrook Road study areas associated with the repair and rehabilitation were evaluated using the methodology described below.

Impact Analysis Methodology

At both the Lucas Turnpike and Mossybrook Road study areas, the hydraulic grade line of the aqueduct was used to estimate the elevation to which water within the Rondout Pressure Tunnel would rise if open to atmospheric pressure at Leaks 3A, 3B, 4, the Private Well, and the Shaft 7 Leak. This water level (i.e., the height at which water can rise) was used to estimate leak flow at the depth of the pressure tunnel to the surrounding fracture network in the bedrock aquifer.

DEP's historical tunnel construction information was also reviewed to identify the local geology and hydrogeology near the leaks in the Lucas Turnpike and Mossybrook Road study areas. In addition, reports by Fluhr and Terenzio (1973, 1984) that describe the geologic conditions near the Rondout Pressure Tunnel were also used to assess potential groundwater flow paths in the bedrock. Finally, the Town of Marbletown Aquifer Protection Study, completed in 2005, was reviewed to assess the current uses of the groundwater resources in the immediate vicinity of the study area.

A groundwater impact analysis to assess potential changes in groundwater quality in the Lucas Turnpike and Mossybrook Road study areas was therefore conducted. The groundwater impact analysis results were then compared to established levels for residual disinfectants in drinking water as described in Section 9.3.11, "Water and Sewer Infrastructure," and Section 9.3.17, "Public Health."

Surface Water

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in a disturbance to surface water from activities at the work sites that could cause direct and indirect effects on surface water levels and water quality within study areas.

Screening Assessment

Surface water within the study areas was identified using mapping, ArcGIS data, NYSDEC hydrography data, and site investigations. **Table 9.3-9** identifies mapped surface waterbodies (if named), NYSDEC Part 701 Classifications that describes the State’s designated “best use” of the waterbody (e.g., for drinking water or swimming), the water index number that is a unique identifier for each stream segment in New York, whether the site is used for aqueduct unwatering, and whether an impact analysis is required. There were no surface waterbodies identified within the following study areas: Lower Knolls Road, Le Fevre Lane, Armato Lane, Winchell Drive, Passaro Drive, and Gatehouse Road. In addition, the following study areas do not have surface water in the immediate vicinity of the repair and rehabilitation work activities: Ashokan Screen Chamber, Mountain Rest Road, Old Albany Post Road, and Willow Street. Repair and rehabilitation work activities within these study areas would be in compliance with the applicable town codes related to surface water (watercourses) discussed in Section 9.3.3.3, “Town Codes.” Therefore, a natural resources impact analysis related to surface water is not warranted for these study areas.

For the remaining study areas, surface waterbodies were identified, and the repair and rehabilitation activities would have the potential to cause temporary or permanent disturbance to surface water. These include the Beaverkill Road, Atwood-Olivebridge Road, Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, New Paltz-Minnewaska Road, Forest Glen Road, Strawridge Road, Mount Airy Road, Fishkill Road, Indian Brook Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Nanny Hagen Road, Westlake Drive, Washington Avenue, and Pleasantville Alum Plant study areas.

The repair and rehabilitation work activities would affect certain surface waterbodies through the following activities: flowpath and/or watercourse disturbance, temporary discharges to surface water, temporary diversions to conduct repairs in dry conditions, installation of streambank restoration and protection measures, temporary and permanent access improvements (e.g., temporary stream crossing, access for bridge rehabilitation, culvert repairs), and installation of local dechlorination systems. Leaks proposed for repair have the potential to affect downstream surface water from reduced or modified flows.

Table 9.3-9: Surface Water within the Repair and Rehabilitation Study Areas

Town/ Village	Study Area	Surface Water Name	NYSDEC Part 701 ^{1,2}	Water Index Number	Aqueduct Unwatering ³	In-Water Work Restriction ⁴	Analysis Required
Town of Olive	Ashokan Screen Chamber	Ashokan Release Channel	Class C	H-171 (portion 2)	No	Window not applicable	-
	Beaverkill Road	Relic Channel of Esopus Creek	Class B	H-171 (portion 2)	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲
	Atwood- Olivebridge Road	Tongore Creek	Class C(T)	H-171-40	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲
		Unnamed Tributary to Tongore Creek	Class C	H-171-40	No	No proposed disturbance	
Town of Marbletown	Vly Atwood Road	Hendricks Killitje	Class C	H-171-33	No	Window not applicable	✓, ▲
		Intermittent Drainage Swale	NA	NA	No	Window not applicable	
		Leak Flowpaths	NA	NA	No	Window not applicable	
		Lower Esopus Creek	Class B(T)	H-171 (portion 2)	No	No proposed disturbance	
	Pine Bush Road	Peak Brook	Class C(TS)	H-139-14-12	No	Coldwater fishery (October 1 to April 30)	✓, ▲
	Lucas Turnpike	Artesian Surface Expression	NA	NA	No	Window not applicable	✓, ▲
		Intermittent Drainage Swale	NA	NA	No	Window not applicable	
		Leak Flowpaths	NA	NA	No	Window not applicable	
		Rondout Creek	Class B	H-139-14 (portion 1)	No	No proposed disturbance	
		Unnamed Tributary 1 to Rondout Creek	NA	H-139-14-11	No	No proposed disturbance	
		Unnamed Tributary 2 to Rondout Creek	NA	H-139-14-11	No	No proposed disturbance	

Table 9.3-9: Surface Water within the Repair and Rehabilitation Study Areas

Town/ Village	Study Area	Surface Water Name	NYSDEC Part 701 ^{1,2}	Water Index Number	Aqueduct Unwatering ³	In-Water Work Restriction ⁴	Analysis Required
Town of Marbletown	Canal Road	Rondout Creek	Class B	H-139-14 (portion 1)	No	No proposed disturbance	✓, ▲
		Unnamed Tributary 3 to Rondout Creek	Class B	NA	No	No proposed disturbance	
	Mossybrook Road	Unnamed Tributary to Coxing Kill	Class C	H-139-14-9-2	No	No proposed disturbance	✓, ▲
	Lower Knolls Road	NA	NA	NA	No	Window not applicable	-
Town of New Paltz	Mountain Rest Road	Unnamed Tributary to Kleine Kill	Class C	H-139-13-11- 4	No	No proposed disturbance	-
	New Paltz- Minnewaska Road	Kleine Kill	Class AA	H-139-13-11	No	Window not applicable	✓, ▲
Town of Gardiner	Forest Glen Road	Wallkill River	Class B	H-139-13 (portion 2)	No	No proposed disturbance	✓, ▲
		Unnamed Tributary to Wallkill River	Class C	H-139-13-3 thru 18	No	No proposed disturbance	
	Le Fevre Lane	NA	NA	NA	No	Window not applicable	-
	Armato Lane	NA	NA	NA	No	Window not applicable	-
Town of Shawangunk	Strawridge Road	Unnamed Tributary to Borden Creek	Class AA	H-139-13-31	No	Window not applicable	✓, ▲
Town of Montgomery	Winchell Drive	NA	NA	NA	No	Window not applicable	-
Town of New Windsor	Mount Airy Road	Brown's Pond Reservoir	Class A	H-89-2-P226a	No	Window not applicable	✓, ▲
		Silver Stream	Class A	H-89	Yes	Window not applicable	
	Passaro Drive	NA	NA	NA	No	Window not applicable	-

Table 9.3-9: Surface Water within the Repair and Rehabilitation Study Areas

Town/ Village	Study Area	Surface Water Name	NYSDEC Part 701 ^{1,2}	Water Index Number	Aqueduct Unwatering ³	In-Water Work Restriction ⁴	Analysis Required	
Village of Nelsonville	Gatehouse Road	NA	NA	NA	No	Window not applicable	-	
	Fishkill Road	Foundry Brook	Class C(TS)	H- 83	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲	
Town of Philipstown	Indian Brook Road	Indian Brook	Class C(TS)	H- 77	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲	
	Old Albany Post Road	Unnamed Tributary to Canopus Creek	Class C	H- 55- 2	No	No proposed disturbance	-	
	Sprout Brook Road	Canopus Creek	Class B(T)	H- 55- 2	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲	
		Unnamed Tributary to Canopus Creek	Class C	H- 55- 2	No	No proposed disturbance		
Town of Cortlandt	Aqueduct Road	Peekskill Hollow Creek	Class A(TS)	H-55	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲	
		Unnamed Tributary 1 to Peekskill Hollow Creek	Class C	H-55	No	No proposed disturbance		
		Unnamed Tributary 2 to Peekskill Hollow Creek	Class C	H-55	No	No proposed disturbance		
Town of Yorktown	Jacob Road	Hunter Brook	Class B(TS)	H- 31-P44- 2	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲	
	Chapman Road	Turkey Mountain Brook	Class B	H- 31-P44-2a thru 13	Yes	Window not applicable	✓, ▲	
	Croton Dam Road	Leak Flowpath	NA	NA	NA	No	Window not applicable	✓, ▲
		New Croton Reservoir	Class AA	H- 31-P44	No	No proposed disturbance		
		Unnamed Tributary 1 to New Croton Reservoir	Class B	H- 31-P44- 50	No	No proposed disturbance		
		Unnamed Tributary 2 to New Croton Reservoir	Class B	H- 31-P44- 51	No	No proposed disturbance		

Table 9.3-9: Surface Water within the Repair and Rehabilitation Study Areas

Town/ Village	Study Area	Surface Water Name	NYSDEC Part 701 ^{1,2}	Water Index Number	Aqueduct Unwatering ³	In-Water Work Restriction ⁴	Analysis Required
Town of Yorktown	Kitchawan Road	Unnamed Tributary 3 to New Croton Reservoir	Class B(TS)	H-31-P44-49	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲
Town of New Castle	Somerstown Turnpike	Cornell Brook	Class B(TS)	H-31-P44-4	No	Coldwater fishery (October 1 to April 30)	✓, ▲
		Drainage Swale to Cornell Brook	NA	NA	Yes	Window not applicable	
		Unnamed Tributary 1 to Cornell Brook	NA	H-31-P128b- 46-1	Yes	Window not applicable	
		Unnamed Tributary 2 to Cornell Brook	NA	NA	No	Window not applicable	
	Station Place	Unnamed Tributary 1 to Pocantico River	Class C	NA	No	No proposed disturbance	✓, ▲
	Campfire Road	Unnamed Tributary 2 to Pocantico River	Class C	H-20	Yes	Window not applicable	✓, ▲
Town of Mount Pleasant	Chappaqua Road	Unnamed Tributary 3 to Pocantico River	Class C	H-20	Yes	Window not applicable	✓, ▲
		Leak Flowpaths	NA	NA	No	Window not applicable	
	Nanny Hagen Road	Kensico Reservoir	Class AA	(MW2.4) ER-3-P1063	Yes	Cold and Warmwater fishery (September 15 to June 30)	✓, ▲
		Unnamed Tributary to Kensico Reservoir	Class A	NA	No	No proposed disturbance	
	Westlake Drive	Intermittent Drainage Swale	NA	NA	No	Window not applicable	✓, ▲
		Kensico Reservoir	Class AA	(MW2.4) ER-3-P1063	Yes	Coldwater and Warmwater fishery (September 15 to June 30)	

Table 9.3-9: Surface Water within the Repair and Rehabilitation Study Areas

Town/ Village	Study Area	Surface Water Name	NYSDEC Part 701 ^{1,2}	Water Index Number	Aqueduct Unwatering ³	In-Water Work Restriction ⁴	Analysis Required
Village of Pleasantville	Washington Avenue	Saw Mill River	Class B(T)	H-4	Yes	Coldwater fishery (October 1 to April 30)	✓, ▲
	Pleasantville Alum Plant	Unnamed Tributary to Nanny Hagen Brook	Class C	NA	Yes	Window not applicable	✓, ▲
	Willow Street	Unnamed Tributary to Nanny Hagen Brook	Class C	NA	No	No proposed disturbance	-

Notes:

- = Screens out. Does not warrant an impact analysis.
- ✓ = Impact analysis conducted.
- ▲ = Impact analysis conducted on a project-wide basis.

NA = Not Applicable. Refers to watercourses with either no classification and/or no associated Water Index Number.

¹ The best usages of waters are in accordance with standards set forth in 6NYCRR Part 701.5:

- Class AA waters: water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival.
- Class A waters: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival.
- Class B waters: primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival.
- Class C waters: fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The waters shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

² T or TS means that the classified waters in that specific item are trout waters or trout spawning waters, respectively. Any water quality standard, guidance value, or thermal criterion that specifically refers to trout, trout spawning, trout waters, or trout spawning waters applies (6 NYCRR Part 701.25).

³ Venturi meters that contain 10-inch drain valves and are potential unwatering points along the Catskill Aqueduct and not included in a study area are: Ashokan, Pleasantville, and Kensico.

⁴ Anticipated in-water work restrictions based upon consultation with NYSDEC Region 3.

More specifically, the repair and rehabilitation would result in three types of discharges to surface water: raw aqueduct water during tunnel unwatering; treated biofilm wash waters from proposed treatment systems; and dechlorinated water at several leaks, Outside Community Connections, and Kensico Reservoir. Each of these discharges has the potential to temporarily affect surface water and is included in the study areas warranting a surface water impact analysis. Minor discharges may occur at venturi meters; however, these sites were not included in a study area because discharges at these sites would be avoided to the extent possible.

Therefore, the potential for impacts to the surface water within the repair and rehabilitation study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. The potential for the repair and rehabilitation to result in changes to surface water resources as a result of the proposed temporary chlorination at the Ashokan Screen Chamber and permanent disturbance relating to excavation and fill in surface water are analyzed in Section 9.18, “Project-wide Impact Analysis.” The screening assessment and methodology associated with proposed discharges to receiving streams is further assessed as described in Section 9.3.11, “Water and Sewer Infrastructure.”

Impact Analysis Methodology

The surface water impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by determining the boundary of surface waterbodies within the study area and estimating surface water flows; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would alter water resources within the study area that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area and quantifying temporary and permanent disturbance to surface water; and (4) analyzing the potential for impacts from the repair and rehabilitation on surface water by comparing the measured leak flows to the surface water flow to determine the contribution of flow during low flow conditions from the leaks along the Catskill Aqueduct that would be repaired. For leaks where the low flow analysis was inconclusive, a visual assessment of these streams following the USDA Natural Resources Stream Visual Assessment Protocol Version 2 was conducted to establish the baseline health of the receiving streams based on the overall condition of wadeable streams. The baseline health was compared to the predicted health of the receiving streams under future conditions with the repair and rehabilitation.

Further detail regarding the surface water impact analysis methodology is described below.

Step 1: Determine Surface Water Boundary

To estimate the physical dimensions of surface water within the study areas, watercourses were delineated using indicators of ordinary high water marks. Ordinary high water marks as described in 33 Code of Federal Regulations 328.3 are the lines on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area. Ordinary high water marks were flagged and the flag locations were recorded using a Trimble Differential Global Positioning System (DGPS) unit.

For locations that were difficult to access, surveyed stream boundaries from an aerial survey of the aqueduct corridor were used. The data were then plotted using ArcGIS to generate figures depicting the boundaries of these surface waterbodies. Due to the small size of most watercourses within the study areas, the outer boundaries of the streams were marked by walking the centerline of the stream and measuring the width between ordinary high water marks on either bank. During the delineation, particular attention was given to the source of water (i.e., natural or artificially sourced from the Catskill Aqueduct), culverts, and tributaries joining or tributaries separating from the surface water if they were apparent. Each watercourse was assigned a community classification based on the habitat descriptions in Cowardin et al. (Cowardin et al. 1979).

For study areas where a desktop analysis was conducted, surface water potentially occurring within the natural resources study area were identified through an evaluation of NYSDEC water classification data, NYSDEC freshwater wetlands maps, U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps, national hydrography data, published soil survey maps, and USGS topographic maps. Formal delineations of these areas were not possible prior to publishing the DEIS due to landownership, seasonality, or changes to limits of construction after fieldwork was completed.

Step 2: Quantify Disturbance to Surface Water

Temporary and permanent disturbance to surface water resulting from repair and rehabilitation activities was quantified for each surface water using ArcGIS. Disturbance areas associated with regulated State and municipal buffers were also quantified and presented in the impact analysis. Activities categorized as temporary disturbance included installation of erosion and sediment control measures, stream diversions and construction dewatering, construction staging areas, and discharges to surface water (i.e., raw aqueduct water, treated biofilm wash water, and dechlorinated water). Permanent disturbance included the following work activities: loss of flowpath following leak repair, permanent access improvements, and streambank grading and protection measures at select steel pipe siphon blow-off sites.

Step 3: Estimate Surface Water Flows to Identify Leak Contributions during Low Flow

Repair of leaks has the potential to permanently affect downstream resources, primarily through flow reduction. For leaks identified through visual observations during field visits as contributors of flow to the receiving surface waterbodies (also referred to as rivers and streams), leak flow was measured and stream flow was estimated to determine the contribution of leak flow during low surface water flow conditions.

Estimates of low stream flow conditions were analyzed to represent the condition when leak flow contributions would have the maximum potential for impacts when repaired. To establish the baseline relative contribution of leak flows to naturally occurring receiving waterbodies, the measured leak flows were compared to desktop estimates of receiving stream flows. Low flow estimates were not calculated for the Lucas Turnpike Study Area, which includes Leaks 3A, 3B, 4, and the Private Well, or for the Mossybrook Road Study Area, which includes the Shaft 7 Leak. These leaks would be locally dechlorinated and receiving surface waterbodies would not experience a change in leak flow contribution.

Leak Flows

Where feasible, leak flows were measured by installing weirs at locations just downstream of the leak origins and measuring a volume of leak water from the weirs over time through the known weir dimensions. Flows could not be measured at leaks that did not have a distinct flowpath or were influenced by several hydrological components such as wetlands or streams.

Surface Water Flows

Stream flow estimates were prepared using historical flow records from similar streams that were related to the receiving stream based on a similar sized drainage area. Flow distributions, which identify the percentage of time that flow in a stream equals a specified value, were calculated to statistically characterize streamflow. The lowest average stream flow over any consecutive 7-day period with a 10-year occurrence interval (7Q10) is typically used when permitting discharges to surface water to determine the not-to-exceed concentrations of chemical compounds that are permitted for discharge to a stream while maintaining water quality. The lowest average stream flow over any consecutive 7-day period with a recurrence of 2 years (7Q2) is used as a habitat maintenance flow which protects habitat during drought conditions (Pyrce 2004). Since the 7Q10 and 7Q2 flow calculations are widely used metrics of low flow, the 7Q10 and 7Q2 flow calculations were adapted to understand conditions during critical low flow periods where further flow reductions from leak repair could have the greatest potential to result in impacts on local hydrology.

Since the receiving streams are typically ungauged, desktop calculations to approximate stream flow were completed. Following the USGS approach for calculating flow-duration and low flow frequency statistics at streamflow gauging stations, estimates of the 7Q10 and the 7Q2 flows were prepared for the receiving surface waterbodies, as follows:

- The receiving tributary flows were estimated using the drainage area normalization method based on flow from a nearby stream that maintains a USGS flow gauge. The historic record of flows at the nearby gauged stream was normalized (e.g., divided by the drainage area) to calculate flows independent of drainage area. This information was then multiplied by the respective receiving tributary drainage area at the point where the leak enters the tributary, thus creating a flow distribution for the receiving tributary from which 7Q10 and 7Q2 low flows were derived.
- An alternate USGS method for ungauged streams in the Lower Hudson River Basin (Barnes 1986) was also applied to these study areas to confirm the drainage area normalization. This method utilizes regression equations for the 7Q10 and 7Q2 flows that were developed based on statistical analyses of 53 streams in the Lower Hudson River Basin. The referenced USGS method typically yields values that are lower than the ratio method. Therefore, this method served as a screening measure of the low flow nature of the receiving streams.

These estimated 7Q10 and 7Q2 stream flows were compared to leak flows to estimate the percent of leak flow contribution to the receiving surface waterbody, and to assess the potential for impacts to aquatic habitat if leak flows were eliminated. Where leak flows could not be

measured or reasonably estimated, or results indicated potential for impacts to aquatic habitat, further visual stream assessments were completed, as described in Step 4.

Step 4: Conduct Visual Stream Assessments

The USDA NRCS developed the Stream Visual Assessment Protocol Version 2 as a tool for the qualitative and rapid assessment of stream health (USDA 2009). This protocol and its predecessor (Version 1, USDA 1998) are widely accepted tools to estimate baseline conditions for stream health and are the first tier assessment in a four-part hierarchy. For study areas where the low flow analysis was inconclusive, visual stream assessments were completed following USDA's Stream Visual Assessment Protocol Version 2.

The USDA Stream Visual Assessment Protocol (Version 2) scores up to 16 stream health elements and then averages the scores as an indicator of a stream's overall health (see **Table 9.3-10**). Scoring followed USDA (2009) guidelines. The receiving waterbodies were scored in the field based on the applicable stream health elements to establish baseline conditions. Two reaches were scored for each receiving waterbody: an upstream reach located upstream of the confluence point with the leak and a downstream reach that began where the leak enters the receiving waterbody. A score was calculated for each reach of a stream, which the protocol defines as a length of stream equal to the active channel width (i.e., bankfull width) multiplied by 12. These scores were used to characterize baseline conditions. To assess future conditions with the repair and rehabilitation, scores for the upstream and downstream reaches were predicted based on these stream health elements under the assumed conditions of the surface water following leak repair. Potential changes to stream functions and values were assessed by comparing baseline conditions to predicted future conditions following leak repairs. This qualitative assessment was conducted to contextualize the results of the low flow calculations described in Step 3.

The stream visual assessment is part of a four-tiered assessment protocol. For the purposes of this assessment, only a Tier 1 qualitative assessment (e.g., scoring assessment) was used. In this hierarchy, each successive tier employs more rigorous, quantitative methods that are used to assess the ecological condition and detect issues originating elsewhere in the watershed. The leaks are discrete sites located within a confined area and had a narrow zone of influence due to their relatively low flows, so a qualitative scoring assessment was deemed sufficient for the purposes of the environmental review.

Wetlands

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in a disturbance to wetlands from activities at the work sites that could cause direct and indirect effects on wetland water levels and quality within the study areas.

Screening Assessment

Wetlands potentially occurring within the study areas were identified through a desktop evaluation of NYSDEC freshwater wetlands maps and USFWS NWI maps. The NYSDEC maps depict the approximate location of the wetland boundary, as well as a wetland check zone. The wetland check zone is a buffer area that extends 100 feet into the upland from the mapped

wetland boundary. NYSDEC freshwater wetland maps are based on aerial photography, soil surveys, elevation data, and other wetland inventories. NYSDEC typically does not regulate (or map) wetlands smaller than 12.4 acres, unless it is deemed to be of unusual local importance. USFWS NWI identifies wetlands of at least 0.5 acre in size according to mapping standards and may not identify smaller wetlands that could be federally or locally regulated. NWI maps are based on aerial photography, supplemented by published soil survey maps and USGS topographic maps. No ground-truthing of NWI wetlands was performed by USFWS to validate or verify the mapping. USFWS NWI classifies mapped wetlands and deepwater habitats. Freshwater (palustrine) wetlands are further based on their cover type (e.g., emergent, scrub-shrub, forested, unconsolidated bottom; Cowardin et al. 1979). Unmapped wetlands, including wetlands associated with leaks, were identified through a desktop assessment using NYSDEC freshwater wetlands maps, USFWS NWI wetland maps, national hydrography data, published soil survey maps, USGS topographic maps, and/or field visits.

Table 9.3-10: Stream Visual Assessment Protocol Scoring Categories

Category	Description	Scoring
Channel Condition	Signs of incision (such as vertical banks) or aggradation (such as very shallow multiple channels).	10: No discernible signs of incision or aggradation; no bank failures. 0: Little or no connection between flood plain and stream channel and no inundation or severe lateral channel migration, and bank erosion.
Hydrologic Alteration	Degree to which hydrology and streamflow conditions differ from natural, unregulated flow patterns.	10: Bankfull or higher flows occur every 1 to 2 years; No dams, dikes, or development in the floodplain. 0: Bankfull or higher flows rarely occur; urban runoff discharges directly into stream and severely alters the natural flow regime.
Bank Condition	Proportion of unstable to stable banks.	10: Banks are stable; protected by roots of natural vegetation, wood, and rock; no fabricated structures. 0: Banks are unstable; no bank protection with roots, wood, rock, or vegetation; riprap or other structures dominate banks.
Riparian Area Quantity	Rates the width of natural vegetated riparian vegetation. Used in conjunction with riparian quality (see below).	10: Natural plant community extends at least two bankfull widths or more than the active floodplain. 0: Natural plant community extends less than 1/3 of the bankfull width or less than 1/4 of active flood plain.
Riparian Area Quality	Rates the composition, density, and structural complexity of native or naturalized riparian habitat.	10: Natural and diverse riparian vegetation with composition, density and age structure appropriate for the site. 0: Little or no natural vegetation.
Canopy Cover	Identifies stream-side shading for coldwater or warmwater streams.	10: Well-shaded water surface; >75% for coldwater streams and 50-75% for warmwater streams. 0: <20% shaded water surface.

Table 9.3-10: Stream Visual Assessment Protocol Scoring Categories

Category	Description	Scoring
Water Appearance	Turbidity and color to assess potential runoff and nutrient enrichment.	10: Visible to depths of 3 to 6 feet below the surface. 0: Visible to <0.5 feet below the surface.
Nutrient Enrichment	Types and amounts of aquatic vegetation in the water.	10: Clear water, diverse plants, little algae. 0: Pea green color present, dense macrophytes, thick algal mats
Manure or Human Waste	Manure from livestock or wastewater piped or diverted directly to a stream is a health risk to aquatic species and humans.	10: No pipes or concentrated flows discharging animal waste or sewage directly into stream 0: Pipes or concentrated flows discharge untreated animal waste or sewage directly into stream
Pools	Mix of shallow and deep pools for habitat complexity for low-gradient and high-gradient streams.	10: Deep and shallow pools, metrics vary if stream is high- or low-gradient. 0: Pools absent.
Barriers to Movement	Artificial barriers and water withdrawals that result in partial, temporary or complete barriers.	10: No artificial barriers that prohibit movement. 0: Physical structures, water withdrawals and/or water quality prohibit movement of aquatic species.
Fish Habitat Complexity	Variety and abundance of habitat features and cover types available (e.g., logs, boulders, overhanging vegetation, off-channel habitat, etc.).	10: Ten or more habitat features available. 0: Less than four habitat features available.
Aquatic Invertebrate Habitat	Variety of substrate types within a relatively small area of the stream.	10: At least nine types of habitat present. 0: None to one type of habitat present.
Aquatic Invertebrate Community	Presence of pollution-tolerant and intolerant invertebrates.	10: Diverse and well represented by pollution-sensitive species. 0: Dominated by pollution-tolerant species.
Riffle Embeddedness (If Applicable)	The degree to which gravel and cobble are buried by fine sediment.	10: Gravel or cobble substrates are <10% embedded. 0: Gravel or cobble substrates are >40% embedded.
Salinity	Not applicable to the repair and rehabilitation.	
Source: USDA 2009. Stream Visual Assessment Protocol Version 2. Report 190–VI–NBH, Amend. 3, December 2009.		

As shown in **Table 9.3-11**, there were no wetlands identified within the following study areas: Mountain Rest Road, Le Fevre Lane, Armato Lane, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Chapman Road, Washington Avenue, Pleasantville Alum Plant, and Willow Street. The following study areas do not contain wetlands in the natural resources study area: Ashokan Screen Chamber, Atwood-Olivebridge Road, Vly Atwood, Pine Bush Road, Lower Knolls Road, New Paltz-Minnewaska Road, Winchell Drive, Old Albany Post Road, Aqueduct Road, Jacob Road, Kitchawan Road, Somerstown Turnpike, Station Place, and Westlake Drive. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to wetlands discussed in Section 9.3.3.3, “Town Codes.” Therefore, a natural resources impact analysis related to wetlands is not warranted for these study areas.

The repair and rehabilitation work activities would affect wetlands through the following activities: discharge of treated water to surface water and associated wetlands, temporary or permanent excavation or fill (e.g., access improvements, structural and mechanical repairs), and installation of local dechlorination systems. Leaks proposed for repair have the potential to affect wetlands from reduced or modified inflows. Repair and rehabilitation activities have the potential to cause temporary or permanent disturbance to wetlands in the following study areas: Beaverkill Road, Lucas Turnpike, Canal Road, Mossybrook Road, Forest Glen Road, Strawridge Road, Mount Airy Road, Sprout Brook Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Campfire Road, Chappaqua Road, and Nanny Hagen Road. Potential impacts to wetlands within these study areas were evaluated in the respective “Natural Resources” section using the methodology described below. The potential for the repair and rehabilitation to result in changes to wetlands as a result of the proposed temporary chlorination at the Ashokan Screen Chamber and permanent disturbance relating to excavation and fill in wetlands resulting from the repair and rehabilitation are analyzed in Section 9.18, “Project-wide Impact Analysis.”

Impact Analysis Methodology

The impact analysis consisted of: (1) establishing and describing the baseline conditions by determining the boundary of wetlands within the study area; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would alter water resources within the study area that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area by quantifying temporary and permanent disturbance to wetlands; and (4) analyzing the potential for impacts from the repair and rehabilitation on wetlands for leaks identified as substantive contributors of flow to adjacent wetlands (greater than 50 percent of contribution to receiving waterbody) and calculating a hydrologic budget for the wetlands to demonstrate whether sufficient hydrology would exist to support wetlands in the absence of leak flow.

Further detail on the wetlands impact analysis methodology is described below.

Table 9.3-11: Wetlands within Repair and Rehabilitation Study Areas

Town/Village	Study Area	Wetland Source ^{1,2}	Wetland Classification (Cowardin et al. 1979)	Analysis Required
Town of Olive	Ashokan Screen Chamber	NWI	PEM1Ex	-
	Beaverkill Road	NWI	PUBHh (3 wetlands)	✓, ▲
		Surveyed	PUB (1 wetland)	
	Atwood-Olivebridge Road	NWI	PUBHh (2 wetlands), PEM1Ah	-
Town of Marbletown	Vly Atwood Road	NWI	PFO1C, PFO1E (2 wetlands)	-
	Pine Bush Road	NWI	PUBFb, PEM1C, PFO1A, PUBHx (3 wetlands), PSS1A (2 wetlands), PUBHh (2 wetlands), PFO1E, PEM1A	-
	Lucas Turnpike	Surveyed	PFO (3 wetlands), PEM	✓, ▲
		NWI	PUBHh, PFO1C	
		NYSDEC	Class 1	
	Canal Road	NWI	R3UBH, PFO1A	✓, ▲
		Surveyed	PFO1 (1 wetland)	
Mossybrook Road	Surveyed	PFO (1 wetland)	✓, ▲	
Lower Knolls Road	NWI	PSS1E, PUBHh	-	
Town of New Paltz	Mountain Rest Road		NA	-
	New Paltz-Minnewaska Road	NWI	PUBH, PSS1E	-
Town of Gardiner	Forest Glen Road	NWI	R2UBH, PFO1A, R5USA	✓, ▲
		Surveyed	PFO1 (1 wetland)	
	Le Fevre Lane		NA	-
	Armato Lane		NA	-
Town of Shawangunk	Strawridge Road	NWI	PFO1E (6 wetlands), PUBHh (2 wetlands)	✓, ▲
Town of Montgomery	Winchell Drive	NWI	PFO1E (2 wetlands)	-
Town of New Windsor	Mount Airy Road	NWI	PUBH, L2USCh, PEM1F, PFO1E	✓, ▲
		NYSDEC	Class 2	
		Surveyed	PEM (2 wetlands)	
	Passaro Drive		NA	-
Village of Nelsonville	Gatehouse Road		NA	-
	Fishkill Road		NA	-

Table 9.3-11: Wetlands within Repair and Rehabilitation Study Areas

Town/Village	Study Area	Wetland Source ^{1,2}	Wetland Classification (Cowardin et al. 1979)	Analysis Required
Town of Philipstown	Indian Brook Road		NA	-
	Old Albany Post Road	NWI	PFO1E (3 wetlands)	-
	Sprout Brook Road	NYSDEC	Class 1 (2 wetlands)	✓, ▲
		NWI	PFO1E (2 wetlands)	
Surveyed	PFO1E (1 wetland)			
Town of Cortlandt	Aqueduct Road	NWI	PUBHx (4 wetlands)	-
Town of Yorktown	Jacob Road	NWI	PUBHh, PFO1C	-
	Chapman Road		NA	-
	Croton Dam Road	Surveyed	PFO2	✓, ▲
	Kitchawan Road		NA	-
Town of New Castle	Somerstown Turnpike	NWI	PUBHx, PUBH	-
	Station Place	NYSDEC	Class 2 (3 polygons)	-
		NWI	PEM1E, PSS1/FO1C	
	Campfire Road	NYSDEC	Class 2 (2 wetlands)	✓, ▲
Town of Mount Pleasant	Chappaqua Road	NWI	PFO1C	✓, ▲
		Surveyed	PEM/PSS, PEM	
	Nanny Hagen Road	Surveyed	NA	✓, ▲
	Westlake Drive	NWI	PUBHx	-
Village of Pleasantville	Washington Avenue		NA	-
	Pleasantville Alum Plant		NA	-
	Willow Street		NA	-

Notes:

- = Screens out. Does not warrant an impact analysis.
- ✓ = Impact analysis conducted.
- ▲ = Impact analysis conducted on a project-wide basis.
- NA = Not Applicable

¹ NWI means National Wetlands Inventory. NWI wetlands are classified based on Cowardin et al. (Cowardin et al.1979), which are defined at <http://www.fws.gov/wetlands/data/wetland-codes.html>.

² NYSDEC means New York State Department of Environmental Conservation. State wetland classifications are based on New York Environmental Conservation Law Part 24-1301.

Step 1: Determine Wetland Boundary

Wetlands within the study areas identified in **Table 9.3-11** as requiring analysis were delineated in accordance with the “Field Guide for Wetland Delineation – 1987 Corps of Engineers Manual” prepared by the Wetland Training Institute (1995) as well as the “Regional Supplement to the Corps of Engineers Wetland Delineation Manual: North Central and Northeast Region (Version 2.0)” issued January 2012. Sequentially numbered flags were placed to delineate wetlands within the study areas. The flag locations were recorded using a Trimble DGPS unit. The data were post-processed into ArcGIS to prepare figures.

Wetland mapping was conducted at the Lucas Turnpike, Canal Road, Mossybrook Road, Forest Glen Road, Mount Airy Road, and Nanny Hagen Road study areas. Formal delineations of these areas were not possible due to landownership, seasonality, or changes to limits of construction after fieldwork was completed. Portions of these natural resources study areas were conservatively mapped based on a visual survey of topography, vegetation, and surface hydrology to determine the presence or absence of wetlands. Areas within the study areas that contained wetlands were identified on the habitat maps as “non-delineated wetland” areas. For study areas where a desktop assessment was conducted, wetlands potentially occurring within the natural resources study area were identified through an evaluation of aerial photographs, NYSDEC water classification data, NYSDEC freshwater wetlands maps, USFWS NWI wetland maps, national hydrography data, published soil survey maps, and USGS topographic maps.

Wetlands associated with leaks were designated by the leak number, followed by a “WL” for wetland, and a letter if there were multiple wetlands. For example, wetlands at Leak 3 were named 3-WL, whereas a wetland at Leak 4 would be named 4-WL. Wetlands not associated with leaks were designated based on the aqueduct tunnel location, followed by a “WL” for wetland and a letter if there were multiple wetlands. For example, wetlands at the Sprout Brook Road Study Area were identified as Sprout-WL-A for Wetland A, and as Sprout-WL-B for Wetland B.

Step 2: Quantify Disturbance to Wetlands

An assessment of potential temporary and permanent disturbance to wetlands resulting from repair and rehabilitation activities was quantified for each delineated wetland using ArcGIS. Disturbance areas associated with regulated State and municipal wetland buffers were also quantified and presented in the impact analysis. Activities categorized as temporary disturbance included installation of erosion and sediment control measures, stream diversions and construction dewatering, construction staging areas, and discharges to surface water that may be associated with wetlands (i.e., raw aqueduct water, treated biofilm wash water, dechlorinated water). Permanent disturbance included loss of wetlands following leak repair, permanent access improvements, and streambank grading and protection measures at select steel pipe siphon blow-off sites.

Step 3: Analysis of Wetland Hydrology

Croton Dam Road and Chappaqua Road are the only study areas where leaks to be repaired were identified as contributing to adjacent wetlands. Due to the small size (0.07 acre) and limited functions provided by the affected wetland at Croton Dam Road, the wetland analysis was

terminated at Step 2. Within the Chappaqua Road Study Area, a hydrologic budget analysis was performed to quantify the potential effect of repairing Leak 8 on nearby wetlands. These wetlands provide potential habitat for protected species (e.g., bog turtles (*Clemmys* [=*Glyptemys*] *muhlenbergii*). Therefore, a Step 3-level analysis was conducted for the Chappaqua Road Study Area.

A hydrologic budget analysis accounts for water inflow (i.e., precipitation, groundwater inflow, surface water inflow) and system outflow (i.e., evapotranspiration, groundwater outflow, surface water outflow).¹ Water storage volume represents the sum of the inflows less the sum of the outflows and refers to the capacity available for water storage. This tool is useful for gauging the timing and amounts of water that can be expected at a particular site as wetlands can be defined by the number of days of soil saturation during the growing season. Essentially, hydrologic budgets are analogous to an accounting system with inflows representing credits and outflows as debits contributing to overall water storage, or water availability, of an area.

A hydrologic budget is traditionally used when designing wetland mitigation or restorations to verify that a site’s existing hydrology can support the proposed wetland habitats. The analysis quantifies the potential effects, if any, of repairing the leaks and thereby reducing inflows on wetlands within a study area. The duration and seasonality of soil saturation, soil type, and drainage characteristics exert a strong influence on the number, type, and distribution of plants and plant communities in wetlands. To support wetland vegetation, the root zone of wetland vegetation (generally the upper 12 inches) should not have any extended periods of drying even during the driest year in the last 50 years (Environmental Laboratory 1987).

The hydrologic budget analysis followed the methodology described in the New Jersey Department of Environmental Protection’s (NJDEP) Regionalized Water Budget Manual for Compensatory Wetland Mitigation Sites in New Jersey (NJDEP 2008) and from “Planning Hydrology for Constructed Wetlands” (Pierce 1993). The budget used the equation below to account for water inflows (from multiple sources) and system outflows:

$$\Delta S = [P + S_i + G_i] - [ET + S_o + G_o]$$

where:

ΔS= change in volume of water storage in a defined area over time

- | | |
|--|---------------------------------------|
| P = Precipitation | S _i = Surface-water inflow |
| G _i = Groundwater inflow | ET = Evapotranspiration |
| S _o = Surface-water outflow | G _o = Groundwater outflow |

Inflow and outflow data for the hydrologic budget were obtained from several sources. Daily precipitation data recorded at Westchester County Airport for the last 30 years and evapotranspiration data were obtained from the Northeast Regional Climate Center. Surface water inflows and outflows were calculated by delineating the watershed contributing to the wetlands through the use of ArcGIS, which was then used to calculate runoff. The delineated watershed was divided into land-cover/land-use types according to the 2009 NYSDEC Land

¹ For more information on wetland water budgets, see <http://water.usgs.gov/nwsum/WSP2425/hydrology.html>.

Cover mapping data set and into hydrologic soil groups according to the NRCS soil survey for the purposes of runoff calculation. The predicted runoff input for the hydrologic budget was calculated using the TR-55, or Runoff Curve Number method. This method was developed by the USDA's Soil Conservation Service and is widely used to estimate the amount of runoff from a rainfall event in small- to medium-sized watersheds. No groundwater data (i.e., monitoring wells or piezometers) were available for the project site, so the associated groundwater input was set to zero. This was a conservative assumption, as there is likely to be some non-zero amount of groundwater input to the wetlands. Similarly, no information on groundwater outflow from the site was available. However, groundwater output was derived from estimated permeabilities for constructed wetlands soils (Pierce 1993) and is typical for naturally occurring wetlands as well.

After the above components were computed for each day in the model year, the results were summed to obtain a monthly value and plotted to show the total depth of water available each month within the study area. The results indicate the net water increase or decrease over a range of conditions. Additionally, to assess whether a site would meet jurisdictional wetland hydrological characteristic requirements, the projected water depth of the wetland was computed.

Floodplains

This section presents the screening assessment and analyzes the potential for repair and rehabilitation activities to result in a disturbance to floodplains within the surrounding study areas from activities at the work sites.

Screening Assessment

Floodplains, identified by FEMA as special flood hazard areas, mitigate flooding by allowing floodwaters to dissipate their energy and recharge into the ground. Those study areas that contain special flood hazard areas were mapped. As many study areas contain first and second order tributaries, there were several surface water areas where floodplains have not been identified by FEMA.

As listed in **Table 9.3-12**, there are no designated FEMA flood hazard areas within the following study areas: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Mossybrook Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Le Fevre Lane, Armato Lane, Strawridge Road, Winchell Drive, Mount Airy Road, Passaro Drive, Gatehouse Road, Old Albany Post Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Pleasantville Alum Plant, and Willow Street. In addition, repair and rehabilitation work activities within the following study areas would not occur within the limits of designated flood hazard areas: Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Forest Glen Road, and Croton Dam Road. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to flood plains discussed in Section 9.3.3.3, "Town Codes." Therefore, a natural resources impact analysis related to floodplains is not warranted for these study areas.

There would either be temporary or permanent activities within designated flood hazard areas at the following study areas: Fishkill Road, Indian Brook Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, Nanny Hagen Road, Westlake Drive, and Washington Avenue. Therefore, the potential for impacts to floodplains within these study areas was evaluated in the respective "Natural Resources" sections using the methodology described below.

Table 9.3-12: Floodplains within the Repair and Rehabilitation Study Areas

Town/Village	Study Area	Surface Water Name	FEMA Flood Insurance Rate Map ID	Special Flood Hazard Area ¹	Regulated Floodway ²	Analysis Required
Town of Olive	Ashokan Screen Chamber	NA				-
	Beaverkill Road	NA				-
	Atwood-Olivebridge Road	NA				-
Town of Marbletown	Vly Atwood Road	Lower Esopus Creek	36111C	A	No	-
	Pine Bush Road	Peak Brook	36111C	A	No	-
	Lucas Turnpike	Rondout Creek	36111C	A	No	-
	Canal Road	Rondout Creek	36111C	A	No	-
	Mossybrook Road	NA				-
	Lower Knolls Road	NA				-
Town of New Paltz	Mountain Rest Road	NA				-
	New Paltz-Minnewaska Road	NA				-
Town of Gardiner	Forest Glen Road	Walkill River	36111C	AE	Yes	-
	Le Fevre Lane	NA				-
	Armato Lane	NA				-
Town of Shawangunk	Strawridge Road	NA				-
Town of Montgomery	Winchell Drive	NA				-
Town of New Windsor	Mount Airy Road	Silver Stream	NA	NA	NA	-
	Passaro Drive	NA				-
Village of Nelsonville	Gatehouse Road	NA				-
	Fishkill Road	Foundry Brook	36079C	AE	Yes	✓
Town of Philipstown	Indian Brook Road	Indian Brook	36079C	A	No	✓
	Old Albany Post Road	NA				-
	Sprout Brook Road	Canopus Creek	36079C	AE	Yes	✓
Town of Cortlandt	Aqueduct Road	Peekskill Hollow Creek	36119C	AE	Yes	✓

Table 9.3-12: Floodplains within the Repair and Rehabilitation Study Areas

Town/Village	Study Area	Surface Water Name	FEMA Flood Insurance Rate Map ID	Special Flood Hazard Area ¹	Regulated Floodway ²	Analysis Required
Town of Yorktown	Jacob Road	Hunter Brook	36119C	A	No	✓
	Chapman Road	Turkey Mountain Brook	36119C	A	No	✓
	Croton Dam Road	New Croton Reservoir	36119C	AE	No	-
	Kitchawan Road	NA				-
Town of New Castle	Somerstown Turnpike	NA				-
	Station Place	NA				-
	Campfire Road	NA				-
Town of Mount Pleasant	Chappaqua Road	NA				-
	Nanny Hagen Road	Kensico Reservoir	36119C	A	No	✓
	Westlake Drive	Kensico Reservoir	36119C	A	No	✓
Village of Pleasantville	Washington Avenue	Saw Mill River	36119C	AE	Yes	✓
	Pleasantville Alum Plant	NA				-
	Willow Street	NA				-

Notes:
 - = Screens out. Does not warrant an impact analysis.
 ✓ = Impact analysis conducted.
 NA = Not Applicable
¹ An area inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. These areas include Zone A and Zone AE (FEMA 2014).
² The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height (FEMA 2014).

Impact Analysis Methodology

The impact analysis consisted of: (1) identifying specific work activities that could occur within the designated flood hazard areas, such as watercourse relocations, new or modified structures, utilities, temporary work activities, or other changes to conveyance capacity; (2) a discussion of future conditions without repair and rehabilitation within the study areas; and (3) analyzing potential impacts associated with the repair and rehabilitation on floodplains and identifying the need for hydrologic and hydraulic analyses to quantify changes in water surface elevation and velocities following construction. A detailed analysis will be conducted prior to issuance of the FEIS to support floodplain permit approvals.

9.3.9.3 Aquatic and Benthic Resources

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in a disturbance to aquatic and benthic resources in the study areas. The assessment focuses on possible direct or indirect effects to aquatic and benthic resources from work activities within or adjacent to water resources, specifically surface water and/or wetlands.

Screening Assessment

Freshwaters may contain habitat and conditions suitable for coldwater or warmwater fisheries. Coldwater fisheries encompass trout waters (T) or waters suitable for trout spawning (TS), and are collectively referred to as supportive of coldwater fisheries. Freshwaters with a classification of AA, A, B, and C may also have T and TS designations, which carry additional requirements that are intended to be protective of coldwater fisheries. This includes a general prohibition on in-water activities, referred to as a coldwater fisheries window, during the vulnerable spawning, incubation, and early development period (October 1 to April 30) (see **Table 9.3-9**). Waterbodies with these classifications or that have evidence of trout are Beaverkill Road, Atwood-Olivebridge Road, Fishkill Road, Indian Brook Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Kitchawan Road, and Washington Avenue study areas. These streams would involve in-water construction, including potential activities that may occur during the coldwater fisheries window and, therefore, further analysis is warranted on a project-wide basis (see **Table 9.3-8**).

There is no prohibition period for in-water activities within streams supporting warmwater fisheries. However, impounded waterbodies, like Kensico Reservoir, do have requirements in place to protect warmwater fisheries and, where applicable, coldwater fisheries as well. During construction, repairs to the Catskill Influent Chamber in the Nanny Hagen Road Study Area and to the Catskill Kensico Bypass manhole in the Westlake Drive Study Area would require in-water construction within Kensico Reservoir. Given Kensico Reservoir's designation as both a warmwater and coldwater fishery and that some work activities may occur during the prohibition period on in-water activities (September 15 through June 30), an assessment of potential impacts to aquatic and benthic resources within the Nanny Hagen Road and Westlake Drive study areas is warranted (see **Table 9.3-8**).

Additionally, temporary chlorination of the Catskill Aqueduct would occur from 2019 through 2023. Local dechlorination systems would be operated during this time within the existing leak flowpath and would not affect leak flow. Discharges from these systems would meet applicable regulatory requirements; however temporary effects to aquatic communities from the proposed

temporary chlorination at the Ashokan Screen Chamber may occur. Therefore, further analysis is warranted on a project-wide basis for Vly Atwood Road, Lucas Turnpike, Canal Road, Mossybrook Road, Mountain Rest Road, Forest Glen Road, Mount Airy Road, and Croton Dam Road study areas (see **Table 9.3-8**).

For in-water work activities in the remaining study areas (e.g., restoring riprap, constructing new culverts), potential for disturbance would be minimal. Construction would be conducted in accordance with State and local requirements to minimize disturbance to aquatic systems and the organisms they support. Impacts to aquatic habitats are not anticipated because protective measures would be in place that would limit potential effects to the immediate vicinity of the work sites, the nature of the work would be short-term, and the work is anticipated to be accomplished during the summer under low flow conditions. Temporarily disturbed areas would be restored to baseline conditions when construction is completed. These activities have been planned to ensure that aquatic resources are maintained and preserved during the repair and rehabilitation. Therefore, an assessment is not warranted for the following study areas: New Paltz-Minnewaska Road, Chapman Road, Somerstown Turnpike, Campfire Road, Chappaqua Road, and Pleasantville Alum Plant study areas.

No further assessment of aquatic and benthic resources was warranted for study areas where in-water work would be avoided: Pine Bush Road, Strawridge Road, and Station Place study areas.

Upon completion of repair and rehabilitation efforts, operation of the Catskill Aqueduct would not affect aquatic and benthic resources. The repaired steel pipe siphon blow-off valves and culvert drain sluice gates would be utilized as originally intended to discharge raw aqueduct water to adjacent streams during construction and future tunnel unwatering as necessary under typical operations. Unwatering at blow-off chambers is generally completed in less than a day and more typically several hours; while unwatering at sluice gates, which is more uncommon, may take several days due to the lower discharge rates. Unwatering is not anticipated to cause scouring or other adverse effects to the receiving streams, therefore, no impacts to aquatic and benthic resources are anticipated. Water resources influenced by existing leaks would transition back to pre-leak conditions following leak repair. Flows would decrease from their artificially elevated levels upon repair of the leaks, and over time, no measurable, long-term effects are anticipated to water resources or the aquatic and benthic communities they support.

In summary, the potential for impacts to aquatic and benthic resources within the Nanny Hagen Road and Westlake Drive study areas was evaluated in the respective “Natural Resources” sections using the methodology described below. The potential for the repair and rehabilitation to affect coldwater fisheries or to result in changes to aquatic communities during temporary chlorination are analyzed on a project-wide basis in Section 9.18, “Project-wide Impact Analysis.”

Impact Analysis Methodology

Where applicable, the impact analysis consisted of: (1) describing baseline conditions of potential habitat and existing aquatic communities from field visits, ArcGIS data, independent reports, a review of current stream designations, NYSDEC consultations, NYSDEC 2016 trout stocking records, and other available data; (2) establishing future conditions without the repair and rehabilitation due to natural processes and by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with the

repair and rehabilitation based on construction and/or operation activities, and the potential for changes to habitat; and (4) analyzing the potential for impacts from the repair and rehabilitation to aquatic communities by qualitatively estimating changes to fish and macroinvertebrate habitat.

9.3.9.4 Terrestrial Resources

This section presents the screening assessment and analyzes the potential for repair and rehabilitation activities to result in a disturbance to terrestrial resources from activities at the work sites that could require tree removal or cause a disturbance to significant natural communities within the surrounding study areas.

Screening Assessment

Ecological communities were identified based on field visits and New York Natural Heritage Program (NYNHP) consultation results. An ecological community is defined as a variable assemblage of interacting plant and animal populations that share a common environment. Significant natural communities are classified by NYNHP as rare or high-quality wetlands, forests, grasslands, ponds, streams, and other types of habitats, ecosystems, and ecological areas. Significant natural communities are inventoried and monitored because of their unique attributes or because of the rare plant and animal species they may harbor. In contrast, a terrestrial cultural community is defined as a community that is created or modified and subsequently maintained by human influence to such a degree that the physical conformation of the substrate, or the biological composition of the resident community, is substantially different than before it was modified by humans (Edinger et al. 2014). The majority of the study areas are dominated by the terrestrial cultural community known as mowed lawn.

At the following study areas, there are either no significant ecological or terrestrial communities, or the repair and rehabilitation activities would not result in tree removal: Beaverkill Road, Canal Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Winchell Drive, Old Albany Post Road, Campfire Road, Chappaqua Road, Pleasantville Alum Plant, and Willow Street. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to tree removal discussed in Section 9.3.3.3, “Town Codes.” Therefore, a terrestrial resources impact analysis within these study areas is not warranted.

Tree removal or alterations to terrestrial resources from site preparation, access road improvements, excavation, and grading for mechanical repairs, among other work activities could affect terrestrial resources, including significant natural communities. Consultations with NYNHP located the following significant natural communities as identified in **Table 9.3-13**: a hemlock-northern hardwood forest community located within the Mossybrook Road and Lower Knolls Road study areas; chestnut oak forest community located within Mountain Rest Road Study Area; chestnut oak forest and oak-tulip tree forest communities located within the Gatehouse Road Study Area; and chestnut oak forest and oak-tulip tree forest communities located within the Fishkill Road Study Area. Of the study areas with significant natural communities, only Mountain Rest Road has no anticipated tree removal proposed during construction; therefore, a terrestrial resources impact analysis is not warranted for Mountain Rest Road Study Area. Repair and rehabilitation work activities within the study area would be in compliance with the applicable town codes related to tree removal discussed in Section 9.3.3.3, “Town Codes.”

Table 9.3-13: Terrestrial Resources within the Repair and Rehabilitation Study Areas

Town/Village	Study Area	Significant Natural Community	Potential Tree Removal
Town of Olive	Ashokan Screen Chamber	-	✓
	Beaverkill Road	-	-
	Atwood-Olivebridge Road	-	✓
Town of Marbletown	Vly Atwood Road	-	✓
	Pine Bush Road	-	✓
	Lucas Turnpike	-	✓
	Canal Road	-	-
	Mossybrook Road	✓ ¹	✓
	Lower Knolls Road	✓ ¹	✓
Town of New Paltz	Mountain Rest Road	- ¹	-
	New Paltz-Minnewaska Road	-	✓
Town of Gardiner	Forest Glen Road	-	-
	Le Fevre Lane	-	-
	Armato Lane	-	-
Town of Shawangunk	Strawridge Road	-	✓
Town of Montgomery	Winchell Drive	-	-
Town of New Windsor	Mount Airy Road	-	✓
	Passaro Drive	-	✓
Village of Nelsonville	Gatehouse Road	✓ ¹	✓
	Fishkill Road	✓ ¹	✓
Town of Philipstown	Indian Brook Road	-	✓
	Old Albany Post Road	-	-
	Sprout Brook Road	-	✓
Town of Cortlandt	Aqueduct Road	-	✓
Town of Yorktown	Jacob Road	-	✓
	Chapman Road	-	✓
	Croton Dam Road	-	✓
	Kitchawan Road	-	✓
Town of New Castle	Somerstown Turnpike	-	✓
	Station Place	-	✓
	Campfire Road	-	-
Town of Mount Pleasant	Chappaqua Road	-	-
	Nanny Hagen Road	-	✓
	Westlake Drive	-	✓
Village of Pleasantville	Washington Avenue	-	✓
	Pleasantville Alum Plant	-	-
	Willow Street	-	-
Notes:			
- = Screens out. Does not warrant an impact analysis.			
✓ = Impact analysis conducted.			
¹ Record listed on NYNHP database			

The following study areas may have tree removal activity, and which include study areas identified to contain significant natural communities: Ashokan Screen Chamber, Atwood-Olivebridge Road, Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Mossybrook Road, Lower Knolls Road, New Paltz-Minnewaska Road, Strawridge Road, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Nanny Hagen Road, Westlake Drive, and Washington Avenue. Therefore, the potential for impacts to terrestrial resources within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. Additionally, the potential for the repair and rehabilitation to result in changes to terrestrial resources as a result of the proposed temporary chlorination at the Ashokan Screen Chamber is analyzed on a project-wide basis in Section 9.18, “Project-wide Impact Analysis.”

Impact Analysis Methodology

The impact analysis consisted of: (1) describing baseline conditions for terrestrial resources based on ArcGIS data, NYNHP consultation, and observations of ecological habitats during site surveys; (2) establishing future conditions without repair and rehabilitation due to natural processes and by identifying proposed projects within the study areas; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area and estimating the numbers, species, and diameter of trees to be removed; and (4) analyzing the potential for impacts associated with repair and rehabilitation on terrestrial resources by estimating the potential disturbance to significant natural communities.

9.3.9.5 Wildlife

This section presents the screening assessment of the potential for the repair and rehabilitation to disturb wildlife or their habitat within the surrounding study areas from activities at the work sites.

Screening Assessment

Potential wildlife occurring within the study areas was identified by consulting the 2000-2005 New York State Breeding Bird Atlas, the New York State Amphibian and Reptile Atlas Project (Herp Atlas), and the NYSDEC Nature Explorer. These databases are discussed in more detail below. Wildlife was also identified via any incidental wildlife observations made during site surveys.

The Breeding Bird Atlas is the result of a five-year survey in which the State was divided into 3-mile by 3-mile survey blocks that were assessed for breeding bird species by State biologists, researchers, and volunteer ornithologists and bird watchers. This data is available in a database through the NYSDEC website (New York State Breeding Bird Atlas 2000). The blocks which include the study areas are shown on **Figure 9.3-2**. The Herp Atlas is a statewide survey of amphibians and reptiles that was conducted over 10 years starting in 1990. The Herp Atlas information is organized by USGS 7.5-minute quadrangles and is also available through the

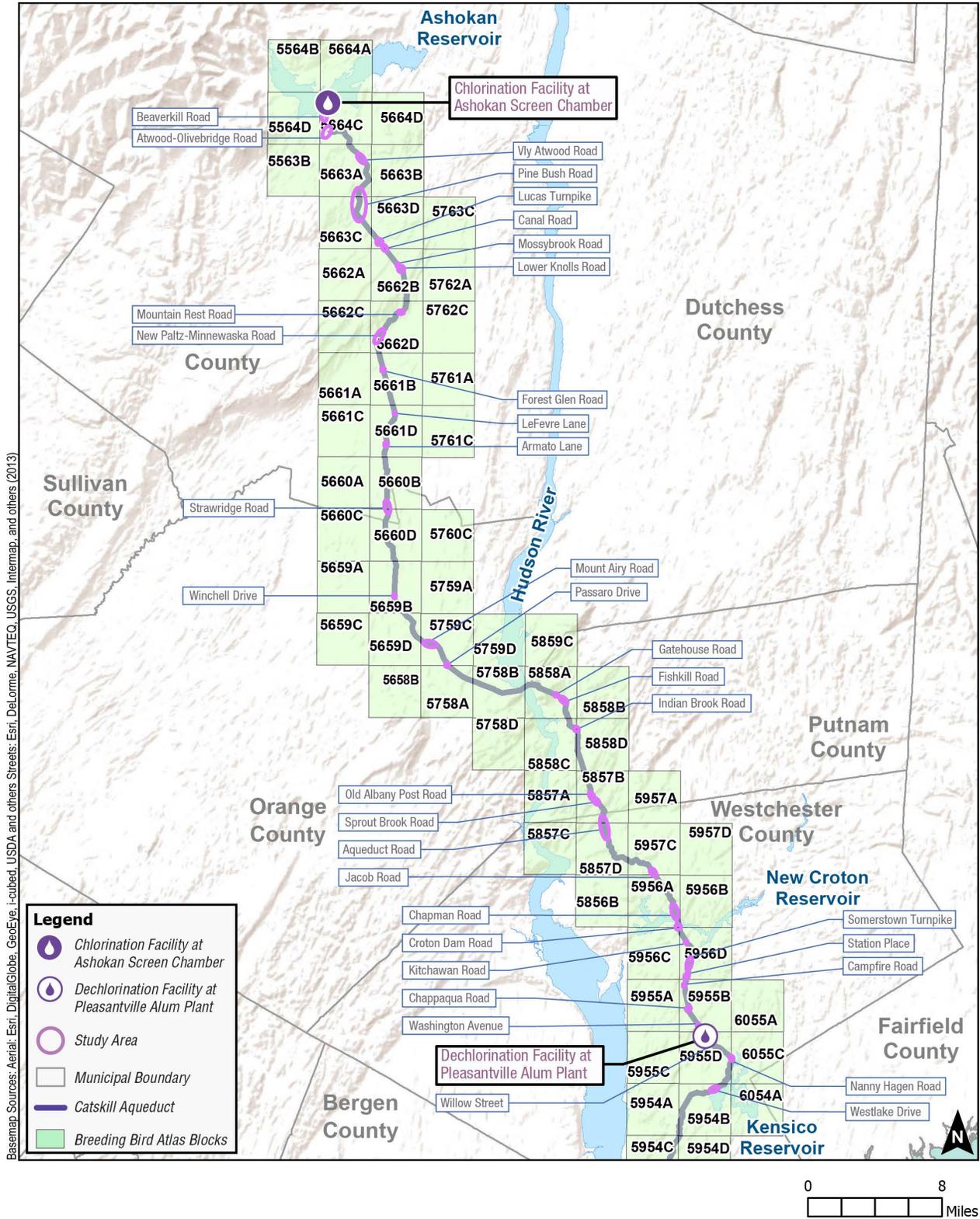


Figure 9.3-2: Breeding Bird Atlas Blocks along the Catskill Aqueduct Corridor



NYSDEC website (New York Herp Atlas Project 1999). The Herp Atlas quadrangles within which the study areas are located are shown on **Figure 9.3-3**. The NYSDEC Nature Explorer is a database that compiles information from the aforementioned databases, as well as wildlife survey and database information from NYNHP. Species location information in this database is provided on a countywide level.

As noted previously, repair and rehabilitation work activities within these study areas would affect sensitive habitats frequented by wildlife including surface water and/or wetlands during construction: discharge to surface water, temporary stream diversions and reservoir drawdowns to allow construction under dry conditions, installation of streambank restoration and protection measures, temporary and permanent access improvements (e.g., temporary stream crossings, access for bridge rehabilitation, culvert repairs), and installation of local dechlorination systems. In addition, leaks proposed for repair have the potential to affect downstream surface water and wetlands. Additionally, tree removal or alterations to terrestrial resources from site preparation, access road improvements, excavation and grading for mechanical and structural repairs, among other work activities could affect terrestrial resources used by wildlife.

At the start of construction, sediment and erosion control measures would be installed around each work site to prevent or limit temporary effects to surface water and wetland features inhabited or frequented by wildlife. Construction would include minor grading, vegetation clearing, and tree removal for site access and staging areas that may contain suitable habitat for some wildlife. The repair and rehabilitation has been designed to minimize the number of trees removed by limiting the area of disturbance to previously cleared locations along the aqueduct where feasible. As construction would predominantly occur on previously disturbed areas along the Catskill Aqueduct, no significant encroachment on wildlife or their habitat would be expected.

There may be short-term increases in noise levels at the work sites that may temporarily discourage wildlife from breeding or foraging areas near these sites. However, construction would take place primarily during daytime hours, thereby avoiding direct disturbance to potential roosting, nesting, and foraging wildlife. In most cases, work activities would be largely confined to previously disturbed areas and would not affect forest-interior species. Should any potential habitat exist at the work sites, a variety of habitats would be available for use in the vicinity during construction. Moreover, individuals within the mowed/maintained areas and edge habitat are likely acclimated to ambient noise and some human disturbance. Any removal of trees and would be conducted from November 1 through March 31, which is outside of the breeding/nesting period for most bird species and coincides with the time period when amphibians and reptiles are less active. Following completion of construction, equipment and vehicles would be removed from the study areas and noise-generating activities would cease.

Where permanent disturbance to habitat is required, measures would be taken to offset disturbance to habitats to ensure no net loss (e.g., replanting disturbed areas). Disturbance associated with constructing new structures like air vents and boatholes would be confined to the extent of the immediate vicinity of the aqueduct appurtenance in cleared areas and would not result in direct effects to potential habitat. The cessation of leaks would restore the sites to pre-leak conditions, and would therefore not affect refuge, foraging, or breeding habitat for wildlife.

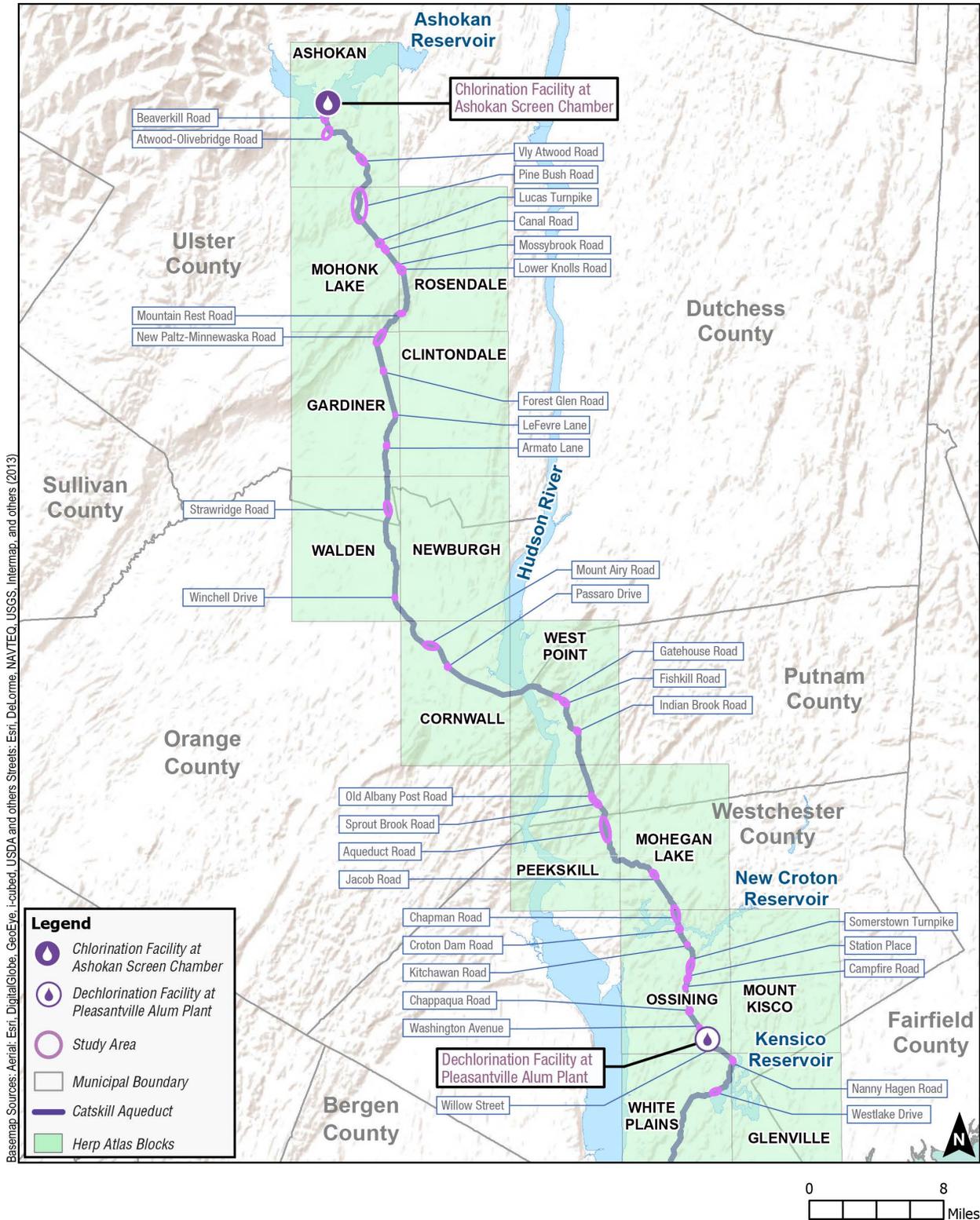


Figure 9.3-3: Herp Atlas Quadrangles along the Catskill Aqueduct Corridor



Following construction and temporary chlorination, operation of the Catskill Aqueduct would be consistent with baseline conditions and would include routine inspection and maintenance, with vehicles entering and exiting the sites as they do today. Vegetated areas temporarily cleared during construction would grow back with similar communities to baseline conditions. As a result, there would be no significant disturbance to wildlife or their habitats associated with the repair and rehabilitation efforts within the study areas. Therefore, a wildlife impact analysis within the study areas is not warranted.

9.3.9.6 Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to disturb federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare and vulnerable species or their habitat within the study areas from activities at the work sites.

Screening Assessment

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and other unlisted rare or vulnerable species within 0.25 mile of work sites were identified in consultation with USFWS, USACE, NYNHP, and NYSDEC. State protected rare plant species were considered when applicable. Additionally, other unlisted rare or vulnerable species were considered when identified in the NYNHP database as occurring within or near (0.25 mile) a work site in a study area. For study areas within Westchester County, the Westchester County Endangered Species List (updated 2005), maintained by the County's Department of Parks and Conservation, was reviewed. DEP coordinated with these agencies and county and local offices, as applicable, to determine whether further analyses would be necessary for the study areas. ArcGIS data and field visits were also used to identify broad habitat characteristics of the study areas.

To develop the list of species identified within the study areas, DEP contacted NYNHP to determine whether federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and other unlisted rare or vulnerable species were reported as occurring within or adjacent to the study areas. Specifically, NYNHP provided results from their consultation that identified the species and/or habitats with their State, heritage, and global rankings based on species rarity, population trends, and threats, along with other information related to the species. As part of this database query, NYNHP identified timber rattlesnakes within 1.5 miles of the study areas, Bald Eagles (*Haliaeetus leucocephalus*) within 1 mile of the study areas, bog turtles within 1 mile of the study areas, Indiana bats (*Myotis sodalis*) within 2.5 miles of the study areas, and Northern long-eared bat (*Myotis septentrionalis*) hibernacula within 5 miles of the study areas. NYSDEC Central and Regional offices were contacted to provide additional information on species, locations, and habitats in accordance with USFWS protocol.

USFWS was consulted, in accordance with the Endangered Species Act of 1973 and Fish and Wildlife Coordination Act of 1934, and provided an online report of any federal listed Endangered, Threatened, Candidate, or proposed for listing species known to exist within the study area counties. Requests for information and concurrence of findings for federally protected

species with the potential to occur were sent to USFWS on September 19, 2014 and July 2, 2015. An addendum to the previously submitted requests was sent on December 12, 2015 and a response from USFWS acknowledging their review was received on February 23, 2016. The assessments for federal threatened and endangered species determines whether the proposed project activities have the potential to affect or result in a take of a species. Where there is a federal nexus with the project, species are assessed under Section 7 of the Endangered Species Act. Under Section 7, a project's impacts to protected species are designated as one of the following: "no effects," "may affect but is not likely to adversely affect," and "may affect and is likely to adversely affect." A finding of "no effects" means there will be no impacts, positive or negative, to protected resources. A finding of "may affect but is not likely to adversely affect" means that project impacts would either be beneficial, not measurable or undetectable, or otherwise unable to be evaluated. A finding of "may affect and is likely to adversely affect" means protective resources are likely to be exposed to the project action or environmental consequences and would respond negatively. Under Section 10 of the Endangered Species Act, projects are evaluated on their potential to result in take to a protected resource. Take is defined in the Endangered Species Act as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct," and "harm" includes actions that result in significant habitat modification.

In addition to data provided by these sources, local and county legislation related to Endangered, Threatened, and State Species of Special Concern was reviewed and species lists compared with State and federal species information to ensure relevant flora and fauna were identified. Species provided protection under the Migratory Bird Treaty Act of 1918, and other protective legislation such as the Bald and Golden Eagle Protection Act, were evaluated if documented to occur within the study area. The screening assessment for species currently or proposed for federal or State protection is shown in **Table 9.3-14**.

Federally Listed Species

Species currently under or proposed for federal protection were identified as having the potential to occur within the study areas. Therefore, a screening assessment for these species was conducted. For these species, the repair and rehabilitation activities within each of the study areas was evaluated, and field visits were conducted to determine if there was the potential for disturbance to the species or its habitat. The impact analysis consisted of: (1) mapping and describing baseline conditions of potential habitat or significant natural communities based on these field visits; (2) establishing future conditions without the repair and rehabilitation due to natural processes and by identifying proposed projects within the study areas; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential for impacts associated with repair and rehabilitation through an assessment of potential disturbance to the species and its habitat. Conservation measures were identified to protect the species when applicable.

The species-specific impact analysis methodology for these species is provided below in alphabetical order by taxonomic group similar to **Table 9.3-14**.

Table 9.3-14: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species within the Repair and Rehabilitation Study Areas

West of Hudson																				
Common Name	Scientific Name	Federal and State Listing Status	Town of Olive			Town of Marbletown						Town of New Paltz		Town of Gardiner			Town of Shawangunk	Town of Montgomery	Town of New Windsor	
			Ashokan Screen Chamber	Beaverkill Road	Atwood-Olivebridge Road	Vly Atwood Road	Pine Bush Road	Lucas Turnpike	Canal Road	Mossybrook Road	Lower Knolls Road	Mountain Rest Road	New Paltz-Minnewaska Road	Forest Glen Road	Le Fevre Lane	Armato Lane	Strawridge Road	Winchell Drive	Mount Airy Road	Passaro Drive
Amphibians and Reptiles																				
Blue-spotted Salamander	<i>Ambystoma laterale</i>	Federal: Unlisted State: Special Concern	-	-	-	-	● ³	√ ³	√ ³	√ ³	● ³	● ³	● ³	-	-	-	-	-	-	-
Bog Turtle	<i>Clemmys [=Glyptemys] muhlenbergii</i>	Federal: Threatened State: Endangered	● ¹	● ¹	● ¹	● ¹	● ¹	√ ¹	√ ¹	√ ¹	● ¹	● ¹	● ^{1,3}	√ ^{1,3}	● ^{1,2,3}	● ^{1,3}	√ ¹	● ¹	√ ¹	● ¹
Eastern Box Turtle	<i>Terrapene carolina</i>	Federal: Unlisted State: Special Concern	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ¹	√ ³	√ ³	√ ³	√ ¹	√ ³	√ ³	√ ³	√ ³
Eastern Fence Lizard	<i>Sceloporus undulatus</i>	Federal: Unlisted State: Threatened	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Hognose Snake	<i>Heterodon platyrhinos</i>	Federal: Unlisted State: Special Concern	-	-	-	-	-	-	-	√ ³	√ ³	√ ³	-	-	-	-	-	-	-	-
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	Federal: Unlisted State: Special Concern	-	-	-	-	● ³	√ ³	√ ³	√ ³	● ³	● ³	● ³	√ ³	● ³	● ³	√ ³	● ³	-	-
Jefferson Salamander Complex	<i>Ambystoma jeffersonianum x laterale</i>	Federal: Unlisted State: Special Concern	-	-	-	-	● ³	√ ³	√ ³	√ ³	● ³	● ³	● ³	√ ³	● ³	● ³	√ ³	● ³	-	-
Marbled Salamander	<i>Ambystoma opacum</i>	Federal: Unlisted State: Special Concern	● ³	● ³	● ³	√ ³	-	-	-	√ ³	● ³	● ³	-	-	-	-	√ ³	● ³	● ³	● ³
Northern Cricket Frog	<i>Acris c. crepitans</i>	Federal: Unlisted State: Endangered	-	-	-	-	-	-	-	√ ³	● ³	● ³	-	-	-	-	-	-	-	-
Southern Leopard Frog	<i>Lithobates sphenoccephala utricularius</i>	Federal: Unlisted State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Turtle	<i>Clemmys guttata</i>	Federal: Unlisted State: Special Concern	● ³	● ³	● ³	√ ³	● ³	√ ³	√ ³	√ ³	● ³	● ³	● ³	√ ³	● ³	● ³	√ ³	● ³	-	-
Timber Rattlesnake	<i>Crotalus horridus</i>	Federal: Unlisted State: Threatened	-	-	-	-	-	-	-	√ ^{2,3}	√ ^{2,3}	√ ³	√ ³	√ ³	√ ³	√ ³	-	-	√ ³	√ ³
Wood Turtle	<i>Glyptemys insculpta</i>	Federal: Unlisted State: Special Concern	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	-	-	√ ³	√ ³
Common Wormsnake	<i>Carphophis amoenus</i>	Federal: Unlisted State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9.3-14: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species within the Repair and Rehabilitation Study Areas

West of Hudson																				
Common Name	Scientific Name	Federal and State Listing Status	Town of Olive			Town of Marbletown						Town of New Paltz		Town of Gardiner			Town of Shawangunk	Town of Montgomery	Town of New Windsor	
			Ashokan Screen Chamber	Beaverkill Road	Atwood-Olivebridge Road	Vly Atwood Road	Pine Bush Road	Lucas Turnpike	Canal Road	Mossybrook Road	Lower Knolls Road	Mountain Rest Road	New Paltz-Minnewaska Road	Forest Glen Road	Le Fevre Lane	Armato Lane	Strawridge Road	Winchell Drive	Mount Airy Road	Passaro Drive
Birds																				
American Bittern	<i>Botaurus lentiginosus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	√ ⁴	-	-	-	-	-	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Federal: BGPA, MBTA State: Threatened	√ ^{2,4,5}	√ ^{2,4}	√ ^{2,4}	-	-	√ ²	√ ²	-	-	-	-	-	-	-	-	-	-	
Cerulean Warbler	<i>Dendroica cerulea</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	● ⁴	√ ⁴	-	-	-	-	-	-	
Cooper's Hawk	<i>Accipiter cooperii</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	√	-	-	-	-	-	-	√ ⁴	-	-	
Osprey	<i>Pandion haliaetus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Federal: MBTA State: Threatened	-	-	-	-	-	-	-	-	-	● ⁴	● ⁴	-	-	-	-	-	-	
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	√ ⁴	-	-	-	-	-	
Red-shouldered Hawk	<i>Buteo lineatus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	√ ⁴	-	-	-	-	-	
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	● ⁴	√ ⁴	√ ⁴	√ ⁴	● ⁴	-	-	-	
Whip-poor-will	<i>Antrostomus vociferous</i>	Federal: MBTA State: Special Concern	√ ⁴	√ ⁴	√ ⁴	-	-	-	-	-	-	-	-	√ ⁴	-	-	-	-	-	
Bivalves and Fish																				
Dwarf Wedgemussel	<i>Alasmidonta heterodon</i>	Federal: Endangered State: Endangered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	● ¹	● ¹	● ¹	● ¹
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	Federal: Endangered State: Endangered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Atlantic Sturgeon	<i>Acipenser oxyrinchus oxyrinchus</i>	Federal: Endangered State: Endangered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Insects																				
Arrowhead Spiketail	<i>Cordulegaster oblique</i>	Federal: Unlisted State: Unlisted	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 9.3-14: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species within the Repair and Rehabilitation Study Areas

West of Hudson																				
Common Name	Scientific Name	Federal and State Listing Status	Town of Olive			Town of Marbletown						Town of New Paltz		Town of Gardiner			Town of Shawangunk	Town of Montgomery	Town of New Windsor	
			Ashokan Screen Chamber	Beaverkill Road	Atwood-Olivebridge Road	Vly Atwood Road	Pine Bush Road	Lucas Turnpike	Canal Road	Mossybrook Road	Lower Knolls Road	Mountain Rest Road	New Paltz-Minnewaska Road	Forest Glen Road	Le Fevre Lane	Armato Lane	Strawridge Road	Winchell Drive	Mount Airy Road	Passaro Drive
Mammals																				
Indiana Bat	<i>Myotis sodalis</i>	Federal: Endangered State: Endangered	✓ ¹	● ¹	✓ ¹	✓ ^{1,2}	✓ ^{1,2}	✓ ¹	✓ ¹	✓ ¹	✓ ¹	● ¹	✓ ¹	✓ ¹	● ¹	● ¹	✓ ¹	● ^{1,2}	✓ ^{1,2}	✓ ^{1,2}
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Federal: Threatened State: Unlisted	✓ ¹	● ¹	✓ ¹	✓ ^{1,2}	✓ ^{1,2}	✓ ^{1,2}	✓ ^{1,2}	✓ ^{1,2}	✓ ^{1,2}	✓ ¹	✓ ¹	✓ ¹	● ¹	● ¹	✓ ¹	● ¹	✓ ¹	✓ ¹
New England Cottontail	<i>Sylvilagus transitionalis</i>	Federal: Unlisted State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plants																				
Alpine Cliff Fern	<i>Woodsia alpina</i>	Federal: Unlisted State: Endangered	-	-	-	✓ ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodora	<i>Rhododendron canadense</i>	Federal: Unlisted State: Threatened	-	-	-	✓ ²	✓ ²	-	-	-	-	-	-	-	-	-	-	-	-	-
Roseroot	<i>Rhodiola rosea</i>	Federal: Unlisted State: Endangered	-	-	-	✓ ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scarlet Indian-paintbrush	<i>Castilleja coccinea</i>	Federal: Unlisted State: Endangered	-	-	-	-	-	-	-	-	-	-	✓ ²	✓ ²	-	-	-	-	-	-
Small Whorled Pogonia	<i>Isotria medeoloides</i>	Federal: Threatened State: Threatened	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓ ¹	✓ ¹	✓ ¹
Woodland Agrimony	<i>Agrimonia rostellata</i>	Federal: Unlisted State: Threatened	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9.3-14: Federal/State Threatened, Endangered, Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species within the Repair and Rehabilitation Study Areas

East of Hudson																				
Common Name	Scientific Name	Federal and State Listing Status	Village of Nelsonville		Town of Philipstown			Town of Cortlandt	Town of Yorktown				Town of New Castle			Town of Mount Pleasant			Village of Pleasantville	
			Gatehouse Road	Fishkill Road	Indian Brook Road	Old Albany Post Road	Sprout Brook Road	Aqueduct Road	Jacob Road	Chapman Road	Croton Dam Road	Kitchawan Road	Somerset Turnpike	Station Place	Campfire Road	Chappaqua Road	Nanny Hagen Road	Westlake Drive	Washington Avenue	Pleasantville Alum Plant
Amphibians and Reptiles																				
Blue-spotted Salamander	<i>Ambystoma laterale</i>	Federal: Unlisted State: Special Concern	● ³	● ³	● ³	● ³	√ ³	● ³	-	-	-	-	-	-	-	-	-	-	-	-
Bog Turtle	<i>Clemmys [=Glyptemys] muhlenbergii</i>	Federal: Threatened State: Endangered	● ¹	● ¹	● ¹	● ¹	√ ¹	● ¹	● ¹	● ¹	√ ¹	√ ¹	√ ¹	● ¹	√ ¹	√ ¹	√ ¹	● ¹	● ¹	● ¹
Eastern Box Turtle	<i>Terrapene carolina</i>	Federal: Unlisted State: Special Concern	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³
Eastern Fence Lizard	<i>Sceloporus undulatus</i>	Federal: Unlisted State: Threatened	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Hognose Snake	<i>Heterodon p. platyrhinos</i>	Federal: Unlisted State: Special Concern	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	-	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	-	-	√ ³
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	Federal: Unlisted State: Special Concern	-	-	-	● ³	√ ³	● ³	-	-	-	-	-	-	-	-	-	-	-	-
Jefferson Salamander Complex	<i>Ambystoma jeffersonianum x laterale</i>	Federal: Unlisted State: Special Concern	● ³	● ³	● ³	● ³	√ ³	● ³	● ³	● ³	-	-	-	-	-	-	-	-	-	-
Marbled Salamander	<i>Ambystoma opacum</i>	Federal: Unlisted State: Special Concern	● ³	● ³	● ³	● ³	√ ³	● ³	● ³	● ³	-	-	-	-	-	-	√ ³	-	-	-
Northern Cricket Frog	<i>Acris c. crepitans</i>	Federal: Unlisted State: Endangered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Southern Leopard Frog	<i>Lithobates sphenoccephala utricularius</i>	Federal: Unlisted State: Special Concern	-	-	-	● ³	√ ³	● ³	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Turtle	<i>Clemmys guttata</i>	Federal: Unlisted State: Special Concern	● ³	● ³	● ³	● ³	√ ³	● ³	● ³	● ³	√ ³	√ ³	√ ³	● ³	√ ³	√ ³	-	-	-	● ³
Timber Rattlesnake	<i>Crotalus horridus</i>	Federal: Unlisted State: Threatened	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	-	-	-	-	-	-	-	-	-	-	-	-
Wood Turtle	<i>Glyptemys insculpta</i>	Federal: Unlisted State: Special Concern	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	-	-	-	-	-	-	-	-	-	-	-	-
Common Wormsnake	<i>Carphophis amoenus</i>	Federal: Unlisted State: Special Concern	√ ³	√ ³	√ ³	√ ³	√ ³	√ ³	-	-	-	-	-	-	-	-	-	-	-	-

Table 9.3-14: Federal/State Threatened, Endangered, Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species within the Repair and Rehabilitation Study Areas

East of Hudson																				
Common Name	Scientific Name	Federal and State Listing Status	Village of Nelsonville		Town of Philipstown			Town of Cortlandt	Town of Yorktown				Town of New Castle			Town of Mount Pleasant			Village of Pleasantville	
			Gatehouse Road	Fishkill Road	Indian Brook Road	Old Albany Post Road	Sprout Brook Road	Aqueduct Road	Jacob Road	Chapman Road	Croton Dam Road	Kitchawan Road	Somerstown Turnpike	Station Place	Campfire Road	Chappaqua Road	Nanny Hagen Road	Westlake Drive	Washington Avenue	Pleasantville Alum Plant
Birds																				
American Bittern	<i>Botaurus lentiginosus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Federal: BGPA, MBTA State: Threatened	-	-	√ ²	-	-	-	-	√ ⁵	√ ⁵	-	-	-	-	√ ⁵	√ ⁵	-	-	-
Cerulean Warbler	<i>Dendroica cerulea</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cooper's Hawk	<i>Accipiter cooperii</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	√ ⁴	√ ⁴	√ ⁴	-	-	√ ⁴	√ ⁴	-
Osprey	<i>Pandion haliaetus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	√ ⁴	√ ⁴	√ ⁴	√ ⁴	-	-	√ ⁴	-	-	● ⁴	● ⁴
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Federal: MBTA State: Threatened	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-shouldered Hawk	<i>Buteo lineatus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	√ ⁴	√ ⁴	√ ⁴	√ ⁴	-	-	√ ⁴	-	-	√ ⁴	√ ⁴
Whip-poor-will	<i>Antrostomus vociferous</i>	Federal: MBTA State: Special Concern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bivalves and Fish																				
Dwarf Wedgemussel	<i>Alasmidonta heterodon</i>	Federal: Endangered State: Endangered	-	-	● ¹	● ¹	● ¹	-	-	-	-	-	-	-	-	-	-	-	-	-
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	Federal: Endangered State: Endangered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Sturgeon	<i>Acipenser oxyrinchus oxyrinchus</i>	Federal: Endangered State: Endangered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insects																				
Arrowhead Spiketail	<i>Cordulegaster oblique</i>	Federal: Unlisted State: Unlisted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Bog Turtle (Clemmys [=Glyptemys] muhlenbergii)

The bog turtle is a small species of turtle that is listed as federally Threatened and State Endangered. Bog turtle habitat consists of open wetland areas with cool, shallow, slow-moving water, deep, soft, mucky soils, and tussock-forming herbaceous vegetation. Wetlands that provide this suitable bog turtle habitat are usually emergent wetlands characterized by a mosaic of microhabitats that include dry pockets, saturated areas, and areas that are periodically flooded. Bog turtles depend on a diversity of microhabitats for foraging, nesting, basking, hibernation, shelter, and other needs. Throughout the bog turtles' northern range, these wetlands are often seeped or spring-fed emergent wetlands located at the headwaters of streams or small tributaries. Forested, closed-canopy wetlands are primarily considered unsuitable habitat for bog turtle. However, bog turtles may be found in this environment when migrating to suitable wetlands (USFWS 2001).

Screening Assessment

Potential bog turtle habitat is identified by the presence of suitable vegetation, hydrology, and soils. A desktop assessment of aerial imagery, hydrography, and NYSDEC and USFWS NWI wetland maps was performed to identify the presence of potential bog turtle habitat including wetlands, open areas, and streams. Additionally, field visits were conducted as part of the screening assessment to verify the presence of unmapped wetlands, whether the occurrence of bog turtle habitat within on-site wetlands was possible, and if disturbance to the wetland could not be avoided.

Although the USFWS Official Species Lists (OSLs) and the New York State Herp Atlas identified the potential for bog turtles within all of the study areas, the NYNHP consultation returned extant or historic populations of bog turtle within 1 mile of the Le Fevre Lane Study Area. Additionally, the Gardiner quadrangle of the New York State Herp Atlas has documented bog turtle populations which overlap with the New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, and Armato Lane study areas.

As listed in **Table 9.3-14**, the desktop assessments and field visits were used in combination to identify whether the occurrence of bog turtle habitat was possible at the Lucas Turnpike, Canal Road, Mossybrook Road, Forest Glen Road, Strawridge Road, Mount Airy Road, Sprout Brook Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Campfire Road, Chappaqua Road, and Nanny Hagen Road study areas. The potential for impacts to bog turtles and their habitat within these study areas were evaluated in the respective "Natural Resources" sections using the methodology described below. No potential areas that could be suitable for bog turtles were identified for the remaining study areas due to the absence of wetlands or wetlands that did not exhibit indicators of potential habitat (i.e., hydrology, vegetation, substrate). Therefore, a natural resources impact analysis related to bog turtles and their habitat within these study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Bog Turtle

For the study areas where the occurrence of suitable bog turtle habitat was possible, ArcGIS data were reviewed and field visits were conducted to determine the potential for impacts to bog

turtles from the repair and rehabilitation based on the proposed work activities and the potential for disturbance. Per USFWS survey guidelines, a Phase I habitat survey was conducted if the wetland(s) had an emergent and/or scrub-shrub component, or were forested with suitable soils and hydrology and if disturbance to the wetland could not be avoided (USFWS 2006). Suitable hydrology and soils are the primary determinants of potentially suitable habitat for bog turtles, and data were recorded on USFWS 2013 Phase I forms.

Typical bog turtle habitat consists of emergent-scrub/shrub wetlands with a specific combination of vegetation, hydrology and substrate. Suitable substrate was determined by probing soils with a 1-inch diameter stick. Vegetation composition, depth of substrate and composition (e.g., soil muckiness), and hydrology were recorded and observed. When potential bog turtle habitat was identified within a portion of a wetland, it was referred to with a “H” designation for Habitat, with the same identifier as the wetland where it was located. For example, habitat identified within 3-WL-A during the Phase I survey was referred to as 3-H-A and subject to Phase II surveys.

Following discussions with USFWS, Phase II Visual Assessments for bog turtles (“Phase II bog turtle surveys”) were undertaken where potential habitat could be temporarily or permanently affected by the repair and rehabilitation. Two USFWS qualified bog turtle biologists led the Phase II bog turtle surveys. The Phase II bog turtle surveys were conducted in accordance with the methodologies outlined in the USFWS “Bog Turtle Characteristics and Survey Guidelines” (May 2000, revised May 2001) for visual surveys and survey protocols, updated by USFWS in April 2006. The wetlands were surveyed for a minimum of 4 hours per study area acre per day of survey. Random searching, opportunistic searching, and transect surveys were used to find individuals.

Based on the results of the Phase II bog turtle surveys and anticipated disturbance to potential habitat from the repair and rehabilitation, DEP assessed the potential for a “take” of bog turtles or their habitat to occur.² Wherever the potential for a take existed, Phase III Trapping Surveys were conducted for bog turtles (“Phase III bog turtle surveys”). Surveys were conducted in accordance with USFWS protocols and a USFWS-approved Phase III Work Plan for the work sites (USFWS 2006). Trapping was conducted by USFWS Recognized Qualified Phase III Surveyors and assistants, as permitted by a NYSDEC Endangered/Threatened Species License. All trapping was conducted during the approved survey window (May 1 through June 30) for 20 consecutive days of trapping following initial setup. During trapping periods, traps were checked once daily and any wildlife captured were recorded on field data sheets for each trap check and then released.

The Phase I and II bog turtle survey methodology and results were submitted to USFWS on April 22, 2014 (referred to herein as the “Phase I/II Bog Turtle Survey Report”). Detailed methodology and results for the Phase III Trapping Surveys were submitted to USFWS on August 25, 2015 (referred to herein as the “Phase III Bog Turtle Survey Report”).

² “Take” is defined in the Endangered Species Act as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any Threatened or Endangered species,” and “harm” includes actions that result in significant habitat modification.

Dwarf Wedgemussel (Alasmidonta heterodon)

The dwarf wedgemussel (*Alasmidonta heterodon*) is a federal and State listed Endangered Species. Typical habitat includes cool, clear, freshwater brooks to rivers (100 meters wide) with slow to moderate velocities and silt, sand, and gravel substrates distributed in small areas between and downstream of larger cobbles and boulders. The only known population in the State occurs in the Neversink River and the Delaware River (NYNHP 2013).

Screening Assessment

The USFWS OSL lists this species in the Towns of Shawangunk, Montgomery, New Windsor, and Philipstown, and the Neversink River and the Delaware River. These include the Strawridge Road, Winchell Drive, Mount Airy Road, Passaro Drive, Indian Brook Road, Old Albany Post Road, and Sprout Brook Road study areas. The remaining study areas do not warrant further analysis (see **Table 9.3-14**). Of the study areas listed in the USFWS OSLs, the following do not have surface water in the immediate vicinity of the repair and rehabilitation work activities and, therefore, do not have suitable dwarf wedgemussel habitat: Strawridge Road, Winchell Drive, and Passaro Drive study areas. Therefore, a natural resources impact analysis related to dwarf wedgemussel and their habitat within these study areas is not warranted and no take is anticipated.

Surface water was identified, and the repair and rehabilitation activities would have the potential to cause temporary or permanent disturbance to surface water within the remaining study areas: Mount Airy Road, Indian Brook Road, Old Albany Post Road, and Sprout Brook Road. However, the Neversink and Delaware Rivers or their tributary waters are not within these study areas. Therefore, a natural resources impact analysis related to dwarf wedgemussel and their habitat within these study areas is not warranted.

Shortnose Sturgeon (Acipenser brevirostrum)

The shortnose sturgeon (*Acipenser brevirostrum*) is a federal and State listed Endangered Species and is found in the Hudson River estuary between New York City and the Federal Dam in Troy (Carlson 1998). The shortnose sturgeon primarily lives in larger rivers and rarely ventures into the ocean. As water temperatures rise in the spring, the species migrates to upstream reaches to spawn. Newly emerged fish travel downstream within weeks of hatching to brackish water that provides foraging habitat (USFWS 2003, Kynard and Horgan 2002). USFWS has not identified this species at the county level in New York because it is under jurisdiction of the National Marine Fisheries Service and, therefore, it is not found on any USFWS OSL for New York counties.

Screening Assessment

The shortnose sturgeon is unlikely to enter any tributary streams in the vicinity of the repair and rehabilitation study areas, and therefore no potential habitat would be affected. Activities pertaining to the repair and rehabilitation would take place in proximity to select tributaries of the Hudson River drainage basin (e.g., Indian Brook, Foundry Brook, Sprout Brook, Canopus Creek). No work is proposed within or immediately adjacent to the Hudson River, and all work

would be a sufficient distance from the Hudson River so as not to disturb any habitat for this species. Prior to commencement of the repair and rehabilitation, sediment and erosion control measures, such as silt fencing, would be installed at each work site with ground disturbance to prevent the potential transport of sediment into surface water, including those that flow to the Hudson River. Bridge repairs and construction of streambank restoration and protection would require in-water work and temporary stream diversions, but would not affect water quality or flows to the Hudson River. During construction, temporary, short-term discharges (e.g., lasting a few days or weeks) of raw aqueduct water and treated biofilm wash water may be discharged to receiving streams. DEP would manage these discharge flows and water quality to receiving streams consistent with applicable regulatory requirements.

Once construction is complete, temporary chlorination would begin. All discharges from the local dechlorination systems would meet applicable discharge requirements and/or water quality standards for the receiving waterbody. Following temporary chlorination, local dechlorination systems would not be operated, the study areas would be restored to baseline conditions, and operation of the Catskill Aqueduct would be consistent with baseline conditions.

Within the Hudson River drainage basin, repair and rehabilitation efforts at the Croton Dam Road and Chappaqua Road study areas would consist of leak repairs that would result in the permanent cessation of leaks. However, the cessation of these leaks would not affect water levels of the Hudson River since these leaks are located miles away. Therefore, a natural resources impact analysis related to shortnose sturgeon and their habitat is not warranted and no take is anticipated.

Atlantic Sturgeon (Acipenser oxyrinchus)

The Atlantic sturgeon (*Acipenser oxyrinchus*) is a federal and State listed Endangered Species and is found in the Hudson River estuary between New York City and the Federal Dam in Troy (Carlson 1998). The Atlantic sturgeon primarily lives in larger rivers and rarely ventures into the ocean. As the water temperatures rise in the spring, the species migrates to upstream reaches to spawn. Newly emerged fish travel drift downstream within weeks of hatching to brackish and estuarine waters that provide foraging habitat (NOAA 2013, Kynard and Horgan 2002). The USFWS has not identified this species at the county level in New York because it is under jurisdiction of the National Marine Fisheries Service and, therefore, it is not found on any USFWS OSL for New York counties.

Screening Assessment

The Atlantic sturgeon is unlikely to enter any tributary streams in the vicinity of the repair and rehabilitation study areas and, therefore, no potential habitat would be affected. Repair and rehabilitation activities would take place in proximity to select tributaries of the Hudson River drainage basin (e.g., Indian Brook, Foundry Brook, Sprout Brook, Canopus Creek). No work is proposed within or adjacent to the Hudson River, and all work would be a sufficient distance from the Hudson River so as not to disturb any habitat for this species. Prior to commencement of the repair and rehabilitation activities, sediment and erosion control measures, such as silt fencing would be installed at each work site with ground disturbance to prevent the potential transport of sediment into surface water, including those that may drain to the Hudson River.

Bridge repairs and construction of streambank restoration and protection would require in-water work and temporary stream diversions, but would not affect water quality or flows to the Hudson River. During construction, temporary, short-term discharges (e.g., lasting a few days or weeks) of raw aqueduct water and treated biofilm wash water may be discharged to receiving streams. DEP would manage these discharge flows and water quality to receiving streams consistent with applicable regulatory requirements.

Once construction is completed, temporary chlorination would begin. All discharges from the local dechlorination systems would meet applicable discharge requirements and/or water quality standards for the receiving waterbody. Following temporary chlorination, local dechlorination systems would not be operated, the study areas would be restored to baseline conditions, and operation of the Catskill Aqueduct would be consistent with baseline conditions.

Within the Hudson River drainage basin, the repair and rehabilitation at the Croton Dam Road and Chappaqua Road study areas would also consist of leak repairs that would result in the permanent cessation of leaks. However, the cessation of these leaks would not affect water levels of the Hudson River since these leaks are located miles away from the Hudson River. Therefore, a natural resources impact analysis related to Atlantic sturgeon and their habitat within the study areas is not warranted and no take is anticipated.

Indiana Bat (*Myotis sodalis*)

The Indiana bat is a federal and State listed Endangered Species. Indiana bats require trees with exfoliating bark or cracks and crevices to roost in during the summer months. These trees are often mature and exposed to direct sunlight for a majority of the day (USFWS 2007). Indiana bats migrate to and from winter hibernacula, where they typically hibernate from mid-October through early April each year. Therefore, tree cutting from November 1 through March 31, when Indiana bats are hibernating or concentrated near their hibernacula, is permissible for trees that provide suitable Indiana bat summer roosting habitat (USFWS 2011).

Suitable summer habitat for Indiana bats consists of a variety of woodland habitats where individuals can roost, forage, and travel, as well as surrounding non-forested habitats, such as open fields and emergent wetlands. Potential roost trees can occur in forested areas consisting of live trees and/or dead snags greater than 3 inches in dbh with exfoliating bark, cracks, crevices, and/or hollows. Roost trees can also be present in linear features such as fencerows, riparian forests, and other wooded corridors (USFWS 2014).

Screening Assessment

The USFWS OSLs identified the potential for Indiana bat summer habitat within all of the study areas. Indiana bat maternity colonies were identified by NYNHP as occurring within 2.5 miles of study areas within the Vly Atwood Road, Pine Bush Road, Winchell Drive, Mount Airy Road, and Passaro Drive study areas. Potential roost/maternity trees occur within the study areas, and streams, wetlands, and tree canopy provide potential foraging habitat. The repair and rehabilitation activities would potentially include tree removal affecting roost trees or permanent changes to hydrology affecting foraging habitat within the following study areas: Ashokan Screen Chamber, Atwood-Olivebridge Road, Vly Atwood Road, Pine Bush Road, Lucas

Turnpike, Canal Road, Mossybrook Road, Lower Knolls Road, New Paltz-Minnewaska Road, Forest Glen Road, Strawridge Road, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Nanny Hagen Road, Westlake Drive, Washington Avenue and Pleasantville Alum Plant. Therefore, the potential for impacts to Indiana bat and their habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below.

Construction may also result in disturbance to streams that provide foraging habitat and temporary noise that discourages Indiana bats from roosting in the immediate vicinity of work sites within the remaining study areas. However, there is abundant suitable habitat in the surrounding areas in which Indiana bats could roost. Streambank restoration and protection would result in minor fill within certain streams, but these upgrades and maintenance would protect against future bank erosion and would not permanently alter flows. Once construction is completed, construction areas would be restored to natural conditions. Following temporary chlorination, local dechlorination systems would not be operated, the staging areas would be restored to baseline conditions, and operation of the Catskill Aqueduct would be consistent with baseline conditions. During future aqueduct maintenance, the steel pipe siphon blow-offs and select culvert drain sluice gates would be used to unwater the aqueduct. Discharges of raw aqueduct water would be short-term and temporary in nature, most lasting a few hours. Therefore, a natural resources impact analysis related to Indiana bat and their habitat, within the remaining study areas, is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Indiana Bat

For the study areas requiring tree removal, summer habitat surveys were conducted within the work sites during April and June 2013, July 2014, July through September 2015, February 2016, and June 2016.³ Habitat surveys conducted in April 2013 followed the procedures outlined in the “Draft Revised Range-wide Indiana Bat Summer Survey Guidelines” dated January 2013 (USFWS 2013), which characterizes Indiana bat summer habitat as trees and/or snags greater than 3 inches dbh. Subsequent habitat surveys conducted in 2015 and 2016 followed the procedures outlined in the May 2013 “Draft Revised Range-wide Indiana Bat Summer Survey Guidelines” and the January 2014 “Final Range-wide Indiana Bat Summer Survey Guidelines,” which indicate trees equal to or greater than 5 inches dbh, are considered Indiana bat summer habitat (USFWS 2013, USFWS 2014). The initial project screening guidelines used in these surveys is still current and has not been modified in recent updates (i.e., USFWS 2016). For consistency, all surveys assessed trees and/or snags greater than 3 inches dbh.

In accordance with the guidelines, the landscape was evaluated for potential roost trees, foraging habitat, water features, and travel corridors to determine the presence of potential Indiana bat summer habitat. As part of the survey, trees and dead snags greater than 3 inches dbh and exhibiting features such as exfoliating bark, cracks, crevices, and/or hollows were determined to be potential Indiana bat summer roost trees. Potential foraging habitat was determined by the presence of streams and/or waterbodies, as well as canopy trees and open fields where insects are

³ For certain study areas, if warranted, a survey will be completed prior to construction.

abundant. The adjacent landscape was analyzed for the presence of travel corridors using aerial images and field observations. Adjacent properties are forested and likely to contain potential summer habitat for this species.

Where possible, all trees potentially affected by the repair and rehabilitation were assessed for potential habitat. However, for larger study areas, sample plots of distinct vegetative communities were established to estimate the number of potential roost trees in areas that were not surveyed. First, distinct vegetative communities were characterized within each study area. For each vegetative community, a 10-foot-radius representative sample plot was established. All species of trees within the representative sample plot were identified and measured for dbh. Trees greater than 3 inches dbh were then evaluated for exfoliating, cracked, or furrowed bark, and for hollows and crevices. The sample plots were used to provide a measure of the density of potential roost trees within a given vegetative community identified in the study area. Each study area surveyed was inspected to ensure that distinct vegetative communities were represented within individual sample plots.

Trees within the sample plot with dbh greater than 3 inches and appropriate bark characteristics were determined to be potential roost trees, and were marked using a Trimble GPS unit with sub-meter accuracy. GPS data were later post-processed using Trimble Pathfinder Office software and plotted using ArcGIS.

Northern Long-eared Bat (*Myotis septentrionalis*)

The Northern long-eared bat was listed as a federal Threatened Species under the Endangered Species Act by USFWS on April 2, 2015. Similar to the Indiana bat, the Northern long-eared bat roosts in trees with exfoliating bark or suitable cracks and crevices. However, the Northern long-eared bat is also known to roost in smaller trees and in man-made structures (USFWS 2014). Because Northern long-eared bats have a similar life history as Indiana bats, the tree-cutting window for Indiana bats can be applied to protect suitable Northern long-eared bat habitat. Therefore, tree cutting from November 1 through March 31, when Northern long-eared bats are hibernating or concentrated near their hibernacula, is permissible for trees that provide suitable Northern long-eared bat summer roosting habitat (USFWS 2011).

Data collected during the Indiana bat habitat surveys were also used to assess the presence of Northern long-eared bat habitats outlined in the “Northern Long-Eared Bat Interim Conference and Planning Guidance” (USFWS 2014).

Screening Assessment

The USFWS OSLs identified the potential for Northern long-eared bat habitat within all of the study areas. Northern long-eared bat were identified by NYNHP as occurring within 5 miles of the Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, Lower Knolls Road, Gatehouse Road, Fishkill Road, and Indian Brook Road study areas. There are no known hibernacula within the study areas, but potential roost/maternity trees are located near work sites, and streams, wetlands, and tree canopy provide potential foraging habitat.

Because this species could inhabit the many man-made structures, like the chamber buildings and bridge crossing structures located along the Catskill Aqueduct, study areas containing these structures have the potential to provide roosting habitat. Construction at most of these structures would be consistent with typical operation and maintenance activities, where employees simply enter and exit the building and would be unlikely to disrupt roosting bats. Exterior alterations to bridge crossings and interior alterations to the Ashokan Screen Chamber, Rondout Drainage Chamber (Canal Road Study Area), New Paltz Connection Chamber (Mountain Rest Road Study Area), and Catskill Influent Chamber (Nanny Hagen Road Study Area) could disrupt roosting bats that may be using these facilities. Additionally, a new structure would be constructed within the Pleasantville Alum Plant Study Area.

The repair and rehabilitation activities would potentially include tree removal, alteration of man-made structures, or permanent changes to hydrology affecting foraging habitat within the following study areas: Ashokan Screen Chamber, Atwood-Olivebridge Road, Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Strawridge Road, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Nanny Hagen Road, Westlake Drive, Washington Avenue, and Pleasantville Alum Plant. Therefore, the potential for impacts to Northern long-eared bats and their habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below.

In addition, there could be disturbance to streams that provide foraging habitat and from temporary noise that discourages Northern long-eared bats from roosting in the immediate vicinity of the work sites within the remaining study areas. There is, however, abundant suitable habitat in the surrounding areas in which Northern long-eared bats could roost. Streambank restoration and protection would result in minor fill within certain streams, but these upgrades and maintenance would protect against future bank erosion and would not permanently alter flows. Once construction is completed, construction areas would be restored to natural conditions. Following temporary chlorination, local dechlorination systems would not be operated, the staging areas would be restored to baseline conditions, and operation of the Catskill Aqueduct would be consistent with baseline conditions. During future aqueduct maintenance, the steel pipe siphon blow-offs and select culvert drain sluice gates would be used to unwater the aqueduct. Discharges of raw aqueduct water would be short-term and temporary in nature, most lasting a few hours. Therefore, a natural resources impact analysis related to Northern long-eared bats and their habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Northern Long-eared Bat

For the study areas requiring tree removal, Northern long-eared bat summer habitat surveys were conducted within the work sites during April and June 2013, July 2014, July through September 2015, February 2016, and June 2016.⁴ Because habitat characteristics for this species and the Indiana bat are very similar, data collected during the Indiana bat habitat surveys were used to

⁴ For certain study areas, if warranted, a survey will be completed prior to construction.

assess the presence of Northern long-eared bat summer habitats outlined in the “Northern Long-Eared Bat Interim Conference and Planning Guidance” (USFWS 2014b).

Habitat surveys conducted in April 2013 followed the procedures outlined in the “Draft Revised Range-wide Indiana Bat Summer Survey Guidelines” dated January 2013 (USFWS 2013), which characterizes summer habitat as trees and/or snags greater than 3 inches dbh. Subsequent habitat surveys conducted in 2015 and 2016 followed the procedures outlined in the May 2013 “Draft Revised Range-wide Indiana Bat Summer Survey Guidelines” and the January 2014 “Final Range-wide Indiana Bat Summer Survey Guidelines,” which indicate trees equal to or greater than 5 inches dbh, are considered Indiana bat summer habitat (USFWS 2013, USFWS 2014). The initial project screening guidelines used in these surveys is still current and has not been modified in recent updates (i.e., USFWS 2016). For consistency, all surveys assessed trees and/or snags greater than 3 inches dbh.

In accordance with the guidelines, the landscape was evaluated for potential roost trees, foraging habitat, water features, and travel corridors to determine the presence of potential Northern long-eared bat summer habitat. As part of the survey, trees and dead snags greater than 3 inches dbh and exhibiting features such as exfoliating bark, cracks, crevices, and/or hollows were determined to be potential summer roost trees. Potential foraging habitat was determined by the presence of streams and/or waterbodies, as well as canopy trees and open fields where insects are abundant. The adjacent landscape was analyzed for the presence of travel corridors using aerial images and field observations. Adjacent areas are forested and likely to contain potential summer habitat for both bat species.

Where possible, all trees potentially affected by the repair and rehabilitation were assessed for potential habitat. However, when the study area was large, sample plots of distinct vegetative communities were evaluated to estimate the number of potential roost trees in areas that were not surveyed. First, distinct vegetative communities were characterized within each study area. For each vegetative community, a 10-foot-radius representative sample plot was established. All species of trees within the representative sample plot were identified and measured for dbh. Trees greater than 3 inches dbh were then evaluated for exfoliating, cracked, or furrowed bark, and for hollows and crevices. The sample plots were used to provide a measure of the density of potential roost trees within a given vegetative community identified in the study area. Each study area surveyed was inspected to ensure that distinct vegetative communities were represented within individual sample plots.

Trees within the sample plot with dbh greater than 3 inches and appropriate bark characteristics were determined to be potential roost trees, and were marked using a Trimble GPS unit with sub-meter accuracy. GPS data were later post-processed using Trimble Pathfinder Office software and plotted using ArcGIS.

During field visits, the locations of man-made structures were noted and observations of potential entry points along the building exteriors were recorded. In most cases, access to the building interiors was not possible during the field visit. Photographs and observations from recent inspections were reviewed, where available. Bridge structures and observations on potential roosting locations were noted.

Small Whorled Pogonia (Isotria medeoloides)

The small whorled pogonia (*Isotria medeoloides*) is a federal and State listed Threatened Species. In New York, this plant was believed to be extirpated (1976 last occurrence). However, the species has recently been confirmed in the State. This orchid grows in mature hardwood forests of beech, birch, maple, oak, and hickory. It can also be found in stands of softwoods such as hemlock. It prefers open understories with sparse to moderate ground cover, acidic soils with high moisture content, and with a thick layer of dead leaves (USFWS 2015). The species also favors features that create long-persisting breaks in the forest canopy, such as steep slopes and streams (USFWS 2001a).

Screening Assessment

According to the USFWS OSLs, the small whorled pogonia has the potential to be located within study areas located in Orange County, New York. The following study areas have the potential for the presence of small whorled pogonia or their habitat: Winchell Drive, Mount Airy Road, and Passaro Drive. Therefore, the potential for impacts to small whorled pogonia and their habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to small whorled pogonia or their habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Small Whorled Pogonia

ArcGIS data was used to determine the potential for impacts to small whorled pogonia from repair and rehabilitation activities based on the proposed work activities and the proximity to suitable habitat. Where warranted, based on proximity to suitable habitat, plant surveys were conducted during a time of year when this species was expected to be in bloom and thus most readily identifiable.

Visual inspections of the study areas were conducted to determine whether small whorled pogonia habitat requirements were present and to identify the dominant species on site and whether specimens of the small whorled pogonia were present. The field surveys consisted of habitat identification using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). For the purpose of these surveys, habitat is defined as a place where a species or a group of species lives. The term “community” as used by ecologists is defined as: (1) a suitable, optimal, or characteristic habitat for a species; and (2) a landscape biological context distinct from other such contexts. Common distinctions of the latter definition include forest, meadow, marsh, tidal mudflat, and lake. Finer distinctions are those such as maple-basswood rich mesic forest, hemlock-northern hardwood forest, and shallow emergent marsh, as defined in Edinger et al. (2014).

Several field guides were used to facilitate plant identification. Photographs of the small whorled pogonia obtained from the USDA Plants Database were also used in the field to confirm the identification of small whorled pogonia. At each location, a NYNHP Rare Plant Survey Form was completed identifying the vascular plant species within the various structural layers (tree, shrub, and herbaceous). DEP corresponded with USFWS on the Threatened and Endangered

plant habitat survey methodology for the study areas, and submitted a template of the plant habitat survey form to USFWS on June 14, 2013 in advance of conducting the surveys.

Conclusion for Federally Listed Species

The potential for impacts to federal Threatened and Endangered Species identified as having the potential to occur within those study areas that did not pass the screening assessment were evaluated in additional detail in the respective “Natural Resources” sections.

State Listed Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

In addition to the federal listed species, State Endangered, Threatened, Special Concern and other unlisted rare or vulnerable species or their habitat were identified as having the potential to occur within one or more study areas. While these species are not currently under or proposed for federal protection under the Endangered Species Act, the Bald Eagle is protected by the Bald and Golden Eagle Protection Act, and all birds are protected by the Migratory Bird Treaty Act. Therefore, a screening assessment for State protected species was conducted.

For the State protected and unprotected species, the repair and rehabilitation activities within each of the study areas were evaluated and field visits were conducted to determine if there was the potential for disturbance to the species or its habitat. Based on this screening assessment, species were identified to have the potential to be affected by the repair and rehabilitation within one or more of the study areas. The impact analysis consisted of: (1) mapping and describing baseline conditions of potential habitat or significant natural communities based on these field visits; (2) establishing future conditions without the repair and rehabilitation due to natural processes and by identifying proposed projects within the study areas; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential for impacts associated with repair and rehabilitation through an assessment of potential disturbance to the species and its habitat. Conservation measures were identified to protect the species when applicable.

The species-specific impact analysis methodology for these species is provided below in alphabetical order by taxonomic group similar to **Table 9.3-14**.

State Listed Species

Eastern Fence Lizard (*Sceloporus undulatus*)

The eastern fence lizard (*Sceloporus undulatus*) is a State listed Threatened Species. Habitat for this species varies geographically. Populations may be primarily arboreal, terrestrial, or saxicolous depending upon their surroundings. In southeast New York, the limit of their northern range, eastern fence lizards usually occur in dry, wooded habitats with sunny or open southerly facing hillsides and rocky outcrops and woody debris (stumps and logs). When inactive, they retreat underground or into crevices. Eggs are laid underground. They hibernate in underground burrows, tree stumps/logs, and in rock crevices (Gibbs et al. 2007).

Screening Assessment

NYNHP has no records of eastern fence lizard populations in the regions proximate to the study areas. The New York State Herp Atlas lists select areas in Putnam and Westchester Counties as having documented populations which include the following study areas: Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, and Aqueduct Road. Therefore, the potential for impacts to eastern fence lizards and their habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to eastern fence lizards, or their habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Eastern Fence Lizard

ArcGIS data, often coupled with field visits, was used to determine the potential for impacts to eastern fence lizard from the repair and rehabilitation based on the work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Northern Cricket Frog (*Acris c. crepitans*)

The northern cricket frog (*Acris c. crepitans*) is a State listed Endangered Species. Habitat for this species includes edges of well-lit marshes, marshy ponds, impoundments, farm ponds, and small slow-moving streams in open areas with shallow water. Floating aquatic vegetation, such as mats of mosses and water lilies, are preferred calling and breeding habitat. Northern cricket frogs move into upland habitats in late summer and early fall, where they overwinter in underground crevices/burrows and under and within rocky crevices, stumps, and logs from late fall to early spring. After emergence, they move and forage in uplands eventually reaching breeding sites in May.

Screening Assessment

NYNHP has no records of northern cricket frog populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Rosendale quadrant as having documented northern cricket frog populations. The only study areas located within the Rosendale quadrant which would have the potential to contain the northern cricket frog or its habitat is the Mossybrook Road Study Area. The Lower Knolls Road and Mountain Rest Road study areas do not include water resources or aquatic habitat in the vicinity of the work sites. Therefore, the potential for impacts to northern cricket frogs and their habitat within these study areas were evaluated in Section 9.5.7.6, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to the northern cricket frog and their habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Northern Cricket Frog

ArcGIS data was used to determine the potential for impacts to the northern cricket frog within the Mossybrook Road Study Area based on proposed work activities and the proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Timber Rattlesnake (Crotalus horridus)

The timber rattlesnake (*Crotalus horridus*) is a State listed Threatened Species. Timber rattlesnakes primarily inhabit deciduous forests in mountainous terrain; however, in summer, they can be found in coniferous forests, mixed forests, old fields, and wetlands (Gibbs et al. 2007). Timber rattlesnakes find dens to overwinter in that are located on mountain slopes with southern exposure, where canopy coverage is less than complete, and where there is access to subterranean environments. The species does not reach reproductive maturity until 4 to 11 years of age, and has declined primarily due to loss of habitat, illegal collection, and hunting. The timber rattlesnake is found in the Hudson Highlands, with concentrations in the Catskill and Shawangunk Mountains.

Screening Assessment

According to consultation with NYNHP, populations of timber rattlesnakes have been documented in the region proximate to the Mossybrook Road and Lower Knolls Road study areas. The New York State Herp Atlas also lists the Cornwall, Gardiner, Peekskill, Rosendale, and West Point quadrangles as having documented timber rattlesnake populations, which include the following study areas: Mossybrook Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, and Aqueduct Road. The timber rattlesnake uses a variety of habitats, so it is difficult to determine which areas may not contain suitable habitat. Therefore, the potential for impacts to timber rattlesnakes and their habitat within these study areas were evaluated in their respective “Natural Resources” sections using the methodology described below. The remaining study areas are located outside of these quadrangles and, therefore, a natural resources impact analysis related to timber rattlesnakes and their habitat within these study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Timber Rattlesnake

ArcGIS data, coupled with a site reconnaissance, was used to determine the potential for impacts to timber rattlesnakes from the repair and rehabilitation based on the proposed work activities and the proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the

species was present within the work sites. Conservation measures were identified to protect the species when applicable.

*Bald Eagle (*Haliaeetus leucocephalus*)*

The Bald Eagle was de-listed from the federal Endangered Species Act in 2007, but remains federally protected under the Bald and Golden Eagle Protection Act. Bald Eagles are also currently listed by the State as Threatened. Bald Eagles engage in courtship and nest-building as early as December and fledge young as early as late March. Nests are typically several feet wide and located in tall, live trees near water (Nye 2008). Bald Eagles occur in lower the Hudson River Valley and have also been regularly observed in the vicinity of most DEP reservoirs during migration and in the winter months. Bald Eagles exhibit site fidelity, returning to the same breeding territory and nest for multiple years and prefer relatively undisturbed areas near large open bodies of water for foraging opportunities and seek out forested areas for nesting habitat. During late summer and early fall, non-breeding Bald Eagles move to their wintering grounds, moving as far south as necessary to obtain food and quickly returning to breeding territories once open-water conditions return (NYSDEC 2015). In addition to nesting pairs, individual foraging or migrating eagles may be present in the vicinity of the study areas during the repair and rehabilitation.

Screening Assessment

NYNHP and/or DEP consultation returned known extant or historic populations of breeding Bald Eagles on or within 1 mile of the following study areas: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Lucas Turnpike, Canal Road, Indian Brook Road, Chapman Road, Croton Dam Road, Nanny Hagen Road, and Westlake Drive. Additionally, the 2000 to 2005 State Breeding Bird Atlas identifies the Bald Eagle as present in Atlas block 5664C that overlaps with the Ashokan Screen Chamber, Beaverkill Road, and Atwood-Olivebridge Road study areas (see **Table 9.3-14**). Therefore, the potential for impacts to Bald Eagles and their habitat within these study areas were evaluated in their respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to Bald Eagles and their habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Bald Eagle

ArcGIS data was used to determine the potential for impacts from the repair and rehabilitation to Bald Eagles based on the proposed work activities and if a buffer restriction would be required in accordance with the USFWS’s “National Bald Eagle Management Guidelines.” The desktop analysis of breeding Bald Eagle habitat consisted of performing a survey to determine nest proximity to work sites using ArcGIS. Bald Eagles often reside around many of the City’s watershed and reservoir systems, utilizing lands surrounding the reservoirs as habitat. Flight patterns are critical for breeding adults transporting food back to the nest to feed young. The distance from the natural resources study area to each known Bald Eagle nest was analyzed to determine if a buffer restriction would be required.

ArcGIS data of non-breeding Bald Eagle habitat consisted of performing a desktop review using ArcGIS to evaluate potential areas of roosting and foraging habitat, as well as their proximity to

the work sites. Roosting habitat consists of large perch trees near open water, where individuals can sit and observe their prey. Bald Eagles are an opportunistic species that feed primarily on fish, waterfowl, and the carcasses of deer and other animals, but also feed on small mammals and reptiles. Potential foraging areas consist of forested shorelines adjacent to reservoirs or rivers, areas below dams, and other areas where food resources are abundant (Beans and Niles 2003, USFWS 2007a). The desktop review identified the most likely area for potential roosting and foraging habitats for the species, as well as the closest of these areas. The distance to these areas was also analyzed to determine if a buffer restriction would be required.

Pied-billed Grebe (*Podilymbus podiceps*)

The Pied-billed Grebe (*Podilymbus podiceps*) is a State listed Threatened Species and is also afforded federal protection through the Migratory Bird Treaty Act. Pied-billed Grebes can be found year-round in the State. During the breeding season, Pied-billed Grebes nest in freshwater marshes that contain fairly deep open water at depths of 0.25 to 2.0 meters interspersed with submerged or floating aquatic vegetation and dense emergent vegetation (Beans and Niles 2003). Vegetative species found at breeding sites include cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), arrow arum (*Peltandra virginica*), and common reed (*Phragmites australis*). During the non-breeding season, Pied-billed Grebes may inhabit inland freshwater ponds, impoundments, lakes, rivers, brackish marshes, estuaries, inlets, and coastal bays. When freshwater freezes over, Pied-billed Grebes can be found in brackish marshes or tidal creeks. The diet of Pied-billed Grebes consists of a variety of aquatic organisms, including fish, crustaceans, insects, mollusks, amphibians, seeds, and aquatic vegetation (Beans and Niles 2003).

Screening Assessment

In the 2000 to 2005 State Breeding Bird Atlas, the Pied-billed Grebe was documented as present in Atlas block 5662D within the Mountain Rest Road and New Paltz-Minnewaska Road study areas. These study areas do not contain freshwater wetlands, large ponds, or rivers. Work would be limited to areas on top of the cut-and-cover tunnel or improvements to existing cleared areas that have no marshy meadows or ponds suitable for Pied-billed Grebes in proximity. Based on these conditions, the Mountain Rest Road and New Paltz-Minnewaska Road study areas do not have the potential for disturbance to suitable habitat and do not warrant further analysis. In addition, the remaining study areas located outside of this quadrangle do not warrant further analysis (see **Table 9.3-14**). Therefore, a natural resources impact analysis related to Pied-billed Grebes and their habitat within the study areas is not warranted and no take is anticipated.

Alpine Cliff Fern (*Woodsia alpine*)

Alpine cliff fern (*Woodsia alpine*) is a State listed Endangered Species. This small fern grows out of rock crevices and is found in the northern latitudes of North America and Eurasia. In the United States, it has been identified in Minnesota, Michigan, New York, Vermont, New Hampshire, and Maine. The alpine cliff fern is typically found in cool sites on dry to moist shaded rock crevices, slopes, or cliffs containing slaty and calcareous rocks, especially limestone (NYNHP 2007).

Screening Assessment

The NYNHP database identifies an extant population near the Vly Atwood Road Study Area as very small and located within a larger forested community associated with cliff walls of dark gray sandstone with strata of Marcellus shale. Therefore, the assessment of potential impacts to alpine cliff fern and its habitat is only required within the Vly Atwood Road Study Area and is presented in Section 9.5.3.7, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to alpine cliff fern and their habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Alpine Cliff Fern

For the Vly Atwood Road Study Area, ArcGIS data was used to determine the potential for impacts to alpine cliff fern based on the proposed work activities and proximity to suitable habitat. A plant survey was conducted following the same methodology described for the small whorled pogonia.

Rhodora (Rhododendron canadense)

Rhodora (Rhododendron canadense) is a State listed Threatened Species. This small deciduous flowering shrub rarely grows over 3 feet tall and prefers moist conditions. The species has been found in Newfoundland, Quebec, Ontario, southern and eastern Pennsylvania, and northern New Jersey. In New York, it is located in the St. Lawrence Valley, Adirondacks, Rensselaer Plateau, and the Shawangunk Mountains. In most of the habitats occupied by rhodora, wetlands of acidic rocky summits and barrens as well as boggy conditions or wet woods containing a mixture of organic material and gravel are present (NYNHP 2007).

Screening Assessment

The rhodora is identified by NYNHP as historically occurring in the vicinity of the Vly Atwood Road and Pine Bush Road study areas, but has not been documented since 1954 when it was observed in Lomontville in an abandoned swale formerly used for farming operations. Therefore, the potential for impacts to rhodora and its habitat is only required at the Vly Atwood Road and Pine Bush Road study areas and are presented in their respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to rhodora and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology - Rhodora

For the Vly Atwood Road and Pine Bush Road study areas, ArcGIS data was used to determine the potential for impacts to rhodora from repair and rehabilitation work activities and proximity to suitable habitat. The plant survey was conducted following the same methodology described for the small whorled pogonia.

Roseroot (Rhodiola rosea)

Roseroot (*Rhodiola rosea*) is a State listed Threatened Species. This plant belongs to the Crassulaceae family and is a succulent, herbaceous perennial plant. NYNHP identifies only a

few sites in New York where this plant has been found, all of them cliffs and all but one near waterfalls. This species usually occurs in mountainous areas at rock ledges or cliffs. The species prefers shaded and cool sites, and occupies cliffs of both calcareous and acidic rock (NYNHP 2007).

Screening Assessment

The NYNHP database documented a large, extant population in the vicinity of the Vly Atwood Road Study Area and located within a larger forested community on sandstone cliffs. Therefore, the potential for impacts to roseroot and its habitat is only required within the Vly Atwood Road Study Area and is presented in Section 9.5.3.7, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to roseroot and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology - Roseroot

For the Vly Atwood Road Study Area, ArcGIS data was used to assess potential impacts to roseroot based upon proposed repair and rehabilitation work activities and proximity to suitable habitat. A plant survey was conducted following the methodology used for the small whorled pogonia.

*Scarlet Indian-paintbrush (*Castilleja coccinea*)*

Scarlet Indian-paintbrush (*Castilleja coccinea*) is a State listed Endangered Species. This species is an annual or biennial wildflower. Occurrence of the species is documented to range from Nova Scotia and Maine in the northeast, west as far as Saskatchewan and Minnesota, and through all the southern states to Florida, reaching its western limits in Louisiana, Oklahoma, and Kansas. In New York, it is found on the Lake Erie and Lake Ontario Plains and in the Lower Hudson Valley. The species was most common in New York from the 1880s through the 1920s, when there was more open prairie-like habitat that has since re-grown into forest or has been developed and farmed. The typical habitat for the Scarlet Indian-paintbrush is open, usually calcareous sites, including grasslands, meadows, and moist prairies with damp sandy and gravel soils (NYNHP 2007).

Screening Assessment

The NYNHP database identifies historic populations near the New Paltz-Minnewaska Road and Forest Glen Road study areas that were last documented in 1899. There is uncertainty regarding its continued presence. As a result, the potential for impacts to Scarlet Indian-paintbrush and its habitat is only required at these study areas and is presented in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to Scarlet Indian-paintbrush and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Scarlet Indian-paintbrush

ArcGIS data was used to assess the potential impacts to Scarlet Indian-paintbrush based on proposed work activities and proximity to suitable habitat. Plant surveys were conducted consistent with the methodology described for small whorled pogonia.

Woodland Agrimony (Agrimonia rostellata)

Woodland Agrimony (*Agrimonia rostellata*) is a State listed Threatened Species. Habitat for this species consists of rich mesic forests, forested gorge slopes cutting through calcareous bedrock, stream banks in rich forests, forested slopes adjacent to streams, forested limestone benches, dry oak woods, wooded pastures on rich soil, shrub thickets, and other mesic sites that are typically wooded and on calcareous soils (NYNHP 2006).

Screening Assessment

NYNHP identifies a population of woodland agrimony near the Old Albany Post Road Study Area as very small and located within a larger forested community. Therefore, the potential for impacts to woodland agrimony and its habitat is only required within the Old Albany Post Road Study Area and is presented in Section 9.12.4.5, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to woodland agrimony and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Woodland Agrimony

For the Old Albany Post Road Study Area, ArcGIS was used to determine the potential for impacts to woodland agrimony at this study area from repair and rehabilitation proposed work activities and the proximity to suitable habitat. Plant surveys were conducted consistent with the methodology described for small whorled pogonia.

*State Species of Special Concern**Blue-spotted Salamander (Ambystoma laterale)*

The blue-spotted salamander (*Ambystoma laterale*) is a State Species of Special Concern. Habitat for this species includes moist, moderately shaded environments. This species favors northern hardwood/hemlock forests that have depressions for seasonal flooding, necessary for reproduction. Blue-spotted salamanders usually reside underground near their breeding pond beneath leaf litter and woody debris.

Screening Assessment

NYNHP has no records of blue-spotted salamander populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Peekskill, Mohonk Lake, and West Point quadrangles as having documented blue-spotted salamander populations. The study areas located within these quadrangles that have the potential to contain the blue-spotted salamander or its habitat include: Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Gatehouse Road, Fishkill Road,

Indian Brook Road, Old Albany Post Road, Sprout Brook Road, and Aqueduct Road (see **Table 9.3-14**). Work would be limited to areas on the cut-and-cover or steel pipe siphon tunnels or improvements to existing roads, which do not provide the moist, shaded habitat conditions suitable for blue-spotted salamanders. Work at other study areas would affect small streams, which also do not provide the isolated, ponded habitat for this species. Based on these conditions, the following study areas do not have the potential to disturb suitable habitat and do not warrant further analysis: Pine Bush Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, and Aqueduct Road. In addition, the study areas located outside of these quadrangles do not warrant further analysis (see **Table 9.3-14**). Therefore, a natural resources impact analysis related to the blue-spotted salamander or its habitat is not warranted for these study areas.

The Lucas Turnpike, Canal Road, Mossybrook Road, and Sprout Brook Road study areas have the potential for the presence of blue-spotted salamanders or their habitat. Therefore, the potential for impacts to blue-spotted salamanders and their habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below.

Impact Analysis Methodology – Blue-Spotted Salamander

ArcGIS data, often coupled with field visits, was used to determine the potential for impacts to the blue-spotted salamander from repair and rehabilitation work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Eastern Box Turtle (Terrapene carolina)

The eastern box turtle (*Terrapene carolina*) is a State Species of Special Concern. It is a terrestrial species that uses a variety of habitats, from forests with sandy, well-drained soils, to dry open uplands such as meadows, pastures, open fields, and utility right-of-ways, to moist lowlands and wetlands (Gibbs et al. 2007). They are poor swimmers and generally avoid streams and open waters. Eastern box turtles typically have small home ranges and they nest in partially open uplands with sandy loam soils. Potential habitat is present in most study areas and individuals have been observed within several study areas.

Screening Assessment

NYNHP has no records of eastern box turtle populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Cornwall, Gardiner, Mohegan Lake, Mohonk Lake, Ossining, Peekskill, Rosendale, Walden, West Point, and White Plains quadrangles as having documented eastern box turtle populations. All of the study areas are located within these quadrangles, and therefore have the potential to contain the eastern box turtle or its habitat (see **Table 9.3-14**). As the eastern box turtle uses a variety of habitats, it is difficult to determine which areas may not contain suitable habitat. Therefore, the potential for impacts to the eastern

box turtle and its habitat within all study areas were evaluated in the respective “Natural Resources” sections using the methodology described below (see **Table 9.3-14**).

Impact Analysis Methodology – Eastern Box Turtle

ArcGIS data, often coupled with field visits, was used to determine the potential for impacts to eastern box turtles from the repair and rehabilitation based on work activities and the proximity to potential habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Eastern Hognose Snake (Heterodon platyrhinos)

The eastern hognose snake (*Heterodon platyrhinos*) is a State Species of Special Concern. This species prefers open canopy woodlands, brushy fields, and high floodplains of large streams containing sandy substrates. The species also utilizes sand plains, pine (*Pinus* spp.) plantations, and pin oak (*Quercus palustris*) forests.

Screening Assessment

NYNHP has no records of eastern hognose snake populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Ossining, Peekskill, Rosendale and West Point quadrangles as having documented eastern hognose snake populations. The study areas within these quadrangles include: Mossybrook Road, Lower Knolls Road, Mountain Rest Road, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, Aqueduct Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Washington Avenue, Pleasantville Alum Plant and Willow Street study areas. The eastern hognose snake uses a variety of habitats, so it is difficult to determine which areas may not contain suitable habitat. Therefore, the potential for impacts to the eastern hognose snake and its habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to the eastern hognose snake and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Eastern Hognose Snake

ArcGIS data, coupled with field visits, was used to determine the potential for impacts from the repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Jefferson Salamander (Ambystoma jeffersonianum)

The Jefferson salamander (*Ambystoma jeffersonianum*) is a State Species of Special Concern. This species requires a mix of forested habitat and wetland to accommodate breeding. Terrestrial habitat for this species consists of mature hardwood or mixed upland forests with well-drained, rocky soils. Vernal to semi-permanent pools are preferred breeding areas, though other wetlands such as shrub swamps may be used. Breeding pools usually lack fish and must hold water into mid-summer to ensure survival of young. Additionally, because the Jefferson salamander interbreeds with the blue-spotted salamander, the hybrid population referred to as the Jefferson Salamander Complex (*Ambystoma jeffersonianum x laterale*) is also protected as a State Species of Special Concern.

Screening Assessment

NYNHP has no records of Jefferson salamander or the Jefferson Salamander Complex in the regions proximate to the study areas. The New York State Herp Atlas lists the Gardiner, Mohonk Lake, Peekskill, Rosendale and Walden quadrangles as having documented populations of these species. The study areas within these quadrangles that may have the potential to contain one or both species or their habitat include: Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Strawridge Road, Winchell Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, Aqueduct Road, Jacob Road, and Chapman Road (see **Table 9.3-14**). At some of these study areas, work would be limited to areas on top of the cut-and-cover or steel pipe siphon tunnels, existing cleared areas, or improvements to existing roads, which do not provide moist, shaded habitat conditions suitable for Jefferson salamanders or the salamander complex. In addition, a few of these study areas would affect small streams, which do not provide the isolated, ponded habitat for these species. Based on these conditions, the following study areas within these quadrangles do not have the potential for disturbance to suitable habitat for either species and a natural resources impact analysis is not warranted: Pine Bush Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Le Fevre Lane, Armato Lane, Winchell Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Aqueduct Road, Jacob Road, and Chapman Road.

Therefore, the potential for impacts to Jefferson salamander, Jefferson Salamander Complex and their habitat within the Lucas Turnpike, Canal Road, Mossybrook Road, Forest Glen Road, Strawridge Road, and Sprout Brook Road study areas were evaluated in their respective “Natural Resources” sections using the methodology described below (see **Table 9.3-14**).

Impact Analysis Methodology – Jefferson Salamander

ArcGIS data, coupled with field visits, was conducted to determine the potential for impacts to Jefferson salamanders or the salamander complex from the repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine

if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Marbled Salamander (Ambystoma opacum)

The marbled salamander (*Ambystoma opacum*) is a State Species of Special Concern. This species occurs in a variety of habitats depending on the time of year. During the spring and summer, the adults spend their time in sandy upland deciduous forests and wooded hillsides. In autumn, this species migrates to wetlands to breed. As adults, marbled salamanders are nocturnal and take refuge under logs, rocks or other cover during the day (Gibbs et al. 2007). Females will lay about 30-100 eggs in a depression on land (usually beneath a log or leaf litter) or wetlands, and eggs either hatch that year or overwinter until spring to hatch.

Screening Assessment

NYNHP has no records of marbled salamander populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Ashokan, Cornwall, Glenville, Mohegan Lake, Peekskill, Rosendale, Walden, and West Point quadrangles as having documented marbled salamander populations. The study areas located within these quadrangles that have the potential to contain the marbled salamander or its habitat include: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Vly Atwood Road, Mossybrook Road, Lower Knolls Road, Mountain Rest Road, Strawridge Road, Winchell Drive, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, and Nanny Hagen Road (see **Table 9.3-14**). At some of these study areas, work would be limited to areas on top of the cut-and-cover or steel pipe siphon tunnels or improvements to existing roads, which do not provide moist, shaded habitat conditions suitable for marbled salamanders. Other study areas would potentially affect small streams, which do not provide the isolated, ponded habitat for this species. Based on these conditions, the following study areas within these quadrangles do not have the potential for disturbance to suitable habitat and a natural resources impact analysis is not warranted: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Lower Knolls Road, Mountain Rest Road, Winchell Drive, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Aqueduct Road, Jacob Road, and Chapman Road.

Therefore, the potential for impacts to marbled salamanders and their habitat within the Vly Atwood Road, Mossybrook Road, Strawridge Road, Sprout Brook Road, and Nanny Hagen Road study areas were evaluated in their respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to marbled salamanders and their habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Marbled Salamander

ArcGIS data, often coupled with field visits, was used to determine the potential for impacts to the marbled salamander based on proposed work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits

were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Southern Leopard Frog (*Lithobates sphenoccephala utricularius*)

The southern leopard frog (*Lithobates sphenoccephala utricularius*) is a State Species of Special Concern. This species occurs in the vicinity of most freshwater habitats, but can also occur in slightly brackish tidal marshes. In summer, it disperses from water into moist vegetation. It occupies the bottoms of pools and caves when inactive. Its eggs and larvae develop in still, shallow waters.

Screening Assessment

NYNHP has no records of southern leopard frog populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Peekskill quadrant as having documented southern leopard frog populations. The Old Albany Post Road, Sprout Brook Road, and Aqueduct Road study areas are located within this quadrangle and, therefore, have the potential to contain the southern leopard frog or its habitat (see **Table 9.3-14**). At the Old Albany Post Road Study Area, work would be limited to areas on top of the cut-and-cover or steel pipe siphon tunnels or improvements to existing roads, which do not provide moist, shaded habitat conditions suitable for the southern leopard frog. In addition, work within the Aqueduct Road Study Area would affect a small stream, but this would not provide the isolated, ponded habitat for this species. Therefore, based on baseline conditions at the Old Albany Post Road and Aqueduct Road study areas, no suitable habitat was identified and, a natural resources impact analysis related to the southern leopard frog and its habitat within these study areas is not warranted.

Therefore, the potential for impacts to the southern leopard frog or its habitat within the Sprout Brook Road Study Area were evaluated in Section 9.12.5.3, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to the southern leopard frog and its habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Southern Leopard Frog

ArcGIS data, coupled with a field visit, was used to assess potential impacts from proposed repair and rehabilitation work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Spotted Turtle (*Clemmys guttata*)

The spotted turtle (*Clemmys guttata*) is a State Species of Special Concern. Spotted turtles inhabit marshy meadows, bogs, swamps, ponds, ditches, and other small bodies of still water. Individuals are usually active from March to October, with the breeding season extending from March to May. At the end of the breeding season, females leave breeding pools in search of

nesting areas that typically comprise open, sunny areas such as wetlands and wet meadows where nest cavities are dug in moist areas like sphagnum moss, sedge tussocks, or loamy soils (Gibbs et al. 2007). Habitat is present and individuals have been observed within select study areas.

Screening Assessment

NYNHP has no records of spotted turtle populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Ashokan, Gardiner, Mohegan Lake, Mohonk Lake, Ossining, Peekskill, Rosendale, Walden, and West Point quadrangles as having documented spotted turtle populations. The study areas located within these quadrangles that would have the potential to contain the spotted turtle or its habitat include: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Strawridge Road, Winchell Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Pleasantville Alum Plant, and Willow Street (see **Table 9.3-14**). At some of these study areas, work would be limited to areas on top of the cut-and-cover or steel pipe siphon tunnels or improvements to existing roads and do not have marshy meadows or ponds suitable for spotted turtles at or in close proximity. Potential habitat for this species would, therefore, not be anticipated at the following study areas that do not provide the combination of ponds and fields: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Pine Bush Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Le Fevre Lane, Armato Lane, Winchell Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Aqueduct Road, Jacob Road, Chapman Road, Station Place, Pleasantville Alum Plant, and Willow Street.

Therefore, the potential for impacts to spotted turtles and their habitat within the Vly Atwood Road, Lucas Turnpike, Canal Road, Mossybrook Road, Forest Glen Road, Strawridge Road, Sprout Brook Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Campfire Road, and Chappaqua Road study areas were evaluated in their respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to spotted turtles and their habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Spotted Turtle

ArcGIS data, coupled with field visits, was used to determine the potential for impacts to spotted turtles from repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Wood Turtle (*Glyptemys insculpta*)

The wood turtle (*Glyptemys insculpta*) is a State Species of Special Concern. Wood turtles have large home ranges and typically inhabit river-side or stream-side environments bordered by woodlands or meadows and utilize open sites with low canopy cover (Gibbs et al. 2007). Individuals bask along stream banks and hibernate in creeks. Potential habitat for this species may exist along the streams within the study areas.

Screening Assessment

NYNHP has no records of wood turtle populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Ashokan, Cornwall, Gardiner, Mohonk Lake, Peekskill, Rosendale, and West Point quadrangles as having documented wood turtle populations. The study areas located within these quadrangles that would have the potential to contain the wood turtle or its habitat include: Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, Vly Atwood Road, Pine Bush Road, Lucas Turnpike, Canal Road, Mossybrook Road, Lower Knolls Road, Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Mount Airy Road, Passaro Drive, Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, and Aqueduct Road (see **Table 9.3-14**). The wood turtle uses a variety of habitats, so it is difficult to determine which areas may not contain suitable habitat. Therefore, the potential for impacts to the wood turtle and its habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below (see **Table 9.3-14**).

Impact Analysis Methodology – Wood Turtle

ArcGIS data, often coupled with field visits, was used to determine the potential for impacts to wood turtles from proposed repair and rehabilitation work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Common Wormsnake (*Carphophis amoenus*)

The common wormsake (*Carphophis amoenus*) is a State Species of Special Concern. Habitat for this species consists of mesic, wooded, or partially wooded areas of hardwood or pine, often along edges or ecotones, such as near wetlands or margins of farm fields. Though this species is often found in hilly areas, it is sometimes in flatwoods as well. This snake is found in loose damp soil, under surface cover or leaf litter, or in rotted logs and goes deep underground during cold or dry weather. Eggs are laid under rocks, in rotting logs, stumps, or sawdust piles.

Screening Assessment

NYNHP has no records of common wormsake populations in the regions proximate to the study areas. The New York State Herp Atlas lists the Peekskill and West Point quadrangles as having

documented common wormsnake populations. The study areas located within these quadrangles and, therefore, have the potential to contain the common wormsnake or its habitat include: Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, and Aqueduct Road (see **Table 9.3-14**). The common wormsnake uses a variety of habitats, so it is difficult to determine which areas may not contain suitable habitat. Therefore, the potential for impacts to the common wormsnake and its habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to the common wormsnake and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Common Wormsnake

ArcGIS data, often coupled with field visits, was used to determine the potential for impacts to wormsnares from the repair and rehabilitation based on proposed work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

*American Bittern (*Botaurus lentiginosus*)*

The American Bittern (*Botaurus lentiginosus*) is listed as a State Species of Special Concern. These birds can be found in wetlands of different sizes and types. In winter, they move to areas where waterbodies do not freeze, especially near the coast, where they occasionally use brackish marshes. American Bitterns breed in freshwater marshes that have tall vegetation. They build their nests where thick vegetation emerges from shallow water, such as cattails, bulrushes, and sedges. Occasionally, they will nests in grasslands that have dense, tall herbaceous plants.

Screening Assessment

NYNHP has no records of American Bittern populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas identifies the American Bittern as present in Atlas block 5661B which includes the Forest Glen Road Study Area (see **Table 9.3-14**). Therefore, the potential for impacts to the American Bittern, and their habitat associated within this study area was evaluated in Section 9.7.3.6, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to the American Bittern and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – American Bittern

For the Forest Glen Road Study Area, ArcGIS data and field visits were used to determine the potential for impacts to American Bittern from the repair and rehabilitation based on the proposed work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological

community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Cerulean Warbler (*Dendroica cerulea*)

The Cerulean Warbler (*Dendroica cerulea*) is listed as a State Species of Special Concern. This species breeds in forests with tall deciduous trees and open understory, such as wet bottomlands and dry slopes. This species tends to set up its nesting territory in the closed canopy of old growth forests near stream bottoms, lakes, or rivers. The Cerulean Warbler moves south of New York to overwinter in broad-leaved, evergreen forests.

Screening Assessment

NYNHP has no records of Cerulean Warbler populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas identifies the Cerulean Warbler as present in Atlas block 5662D which includes the Mountain Rest Road and New Paltz-Minnewaska Road study areas (see **Table 9.3-14**). Because the Mountain Rest Road Study Area has no permanent disturbance, any individuals temporarily displaced by repair and rehabilitation activities are anticipated to return at the completion of construction. Therefore, the potential for impacts to the Cerulean Warbler and its habitat within the New Paltz-Minnewaska Road Study Area was evaluated in Section 9.6.4.9, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to the Cerulean Warbler and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Cerulean Warbler

For the New Paltz-Minnewaska Road Study Area, ArcGIS data and field visits were used to determine the potential for impacts to Cerulean Warblers from the repair and rehabilitation based on proposed work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Cooper's Hawk (*Accipiter cooperii*)

The Cooper's Hawk (*Accipiter cooperii*) is listed as a State Species of Special Concern. The Cooper's Hawk is closely related to the Sharp-shinned Hawk and is one of North America's most widespread and common raptors. In New York, the density and range of both breeding and overwintering Cooper's Hawks has increased markedly in recent decades. Cooper's Hawks generally nest in deciduous and mixed forests, but they are considered relatively tolerant of human disturbance and habitat fragmentation and are occasionally found nesting in small woodlots and even urban parks. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands.

Screening Assessment

NYNHP has no records of Cooper's Hawk populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas identified the Cooper's Hawk as present in Atlas blocks 5660D and 5955B which includes the Strawridge Road, Station Place, Campfire Road, Chappaqua Road, Washington Avenue, and Pleasantville Alum Plant study areas (see **Table 9.3-14**). Additionally, a Cooper's Hawk was observed during a field visit to Mossybrook Road Study Area. The Cooper's Hawk uses a variety of habitats, so it is difficult to determine which areas may not contain suitable habitat. Therefore, the potential for impacts to the Cooper's Hawk and their habitat within these study areas were evaluated in the respective "Natural Resources" sections using the methodology described below. A natural resources impact analysis related to Cooper's Hawk and its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Cooper's Hawk

ArcGIS data, coupled with a site reconnaissance, was used to determine the potential for impacts to Cooper's Hawks from repair and rehabilitation based on proposed work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in "Ecological Communities of New York State" (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Osprey (*Pandion haliaetus*)

The Osprey (*Pandion haliaetus*) is listed as a State Species of Special Concern. Ospreys prefer shallow fishing grounds, frequenting deep water only where fish school near the surface. Their habitat includes almost any expanse of shallow, fish-filled waters, including rivers, lakes, reservoirs, lagoons, swamps, and marshes. Ospreys only nest in locations that can provide access to fish within a 12-mile radius of their nesting site. Ospreys choose open and elevated nest sites which have a long enough ice-free season to allow the young to fledge.

Screening Assessment

NYNHP has no records of Osprey populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas has the Osprey documented as present in Atlas block 5956D which includes the Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Nanny Hagen Road, Pleasantville Alum Plant, and Willow Street study areas (see **Table 9.3-14**). At several of these study areas, work would be limited to areas on top of cut-and-cover tunnels or improvements to existing developed land. Additionally, these are study areas that have no open water suitable for Ospreys and no proposed disturbance to trees. Based on these conditions, the Pleasantville Alum Plant, and Willow Street study areas do not have the potential for disturbance to suitable habitat and a natural resources impact analysis related to Ospreys or their habitat is not warranted.

Therefore, the potential for impacts to Ospreys and their habitat within the Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, and Nanny Hagen Road study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to Osprey or their habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Osprey

ArcGIS data, coupled with field visits, was used to determine the potential for impacts to Osprey from the repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Red-headed Woodpecker (Melanerpes erythrocephalus)

The Red-headed Woodpecker (*Melanerpes erythrocephalus*) is listed as a State Species of Special Concern. This species inhabits deciduous woodlands with oak or beech, groves of dead or dying trees, river bottoms, burned areas, areas of recent clearing, beaver swamps, orchards, parks, farmland, grasslands with scattered trees, forest edges, and roadsides.

Screening Assessment

NYNHP has no records of Red-headed Woodpecker populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas identifies the Red-headed Woodpecker within Atlas block 5661B which includes the Forest Glen Road Study Area (see **Table 9.3-14**). Therefore, the potential for impacts to the Red-headed Woodpecker and its habitat within this study area was evaluated in the Section 9.7.3.6, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to the Red-headed Woodpecker or its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Red-headed Woodpecker

For the Forest Glen Road Study Area, ArcGIS data coupled with field visits were used to determine the potential for impacts to Red-headed Woodpeckers from the repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Red-shouldered Hawk (Buteo lineatus)

The Red-shouldered Hawk (*Buteo lineatus*) is listed as a State Species of Special Concern. Red-shouldered Hawks favor large tracts of mature deciduous and mixed forest in riparian areas

or flooded swamps/wetlands (Dykstra et al. 2000). This species occasionally nests in suburban areas where forest cover is less contiguous. Migration and wintering habitats are similar to breeding habitat, although non-breeding birds occur more frequently in fragmented landscapes and open areas than when nesting (Dykstra et al. 2000).

Screening Assessment

NYNHP has no records of Red-shouldered Hawk populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas identifies the Red-shouldered Hawk as present in Atlas block 5661B which includes the Forest Glen Road Study Area (see **Table 9.3-14**). Therefore, the potential for impacts to the Red-shouldered Hawk and its habitat within this study area was evaluated in Section 9.7.3.6, “Natural Resources,” using the methodology described below. A natural resources impact analysis related to the Red-shouldered Hawk or its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Red-shouldered Hawk

For the Forest Glen Road Study Area, ArcGIS data coupled with field visits was used to determine the potential for impacts to the Red-shouldered Hawk from the repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Sharp-shinned Hawk (Accipiter striatus)

The Sharp-shinned Hawk (*Accipiter striatus*) is a State Species of Special Concern. It is a small, migratory hawk that is common and widely distributed across North America. Sharp-shinned Hawks breed in deep forests. During the non-breeding season, they hunt small birds and mammals along forest edges.

Screening Assessment

NYNHP has no records of Sharp-shinned Hawk populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas identifies the Sharp-shinned Hawk within Atlas blocks 5661B, 5661D, 5662D, 5955D, and 5956D which includes the following study areas: Mountain Rest Road, New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, Armato Lane, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Nanny Hagen Road, Pleasantville Alum Plant, and Willow Street (see **Table 9.3-14**). As the Sharp-shinned Hawk uses a variety of habitats, it is difficult to determine which areas may not contain suitable habitat. However, the Mountain Rest Road and Armato Lane study areas are existing cleared areas that would be temporarily used for construction staging and would not require any permanent improvements. A natural resources impact analysis related to the Sharp-shinned Hawk and its habitat within these study areas is not warranted.

Therefore, the potential for impacts to the Sharp-shinned Hawk or its habitat within the New Paltz-Minnewaska Road, Forest Glen Road, Le Fevre Lane, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Nanny Hagen Road, Pleasantville Alum Plant, and Willow Street study areas were evaluated in their respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to Sharp-shinned Hawk and its habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Sharp-shinned Hawk

ArcGIS data coupled with field visits were used to determine the potential for impacts to the Sharp-shinned Hawk from the repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

*Whip-poor-will (*Antrostomus vociferus*)*

The Whip-poor-will (*Antrostomus vociferus*) is listed as a State Species of Special Concern. The Whip-poor-will breeds in dry, deciduous or mixed forests that have sparse underbrush. This species forages in open areas. The Whip-poor-will is a locally common breeder in parts of New York that are not heavily forested and is usually found in upland habitat that consists of primarily deciduous and mixed forest adjacent to large clearings.

Screening Assessment

NYNHP has no records of Whip-poor-will populations in the regions proximate to the study areas. The 2000 to 2005 State Breeding Bird Atlas identifies the Whip-poor-will as present in Atlas blocks 5661B and 5664C which includes the Ashokan Screen Chamber, Beaverkill Road, Atwood-Olivebridge Road, and Forest Glen Road study areas (see **Table 9.3-14**). The Whip-poor-will uses a variety of habitats, and it is difficult to determine which areas may not contain suitable habitat. As a result, the potential for impacts to the Whip-poor-will and its habitat within these study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to the Whip-poor-will and its habitat for the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – Whip-poor-will

ArcGIS data, often coupled with field visits, was used to determine the potential for impacts to the Whip-poor-will from the repair and rehabilitation based on work activities and proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

New England Cottontail (*Sylvilagus transitionalis*)

The New England cottontail (*Sylvilagus transitionalis*) is a State Species of Special Concern in the State. This species is only found east of the Hudson River (Litvaitis et al. 2006).

The New England cottontail requires dense scrub-shrub habitat consisting of stems 3 inches or less in diameter and 20 inches or more in height, with a stem density of 20,000 or more per acre (Arbuthnot 2008). The New England cottontail closely resembles the eastern cottontail (*Sylvilagus floridanus*), and identification between the two is impossible without analyzing genetic samples or examining morphological features of the skull (Arbuthnot 2008).

Screening Assessment

Since the New England cottontail is only found east of the Hudson River, only the following study areas located in Putnam and Westchester County may have suitable habitat: Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Chapman Road, Croton Dam Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, Nanny Hagen Road, Westlake Drive, Washington Avenue, Pleasantville Alum Plant, and Willow Street.

Based on a desktop review, the Chapman Road, Croton Dam Road, Nanny Hagen Road, Westlake Drive, Pleasantville Alum Plant and Willow Street study areas are either predominantly forested or located in developed areas and are unlikely to contain the successional, thicket habitat preferred by the New England cottontail. Based on these conditions, these study areas do not have the potential for disturbance to suitable habitat and a natural resources impact analysis related to the New England cottontail or its habitat is not warranted.

Therefore, the potential for impacts to the New England cottontail and its habitat within the Gatehouse Road, Fishkill Road, Indian Brook Road, Old Albany Post Road, Sprout Brook Road, Aqueduct Road, Jacob Road, Kitchawan Road, Somerstown Turnpike, Station Place, Campfire Road, Chappaqua Road, and Washington Avenue study areas were evaluated in the respective “Natural Resources” sections using the methodology described below. A natural resources impact analysis related to the New England cottontail or its habitat within the remaining study areas is not warranted (see **Table 9.3-14**).

Impact Analysis Methodology – New England Cottontail

ArcGIS data was used to determine the potential for impacts to the New England cottontail from the repair and rehabilitation based on the proposed work activities and the proximity to suitable habitat. Visual inspections of the study areas were conducted and habitat was identified using ecological community descriptors listed in “Ecological Communities of New York State” (Edinger et al. 2014). These ecological community descriptions and information obtained during field visits were reviewed to determine if suitable habitat for the species was present within the work sites. Conservation measures were identified to protect the species when applicable.

Unlisted Rare or Vulnerable Species

Arrowhead Spiketail (*Cordulegaster obliqua*)

The arrowhead spiketail (*Cordulegaster obliqua*) is a dragonfly species that is unlisted and considered rare or vulnerable in New York. This species spends most of its time at small, spring-fed streams, and seeps with soft bottoms and sometimes rocks. It is usually found in forested areas, sometimes with small areas of more open habitat types like meadows with ferns. The species is sensitive to changes in natural hydrology and increased sediment load to streams.

Screening Assessment

NYNHP identified this species only within the Atwood-Olivebridge Road Study Area (see **Table 9.3-14**). Based on the NYNHP record, the dragonfly sighting was in a mid-reach stream with pools, impoundments, backwaters, and shrub swamps. This study area contains a mid-reach stream, Tongore Creek, with forested habitat along its corridor, which may be suitable habitat for this species. Erosion and sediment control measures would be installed prior to the start of construction and maintained in accordance with State and local requirements to prevent the transport of sediment to Tongore Creek. In-stream activities including a temporary stream diversion along one streambank and discharges of raw aqueduct water and treated wash waters would occur during construction. However, construction would be short-term lasting for less than 24 weeks over the course of 3 years. Minor mortality could result from desiccation of sessile invertebrates during the temporary diversion, but the population as a whole would not be adversely affected, as it would be expected to fully recover by the following spring. Streambank restoration and protection measures would prevent scour during tunnel unwatering and installation of new blow-off valves would be used to reduce in-stream velocities and minimize turbidity. Additionally, these discharges would take place during fall, when in-stream larvae would not be affected. The adult arrowhead spiketail could avoid the immediate work area affected, utilizing similar habitat in the vicinity of the study area. Therefore, a natural resources impact analysis related to arrowhead spiketail or its habitat within the study areas is not warranted and no take is anticipated (see **Table 9.3-14**).

Conclusion for State Listed Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

State listed species were identified as having the potential to occur within the study areas. The potential for impacts to State Threatened and Endangered Species, and State Species of Special Concern within the study areas were evaluated in the respective “Natural Resources” sections.

9.3.10 HAZARDOUS MATERIALS

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes in exposure to hazardous materials from activities at the work sites that could increase pathways to human or environmental exposure to hazardous materials within the surrounding study areas. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on, or directly adjacent to, built resources. Work activities include biofilm removal and condition assessment, certain

mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements or altering existing structures. Entry points into the aqueduct are routinely used by DEP staff and contractors, and the act of entering and exiting the aqueduct to perform these interior repairs would not increase pathways to human or environmental exposure. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. Therefore, with the exception of wash water treatment, sites limited to these work activities would have minimal risk of increased exposure and did not warrant further review.

9.3.10.1 Screening Assessment

The repair and rehabilitation would include construction and/or demolition activities where grading would occur for access and staging areas, and where new boatholes, vents, local dechlorination systems, streambank restoration, and protection and support structures would be installed. Additionally, the chlorination facility at Ashokan Screen Chamber and dechlorination facility at Pleasantville Alum Plant would require ground disturbance during construction and chemical use would be needed during temporary chlorination. Therefore, ground disturbance and/or temporary storage or use of hazardous materials would occur within each of the study areas. To disclose the presence or potential disturbance of hazardous materials associated with the repair and rehabilitation, the potential for impacts related to hazardous materials were evaluated in the respective “Hazardous Materials” sections for each study area using the methodology described below.

9.3.10.2 Impact Analysis Methodology

The impact analysis consisted of: (1) establishing and describing baseline conditions and future conditions without the repair and rehabilitation by preparing a Phase I ESA in general conformance with the most recent American Society for Testing and Materials (ASTM) E1527-13 standard to identify Recognized Environmental Conditions within the study areas. A Phase II Environmental Site Assessment (ESA), if appropriate, in accordance with the ASTM E1903-11 standard was recommended, including physical sampling of media (e.g., soil, groundwater, and soil gas) on a proposed site of concern identified in a Phase I ESA. If contamination above the prevailing regulatory compliance limits was identified, appropriate corrective actions would be completed in accordance with federal, State and local regulations and guidelines. The results of contaminants of concern, if identified, were compared with New York Department of Environmental Conservation (NYSDEC) Subpart 375-6 Soil Cleanup Objectives for Unrestricted Use and Restricted Use Protection of Groundwater which is the most stringent soil cleanup objectives; (2) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (3) analyzing the potential for impacts from the construction and/or demolition and operation of the repair and rehabilitation to result in changes in exposure to hazardous materials within the study areas.

Recognized Environmental Conditions as defined in the ASTM Standard Practice E1527-13 include the following:

The presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to any release to the environment; (2) under

conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment. De minimis conditions are not recognized environmental conditions (refer to definition below).

De minimis conditions: A condition that generally does not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be de minimis conditions are not recognized environmental conditions nor controlled recognized environmental conditions.

The potential for hazardous material impacts was analyzed using the following environmental databases to prepare the Phase I ESA, in general conformance with ASTM E1527-13 guidelines:

- Federal Databases and Records
 - The National Priority List (NPL) database
 - NPL LIENS: Federal Superfund Liens
 - Delisted National Priority List (NPL) database
 - The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) database
 - The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) - No Further Remedial Action Planned (NFRAP) database
 - The Resource Conservation and Recovery Act Corrective Action Sites (RCRA-CORRACTS)
 - The Resource Conservation and Recovery Act Information System (RCRIS) - Treatment, Storage and Disposal (TSD) database
 - The Resource Conservation and Recovery Act Generator (RCRAGN) database
 - The Resource Conservation and Recovery Act Non-Generator/No Longer Regulated (RCRA NonGen/NLR) database
 - Engineering and Institutional Controls (EC/IC) Registries (Federal and State Lists)
 - The Emergency Response Notification System (ERNS)
 - The Facility Index System/Facility Registry System (FINDS) database
 - 2020 CORRACTION: 2020 Corrective Action Program List database
 - United States Financial Assurance Information (US FIN ASSUR)
 - United State Environmental Protection Agency (EPA) Record of Decision (ROD) database
 - Superfund (CERCLA) Consent Decrees database
 - Potentially Responsible Parties (PRP) database

- New York State Databases and Records
 - State hazardous Waste Site (SHWS)/Hazardous Substance Waste Disposal Sites (HSWDS) databases
 - Inactive Hazardous Waste Disposal Sites (IHWDS) database
 - Solid Waste Facilities/Landfills (SWF/LF) Sites database
 - The Leaking Underground Storage Tank (LUST/LTANKS) database
 - The SPILLS database
 - The Underground Storage Tank (UST) and Aboveground Storage Tank (AST)/Petroleum Bulk Storage databases
 - Chemical Bulk Storage (CSB) – (AST/UST) databases
 - Manifest Data Lists
 - Manifest Data Lists
- Engineering and Institutional Controls (EC/IC) Registries (Federal and State Lists)
 - Voluntary Cleanup Program (VCP) database
 - Brownfields Sites database
- Environmental Data Resources (EDR) Proprietary Records
 - Manufactured Gas Plants (MGP)
 - Drycleaners and Historic Cleaners databases, and
 - Historic Auto Stations

9.3.11 WATER AND SEWER INFRASTRUCTURE

This section presents the screening assessment, and analyzes the potential for the repair and rehabilitation to result in changes to conveyance and demand for water supply infrastructure, sewer infrastructure, discharges associated with the repair and rehabilitation, and whether these changes affect stormwater management on a project-wide basis and within individual study areas, as described below.

Work sites located outside the study areas include activities such as biofilm removal and condition assessment, certain mechanical repairs, or short-term (i.e., less than 2 weeks) use of existing DEP facilities. These activities would not affect demand for water or the water distribution system. Biofilm removal and repairs to the aqueduct would not generate wastewater discharges. Residual water in the aqueduct and any construction water generated by the work activities would be managed and routed through treatment systems, as required, and discharged to locations that are analyzed as part of the impact analysis. Therefore, with the exception of wash water treatment, sites limited to these work activities would have no potential for significant adverse impacts to water and sewer infrastructure or stormwater management and did not warrant further review.

The components of water and sewer infrastructure that warrant an impact analysis are identified in **Table 9.3-15**. These study areas would result in either construction or operational changes affecting water supply, wastewater discharges, and stormwater management. Sewer infrastructure would not be utilized for wastewater discharges, so there would be no effect on local wastewater capacity. Construction within the study areas could affect water and sewer infrastructure including site preparation activities (e.g., soil disturbance, additional impervious surface), infrastructure upgrades associated with constructing the chlorination and dechlorination facilities, and discharge of aqueduct water and treated wash waters.

This section also presents the screening assessment of the potential increased demand on infrastructure. This demand would be associated with construction crews using DEP facilities along the aqueduct and temporary changes in water supply associated with the 10-week shutdowns of the Catskill Aqueduct during construction. Activities within the study areas that could affect water and sewer infrastructure during temporary chlorination include: operation of the upgraded facilities associated with chlorination at Ashokan Screen Chamber and dechlorination at Pleasantville Alum Plant; operation of local dechlorination facilities at several leaks; and discharge of dechlorinated waters. Outside community connections that rely on aqueduct water either as a primary or back-up water source may require modifications to their current water treatment facilities to ensure they can receive and manage chlorinated aqueduct water. The temporary addition of sodium hypochlorite or chlorine dioxide during chlorination could result in changes to water characteristics for the approximately 20 communities who rely on the Catskill Aqueduct for water supply purposes. Additionally, chlorinated leak water could influence groundwater wells at some locations and, therefore, affect water supply infrastructure.

9.3.11.1 Water Supply

The repair and rehabilitation, which includes construction, temporary chlorination, and operation, has the potential to result in changes to water supply. This section outlines the methodology used to assess these changes within the study areas as well as on a project-wide basis.

Screening Assessment

Applicable regulatory requirements and/or guidelines from the following State and local agencies were considered in determining potential impacts related to water supply:

- New York State Department of Health;
- Ulster County Department of Health;
- Orange County Department of Health;
- Putnam County Department of Health; and
- Westchester County Department of Health.

The screening assessment considered construction, temporary chlorination, and operation.

Table 9.3-15: Water and Sewer Infrastructure within Repair and Rehabilitation Study Areas

Town/Village	Study Area	Water Supply ¹	Discharges ²	Stormwater
Town of Olive	Ashokan Screen Chamber	✓	▲	✓
	Beaverkill Road	-	▲	-
	Atwood-Olivebridge Road	-	▲	-
Town of Marbletown	Vly Atwood Road	-	▲	-
	Pine Bush Road	-	▲	-
	Lucas Turnpike	✓	▲	-
	Canal Road	-	▲	-
	Mossybrook Road	✓	▲	-
	Lower Knolls Road	-	-	-
Town of New Paltz	Mountain Rest Road	-	▲	-
	New Paltz-Minnewaska Road	-	▲	-
Town of Gardiner	Forest Glen Road	-	▲	-
	Le Fevre Lane	-	-	-
	Armato Lane	-	▲	-
Town of Shawangunk	Strawridge Road	-	▲	-
Town of Montgomery	Winchell Drive	-	▲	-
Town of New Windsor	Mount Airy Road	-	▲	-
	Passaro Drive	-	▲	-
Village of Nelsonville	Gatehouse Road	-	▲	-
	Fishkill Road	-	▲	-
Town of Philipstown	Indian Brook Road	-	▲	-
	Old Albany Post Road	-	▲	-
	Sprout Brook Road	-	▲	-
Town of Cortlandt	Aqueduct Road	-	▲	-
Town of Yorktown	Jacob Road	-	▲	-
	Chapman Road	-	▲	-
	Croton Dam Road	-	▲	-
	Kitchawan Road	-	▲	-
Town of New Castle	Somerstown Turnpike	-	▲	-
	Station Place	-	▲	-
	Campfire Road	-	▲	-
Town of Mount Pleasant	Chappaqua Road	-	▲	-
	Nanny Hagen Road	-	▲	-
	Westlake Drive	-	-	-
Village of Pleasantville	Washington Avenue	-	▲	-
	Pleasantville Alum Plant	✓	▲	✓
	Willow Street	-	▲	-

Notes:

- = Screens out. Does not warrant an impact analysis.

✓ = Impact analysis conducted for the study area.

▲ = Impact analysis conducted on a project-wide basis.

¹ Water supply was analyzed on a project-wide basis for the City Distribution System and Outside Community Connections in Section 9.18, "Project-wide Impact Analysis."

² Discharges include treated water associated with dechlorination, biofilm wash water, and construction wastewaters, as well as release of raw aqueduct water during the repair and rehabilitation.

Construction

Construction activities that have the potential to result in changes to water supply within the study areas include: crews temporarily using facilities along the aqueduct; 10-week shutdowns of the aqueduct; repairs to components of the aqueduct (e.g., blow-off chambers) requiring lower operating flows; and construction of chlorination and dechlorination facilities at Ashokan Screen Chamber and Pleasantville Alum Plant study areas.

Construction and upgrading facilities associated with chlorination at Ashokan Screen Chamber and dechlorination at Pleasantville Alum Plant have the potential to alter water supply infrastructure. Therefore, the potential for impacts to the water supply infrastructure in the Ashokan Screen Chamber and Pleasantville Alum Plant study areas were evaluated in the respective “Water and Sewer Infrastructure” sections using the methodology described below.

Construction of the chlorination and dechlorination facilities would require crews of up to 15 personnel at the Ashokan Screen Chamber and Pleasantville Alum Plant study areas for the duration of construction. Additionally, Ashokan Screen Chamber, Armato Lane, Chapman Road, and Nanny Hagen Road study areas are primary staging areas that would support between 15 and 75 workers each. It is anticipated these locations would reach maximum capacity during intense periods of construction (i.e., during the 10-week shutdowns). However, primary staging areas would be used as gathering points where the majority of workers would be on site at the start and end of their shifts, resulting in a minimal period of increased demand on the local water supply each day that would generally coincide with the 10-week shutdowns. At locations where water is not currently available, employees would be provided with potable water through a portable system. Since there is minimal potential for increased demand on local water supply or infrastructure beyond construction, no further assessment is warranted.

Internal leak repairs and mechanical and structural repairs to the Catskill Aqueduct would be in-kind repairs or upgrades that would not change the form or function of water supply conveyance and do not warrant further assessment.

Temporary shutdowns of the Catskill Aqueduct to implement the repair and rehabilitation would have a short-term effect on the 15 Outside Community Connections that receive water supply from the upper Catskill Aqueduct, which serve approximately 20 communities. As discussed in Section 9.2, “Project Description,” DEP has developed an ongoing program to work with these outside communities, including reviewing the availability of back-up water supplies and analyzing the ability of these users to accommodate reduced or limited access to the Catskill Aqueduct during the 10-week shutdowns, as appropriate. DEP would work with all water suppliers who receive water from the Catskill System to implement measures aimed at monitoring and minimizing any potential changes to water supply characteristics as a result of temporary chlorination. The temporary, 10-week shutdowns of the Catskill Aqueduct would be coordinated to minimize effects to these users and further assessment is not warranted.

Temporary Chlorination

The Outside Community Connections, as well as Kensico Reservoir, could temporarily be provided with raw water that differs in characteristics than the water historically supplied.

Therefore, the potential for impacts to Outside Community Connections and in-City customers resulting from chlorination at Ashokan Screen Chamber warranted further analysis on a project-wide basis as described in Section 9.18, “Project-wide Impact Analysis.”

Additionally, leaks in the aqueduct would be repaired or dechlorinated. As described in Section 9.3.9, “Natural Resources,” deeper groundwater resources utilized as the source of water for private drinking water supply wells would not be disturbed by temporary chlorination occurring near the ground surface. For example, Vly Atwood Road and Croton Dam Road study areas contain toe-of-slope leaks that are shallow and remain near the ground surface. Thus, chlorinated water flowing from toe-of-slope leaks would be treated by local dechlorination facilities without affecting deeper groundwater resources. The other leaks are either scheduled to be repaired and/or are contained in the aqueduct’s existing infrastructure and there would be no interaction with groundwater resources. Exceptions to this are the Lucas Turnpike (Leaks 3A, 3B, 4, and a Private Well) and Mossybrook Road (Shaft 7 Leak) study areas. Private drinking water supply wells within the Lucas Turnpike and Mossybrook Road study areas may be influenced by the Rondout Pressure Tunnel that is approximately 500 feet below the ground surface in these areas. Since the private drinking water supply wells may be influenced by the leaks, these wells have the potential to exhibit water quality changes due to the repair and rehabilitation. Therefore, potential impacts to private drinking water supply wells in Lucas Turnpike and Mossybrook Road study areas were evaluated in the respective “Water and Sewer Infrastructure” sections using the methodology described below.

Operation

Operation following the repair and rehabilitation would not change the demand for water supply. The repair and rehabilitation would restore the aqueduct’s capacity closer to its historical maximum by removing biofilm from the interior aqueduct surface and chlorinating the aqueduct to limit the regrowth of biofilm. New air vent structures would also be installed at key points along the aqueduct to improve water flow. This would be a beneficial effect of the repair and rehabilitation and does not warrant an impact analysis.

Impact Analysis Methodology

The water supply impact analysis within the study areas consisted of: (1) evaluating changes to water supply infrastructure for the Ashokan Screen Chamber and Pleasantville Alum Plant study areas; and (2) analyzing potential impacts to private drinking water supply wells in Lucas Turnpike and Mossybrook Road study areas. The following outlines the methodologies used for each analysis.

The potential impacts to water supply infrastructure of Outside Community Connections and in-City customers from chlorinating Catskill Aqueduct waters were evaluated on a project-wide basis. A detailed methodology precedes the analysis in Section 9.18, “Project-wide Impact Analysis.”

Changes to Water Supply Infrastructure at Ashokan Screen Chamber and Pleasantville Alum Plant

The impact analysis for the Ashokan Screen Chamber and Pleasantville Alum Plant study areas consisted of: (1) establishing and describing water supply systems; (2) establishing future conditions without the repair and rehabilitation by identifying potential water supply demands that are anticipated by the analysis year; (3) establishing future conditions of the water supply with the repair and rehabilitation; and (4) analyzing the potential for impacts to the water infrastructure by evaluating whether the repair and rehabilitation would potentially affect the supply of water available from the Catskill Aqueduct.

Potential Impacts to Private Drinking Water Supply Wells

The study area for the well inventory was defined to determine whether impacts could occur to infrastructure at the nearest drinking water wells within the Lucas Turnpike and Mossybrook Road study areas. In particular, as described in Section 9.3.17, “Public Health,” an analytical solution was used to estimate the farthest travel distance that sodium hypochlorite or chlorine dioxide (the two oxidants that would be used to chlorinate aqueduct waters) could emanate from the leaks. It should be noted that the maximum doses for both oxidants would be below their respective drinking water maximum contaminant level or maximum residual disinfection level. The maximum travel distance (the point at which the oxidant would become non-detectable) was used as the boundary for the well inventory. Outside of this boundary, the analytical solution indicates that sodium hypochlorite or chlorine dioxide would not be detected and would have no potential effect on infrastructure.

Parcels that contain potential wells within the well inventory boundary were identified by reviewing the well inventory in the “Aquifer Protection Study – Town of Marbletown” from 2005 that provides a summary of the existing well information (types, depths, yield, and driller) in the Town. This information was augmented using ArcGIS aerial imagery and Town tax billing information to identify parcels with existing structures that were assumed to have existing groundwater supply wells on the property. It was assumed the existing groundwater supply wells would be in close proximity to each structure.

In addition, potential well locations on currently vacant parcels included in the Well Inventory Study Area were used to estimate the number of wells that could exist in the future. Vacant parcels with a road frontage were also included in the Well Inventory Study Area. Parcels without a road frontage were not included in the Well Inventory Study Area as it is less likely for development to occur since road frontage would be required.

The well inventory was then used to assess the potential changes to the reliability of the water infrastructure to continue to provide drinking water from the bedrock aquifer. The potential for impacts of the contribution of the leaks to water supply is evaluated in Section 9.5.5.11, “Water and Sewer Infrastructure,” for the Lucas Turnpike Study Area, and Section 9.5.7.8, “Water and Sewer Infrastructure,” for the Mossybrook Road Study Area. The potential for changes in the groundwater quality at the nearest drinking water well within the Lucas Turnpike and Mossybrook Road study areas due to chlorination in the leak water is also discussed in Section 9.5.5.15, “Public Health,” and Section 9.5.7.12, “Public Health,” respectively.

9.3.11.2 Wastewater

This section assesses new or different discharges resulting from the repair and rehabilitation within the study areas during construction, temporary chlorination, and operation. The following section outlines the methodology used to assess these discharges on a project-wide basis. These discharges may be regulated through a SPDES permit issued by NYSDEC to ensure that water quality in the receiving waterbody is not adversely affected by the discharges.

Screening Assessment

The following regulations and guidelines were considered in assessing potential discharge requirements:

- NYSDEC Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations;
- NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1; Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations; and
- State Pollutant Discharge Elimination System (SPDES) Program, Water Pollution Control Act (Environmental Conservation Law Article 17; 6 NYCRR Article 3).

The screening assessment considered construction, temporary chlorination, and operation, described below.

Construction

Similar to the water supply screening assessment, there would be a minimal period of increased demand on the local wastewater system each day that would generally occur during the 10-week shutdowns. At locations where water is not currently available, temporary sanitary facilities would be installed on site. Sanitary wastewater generated at these locations would be trucked and disposed at permitted off-site facilities. Since there is minimal potential for increased demand on local sewer capacity or infrastructure beyond construction, no further assessment is warranted.

Discharge of treated biofilm wash water would occur during construction. Wash water treatment systems would be established to treat biofilm wash waters prior to being reused in the biofilm removal, returned to the aqueduct, or discharged into nearby surface water. Further assessment of discharges is warranted. Additionally, repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to wastewater discussed in Section 9.3.3.3, “Town Codes” and discussed further in applicable study areas.

Temporary Chlorination

Dechlorinated water would be discharged at leaks, select Outside Community Connections, and Kensico Reservoir during temporary chlorination of the Catskill Aqueduct from 2019 through 2023. Further assessment of this discharge is warranted.

Operation

Steel pipe siphons and select culvert drain sluice gates have been identified as locations for discharging raw aqueduct water while unwatering the tunnel during construction and future maintenance. Unwatering events would also occur at any time following construction and therefore are described in “Operation.” These discharges would be part of each shutdown and would be conducted in a manner that is consistent with the intended use of the blow-off chambers and culvert drain sluice gates. Because these locations are not currently used in this manner, further assessment is warranted. In contrast, no further assessment is warranted for locations that are currently used for unwatering the aqueduct, such as Catskill Influent Chamber and Catskill Kensico Bypass Blow-off Chambers, because discharging at these locations would be consistent with baseline conditions.

Operation following the repair and rehabilitation would not change the demand or capacity on wastewater infrastructure. It is anticipated that wastewater infrastructure would continue to operate as it does under current conditions and no further assessment is warranted.

Therefore, discharges of treated biofilm wash water during construction, dechlorinated water during temporary chlorination, and unwatering the Catskill Aqueduct during long-term operation were evaluated on a project-wide basis for study areas identified in **Table 9.3-15** using the methodology described below. With the exception of work activities at these study areas, an analysis of impacts to wastewater infrastructure related to the repair and rehabilitation is not warranted based on the above review.

Impact Analysis Methodology

The wastewater analysis addresses potential effects to surface water quality as a result of these discharges. To fully assess the potential for changes to the wastewater infrastructure as a result of repair and rehabilitation, analyses were conducted on a project-wide basis.

The project-wide impact analysis for wastewater infrastructure consisted of: (1) establishing and describing the baseline conditions by determining existing wastewater infrastructure and resources potentially affected by discharges; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would either alter existing infrastructure or result in new wastewater discharges that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities; (4) analyzing the potential for impacts from the repair and rehabilitation on wastewater infrastructure or receiving waters by qualitatively assessing the effect on water quality criteria; and (5) assessing the potential to impact streams during discharge events by comparing estimated discharge rates to full bank flow and storm event flows of the receiving stream. Stormwater

The stormwater analysis assesses potential changes to stormwater quantity, quality and its management within the study areas during construction, temporary chlorination, and operation of the repair and rehabilitation. During construction, stormwater may be affected by changes in impervious surface resulting from the chlorination and dechlorination facilities, the addition of new gravel access roads, and excavation and grading that would occur as part of construction

along the aqueduct. There would be no change to stormwater during temporary chlorination or as part of operating the Catskill Aqueduct.

Screening Assessment

At each study area, stormwater would be managed on site by installing and maintaining erosion and sediment control practices, such as silt fencing and hay bales, and turbidity barriers, throughout construction. The following State and local regulations and guidelines were considered in determining stormwater management requirements:

- SPDES General Permit for Discharges from Construction Activity;
- NYSDEC's New York State Stormwater Management Design Manual;
- NYSDEC's New York State Standards and Specifications for Erosion and Sediment Control;
- DEP Watershed Rules and Regulations;
- Municipal Separate Storm Sewer System (MS4) requirements; and
- Relevant town codes related to stormwater management (see Section 9.3.3.3, "Town Codes").

The repair and rehabilitation would generally result in few increases to existing impervious surface. Boathole installation would result in permanent increases of up to approximately 30 square feet of impermeable surfaces, and construction of new access roads would result in additional impervious surface. In many cases, the area of disturbance during construction at each study area would be less than one acre, and would exceed this threshold only when study areas were assessed cumulatively. To address the cumulative effects of constructing the repair and rehabilitation, one SWPPP would be prepared for the repair and rehabilitation that would be inclusive of all work sites and would identify any required stormwater Best Management Practices necessary to manage stormwater runoff and limit impacts. Potential post-construction stormwater controls that would be considered include detention or retention basins, dry or wet swales, and bioretention basins, depending on site characteristics.

The repair and rehabilitation sites are generally rural or low-density suburban residential areas with large areas of vegetated pervious surface where naturally occurring stormwater infiltration takes place. Following construction, any minor increases in impervious surface would not overburden existing infrastructure or result in significant changes to stormwater runoff. Construction at the Ashokan Screen Chamber and Pleasantville Alum Plant study areas would add impervious surface and require Best Management Practices to manage and treat stormwater generated during construction and operation. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to stormwater management, discussed in Section 9.3.3.3, "Town Codes," and discussed further in applicable study areas. Therefore, stormwater was evaluated in the respective "Water and Sewer Infrastructure" sections for only these two study areas using the methodology described below.

A stormwater impact analysis is not warranted for the remaining repair and rehabilitation study areas.

Impact Analysis Methodology

Stormwater infrastructure was analyzed at the Ashokan Screen Chamber and Pleasantville Alum Plant study areas and the impact analysis consisted of: (1) establishing and describing the baseline conditions within these study areas by determining existing impervious surface and stormwater infrastructure; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would either alter existing infrastructure or result in new impervious surface by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed work activities within the study area; and (4) analyzing the potential for impacts from the repair and rehabilitation on stormwater infrastructure by qualitatively assessing the effect of site improvements and additional impervious surface.

9.3.12 ENERGY

This section presents the screening assessment for the potential for the repair and rehabilitation to result in changes to energy supply or demand from activities at the work sites that could generate energy demands within the surrounding study areas.

9.3.12.1 Screening Assessment

Construction associated with the repair and rehabilitation work activities would be short-term in nature. To support construction, most of the energy would be derived from fossil fuels to operate construction equipment, as well as for vehicle use on site and vehicles traveling to and from the work sites. Once construction is completed, the construction equipment and vehicles would be removed from the work sites and construction staging areas would be restored to baseline conditions. Leaks would be repaired for most study areas prior to temporary chlorination of the Catskill Aqueduct. However, where repair is ultimately not feasible, local dechlorination systems would be operated during temporary chlorination. The local dechlorination systems would be operated only during the period when the Catskill Aqueduct is chlorinated. These systems would primarily be passive and would not require electricity. However, the chemical injection dechlorination systems for Leak 5 within the Canal Road Study Area and for the New Paltz and Newburgh Connection Chambers within the Mountain Rest Road and Mount Airy Road study areas, respectively, would require minor amounts of electricity. Following construction and temporary chlorination activities, the local dechlorination systems would no longer be operated, and operation of the Catskill Aqueduct would be consistent with baseline conditions.

As a result, the energy demand required by the repair and rehabilitation could be met without significant impact to the power requirements of the surrounding community and without significant need for additional power generation capacity from the national power grid. Although the chlorination and dechlorination facilities represent new systems that would be constructed at existing DEP facilities and would increase energy demands during construction and temporary chlorination periods, as with the other repair and rehabilitation activities, these facilities would no longer be required and would no longer be operated once the RWBT tunnel bypass is completed. Thus, increased energy demand in the Ashokan Screen Chamber and Pleasantville

Alum Plant study areas would be temporary. While operation of the liquid alum system at Pleasantville Alum Plant would cease as part of Water for the Future at this time (i.e., DEP would no longer need to add liquid alum to support the RWBT temporary shutdown or the 10-week Catskill Aqueduct shutdowns), alum addition at the Plant may continue, as needed, to control episodic turbidity events. Energy demands during operation of the Catskill Aqueduct following the RWBT completion would be consistent with baseline conditions at these facilities. Therefore, an energy impact analysis within the study areas is not warranted.

9.3.13 TRANSPORTATION

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to transportation from activities at the work sites that could alter traffic flow, volume, or parking within the surrounding study areas.

9.3.13.1 Screening Assessment

The repair and rehabilitation would include vehicles traveling to and from the work sites. The transportation construction analysis takes into account such factors as location, extent, and intensity of work activities. All work activities have the potential to alter traffic flow and, therefore, all vehicles generated by the repair and rehabilitation, even those located outside of study areas, were assessed as part of the transportation analysis. The estimated number of vehicles that would be temporarily generated by the repair and rehabilitation and an analysis of potential impacts are evaluated in the respective “Transportation” sections for each study area using the methodology described below. Work at sites located outside the study areas would be short-term and intermittent in nature, such as biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. With the exception of wash water treatment, sites limited to these work activities were reviewed to evaluate whether the number of vehicle trips generated would exceed the CEQR threshold of 50 peak-hour transportation Passenger Car Equivalents (PCEs). It was determined that none of these work activities at work sites located outside the study areas generated a significant number of vehicle trips and, therefore, a transportation impact analysis for these work activities is not warranted.

9.3.13.2 Impact Analysis Methodology

The impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing traffic conditions, public transportation, and pedestrian activity in the immediate vicinity of the work sites; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would result in changes in land use or an increase in traffic within the study areas that are anticipated to be completed by the analysis year; (3) establishing the future conditions with the repair and rehabilitation based on the temporal distribution of the proposed construction vehicles to the work sites and staging areas for the repair and rehabilitation based on the proposed activities within the study area; (4) determining the peak-hour vehicle trips (including transportation PCEs, for inbound and outbound trips) that would temporarily be generated by the repair and

rehabilitation within the study areas; (5) determining if the parking capacity of the staging areas and study areas is sufficient for construction vehicle parking; (6) routing construction-generated vehicle trips to the study areas with construction vehicles traveling directly to primary staging areas to carpool to the study areas, or directly to secondary staging areas to carpool to the study areas if the primary staging area parking is at capacity; (7) using Vistro Version 3 to visually depict vehicle routing; and (8) analyzing the potential for impacts from the repair and rehabilitation based on the estimated number of vehicles (converted to transportation PCEs) that would be temporarily generated and the duration of the activity. The analysis considered: the extent and duration of increases in vehicle trips from repair and rehabilitation workers and equipment; street, roadway, or sidewalk closures; potential for impacts on the parking supply; and losses in other transportation services during the repair and rehabilitation within the study areas.

9.3.14 AIR QUALITY

This section presents the screening assessment of the potential for the repair and rehabilitation to result in changes to air quality from activities at the work sites that could generate air quality emissions from stationary and mobile sources.

9.3.14.1 Screening Assessment

Construction associated with the repair and rehabilitation work activities would be short-term in nature. Air quality emissions from mobile and stationary sources associated with the repair and rehabilitation would primarily consist of construction equipment, including worker and delivery vehicles, and fugitive dust emissions associated with excavation and grading activities and diesel exhaust from heavy equipment. The number of heavy equipment units that would be needed at a given location within the repair and rehabilitation study areas at a single time would be limited (e.g., generator, grader, excavator, fans, material delivery trucks). Once construction is completed, the construction equipment and vehicles would be removed from the work sites and construction staging areas would be restored to baseline conditions.

Following construction, temporary chlorination of the Catskill Aqueduct would occur from 2019 through 2023. The new chemical storage tanks associated with the chlorination facility at the Ashokan Screen Chamber would be located in a new enclosure that would be constructed within the existing screen chamber building in the Ashokan Screen Chamber Study Area. The new chemical storage tanks associated with the dechlorination facility at the Pleasantville Alum Plant would be located within a separate new building adjacent to the existing plant in the Pleasantville Alum Plant Study Area. The headspace in each tank would be vented through a pipe to outside of the building from the new enclosure and building, respectively. The new enclosure and building would each also be designed with separate air handling systems. There would be no changes to the existing air handling systems in the existing Ashokan Screen Chamber or Pleasantville Alum Plant. The types and/or amounts of chemicals used for chlorination (sodium hypochlorite or chlorine dioxide) and for dechlorination (sodium bisulfite) would not trigger a need for development of an EPA Risk Management Plan or Occupational Safety and Health Administration Process Safety Management Plan. The use of these tanks would be in accordance with applicable regulations, and any *de minimus* emissions from the vents would be negligible amounts of liquid aerosols or solids and would not result in

exceedance of National Ambient Air Quality Standards at the property boundaries. Therefore, a quantitative air quality assessment of emissions or impacts from the chlorination facility at Ashokan Screen Chamber or the dechlorination facility at Pleasantville Alum Plant is not warranted.

Along the aqueduct, leaks would be repaired for most study areas. Where repair is ultimately not feasible, local dechlorination systems would be operated during temporary chlorination. However, the local dechlorination systems would not be a significant source of air emissions because they are primarily passive dechlorination systems. Operation of the chemical injection systems at the Canal Road, Mountain Rest Road, and Mount Airy Road study areas would rely on electricity and, therefore, would not be a significant source of air emissions. Following temporary chlorination, the chlorination and dechlorination facilities and local dechlorination systems would no longer be operated. Operation of the Catskill Aqueduct would be consistent with baseline conditions. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to air quality discussed in Section 9.3.3.3, "Town Codes."

Therefore, an air quality impact analysis within the study areas is not warranted.

9.3.15 NOISE

This section presents the screening assessment, and analyzes the potential for the repair and rehabilitation to result in changes to noise from activities at the work sites that could alter noise within the surrounding study areas by generating noise emissions from stationary and/or mobile sources. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior and on or directly adjacent to existing DEP facilities. Despite being located in areas with generally low ambient noise levels, these work activities would be short-term and intermittent in nature, such as biofilm removal and condition assessment, certain mechanical repairs, and short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements. Wash water treatment systems are one aspect of biofilm removal and condition assessment that involves extended work on the ground surface and is included in the study areas. With the exception of wash water treatment, sites limited to these work activities would not generate substantial noise levels affecting nearby receptors and did not warrant further review.

9.3.15.1 Screening Assessment

Stationary Noise

The stationary noise source screening assessment considered noise-sensitive receptors within 1,500 feet of the work sites within the study areas and included an evaluation of the stationary noise sources to be used at the sites.

The stationary noise construction analysis accounts for such factors as location of the work activities in relation to noise-sensitive receptors and the magnitude and intensity of work activities. If the area of outdoor use of a noise-sensitive receptor would be located within 1,500 feet of stationary noise sources to be used for the repair and rehabilitation, an evaluation of

the stationary noise sources to be used at the work sites within the study area was performed. In addition, for work activities warranting an analysis, a stationary noise impact analysis was performed to determine whether construction complies with local noise code scheduling requirements and/or quantitative noise limits. The following study areas do not include a noise-sensitive receptor and are located within towns with no local noise codes: Beaverkill Road and Atwood-Olivebridge Road. Therefore, a noise impact analysis related to stationary noise associated with the repair and rehabilitation within these study areas is not warranted.

The repair and rehabilitation activity of biofilm removal and condition assessment would operate vacuum or hoisting equipment intermittently for up to 15-minute intervals up to 8 times a day. Generators, light plants, and ventilation fans could also be used, but would be spread out over a larger work area. Due to the intermittent use of stationary noise-generating equipment, a noise impact analysis related to biofilm removal and condition assessment is not warranted.

The staging and access improvements activity would generally be limited to laying gravel at existing staging areas and access roads, which does not warrant a noise impact analysis. However, access to the leaks within the Lucas Turnpike Study Area, the State Route 299 widening within the New Paltz-Minnewaska Road Study Area, and access to the Harlem Railroad Steel Pipe Siphon Blow-off Chambers within the Washington Avenue Study Area would require new access roads and a new bridge. Therefore, with the exception of the Lucas Turnpike, New Paltz-Minnewaska Road, and the Washington Avenue study areas, a noise impact analysis related to staging and access improvements is not warranted.

The primary staging areas would be used throughout the duration of construction from 2017 to 2020. During the third 10-week shutdown in fall 2019, the primary staging areas would be used up to 24 hours per day, 7 days a week. Generators and light plants would be used at these locations for long periods of time, so the primary staging areas screen in for analysis. The secondary staging areas would be used as overflow parking; therefore, a noise impact analysis related to the secondary staging areas is not warranted. Repair and rehabilitation work activities within the study areas would be in compliance with the applicable town codes related to noise discussed in Section 9.3.3.3, "Town Codes," and discussed further in applicable study areas.

Based on the screening assessment, with the exception of the Beaverkill Road and Atwood-Olivebridge Road study areas, the potential for stationary construction noise impacts associated with the repair and rehabilitation were evaluated in the respective "Noise" sections for the remaining study areas, using the methodology described below.

Mobile Noise

The mobile noise construction analysis accounts for such factors as location of the work activities in relation to noise-sensitive receptors and the magnitude and intensity of work activities. Mobile noise sources would include vehicles traveling to and from the work sites and staging areas within the study areas that would range from 24 to 484 peak-day vehicle trips (208 to 8,674 noise PCEs). The peak hour would range from 12 to 162 vehicle trips (104 to 1,349 noise PCEs). However, the repair and rehabilitation activities would be short-term and intermittent in nature with the peak number of vehicle trips to and from the work sites occurring during a limited period (e.g., three 10-week shutdowns). Therefore, a noise impact analysis

related to mobile noise associated with the repair and rehabilitation within the study areas is not warranted.

9.3.15.2 Impact Analysis Methodology – Stationary Noise

The stationary noise impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing noise levels and sources; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would result in a change in land use, or new noise-generating sources that would contribute to an increase in ambient noise levels within the study areas that are anticipated to be completed by the analysis year; (3) establishing noise levels that would be received at the area of outdoor use of a noise-sensitive receptor from construction equipment to be used for the repair and rehabilitation at the work sites based on the proposed activities within the study area; and (4) analyzing the potential for impacts from the repair and rehabilitation by determining if the construction schedule and noise levels that would be emitted from construction equipment in the future with the repair and rehabilitation would comply with local noise codes.

Existing noise levels within the study areas were developed using typical noise levels for residential land uses obtained from American National Standards Institute/Acoustical Society of America S12.9 Part 3 (2013) and are shown in **Table 9.3-16**. The existing noise levels selected for the study areas varied by site based on proximity to major transportation corridors, population density of the areas, and other noise-producing elements.

Reference equipment noise levels and usage factors for the impact analyses were obtained from the *CEQR Technical Manual*, and/or equipment manufacturers. Spreadsheet calculations were performed to estimate stationary noise levels at the property line or the nearest noise-sensitive receptors, as applicable. The three loudest pieces of construction equipment were used in the calculations for each study area, not including mobile equipment (i.e., pick-up trucks, flat-bed trucks, vacuum trucks, dump trucks, and concrete trucks used for deliveries and hauling to and from off-site locations) or equipment that would be in operation intermittently for short periods of time (i.e., total use of equipment would not exceed 15-minute intervals up to 8 times a day), such as those listed in **Table 9.3-17**. The three loudest types of construction equipment were modeled for each activity because only a select number of pieces of equipment would operate at full power in a work site at any given time. The equipment was conservatively assumed to be located in close proximity to each other at the center of the work site. The reference noise levels were adjusted to the appropriate distance assuming free field conditions.⁵ ArcGIS was used to determine the distance between the study area construction sites and the nearest noise receptors. If the estimated noise levels for the peak activity within each study area were predicted to exceed local noise code requirements, or if construction would occur during time periods prohibited by local noise codes, DEP would work with the Towns or Villages, as appropriate.

⁵ Free field conditions refers to an environment free from obstructions that could affect the way sound travels away from the noise source.

Table 9.3-16: Typical Daytime and Nighttime Noise Levels for Residential Land Use Categories

Residential Land Use Category	Daytime Noise Levels (L _{eq} , dBA)	Nighttime Noise Levels (L _{eq} , dBA)
Very noisy urban residential	66	58
Noisy urban residential	61	54
Urban and noisy suburban residential	55	49
Quiet urban and normal suburban residential	50	44
Quiet suburban residential	45	39
Very quiet suburban and rural residential	40	34

Source: American National Standards Institute/Acoustical Society of America S12.9 Part 3 (2013).

Table 9.3-17: Stationary Source Construction Equipment to be Used Intermittently for Short Periods and Reference Noise Levels (L_{eq})

Equipment Type	Reference Noise Level (L _{eq}) at 50 feet (dBA)	Source
Vacuum truck	81	CEQR ¹
Electric Towing Vehicle with Muck Container	82	CEQR ¹
Mobile Scaffolding Unit,	82	CEQR ¹
Concrete Saw	83	CEQR ¹

Note:
¹ City Environmental Quality Review (CEQR) Technical Manual, Chapter 22 (2014).

9.3.16 NEIGHBORHOOD CHARACTER

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to neighborhood character from activities at the work sites that could generate significant adverse effects in any of the technical areas that are considered when analyzing neighborhood character. These technical areas include: land use, zoning, and public policy; socioeconomic conditions; open space and recreation; shadows; historic and cultural resources; urban design and visual resources; transportation; or noise. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior such as biofilm removal and condition assessment, as well as short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements or altering existing structures. Because these activities would be conducted on or directly adjacent to built resources and would not cumulatively affect the technical areas considered when analyzing neighborhood character and did not warrant further review.

9.3.16.1 Screening Assessment

Based on the screening assessments presented above for the repair and rehabilitation, there would be no potential for the repair and rehabilitation to affect shadows and urban design. However, an impact analysis was warranted for land use, zoning, and public policy, open space and recreation, historic and cultural resources, visual resources, transportation, and noise, as discussed in the following sections: Section 9.3.3, “Land Use, Zoning, and Public Policy,” Section 9.3.6, “Open Space and Recreation,” Section 9.3.7, “Historic and Cultural Resources,” Section 9.3.8, “Visual Resources,” Section 9.3.13, “Transportation,” and Section 9.3.14, “Air Quality.” Therefore, the potential for impacts to neighborhood character from potential impacts in these categories within the study areas was evaluated in the respective “Neighborhood Character” sections using the methodology described below.

9.3.16.2 Impact Analysis Methodology

The impact analysis consisted of: (1) establishing and describing the baseline neighborhood character conditions for the study areas; (2) establishing future conditions without the repair and rehabilitation by identifying proposed projects that would alter neighborhood character within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with the repair and rehabilitation based on the proposed activities within the study area; and (4) analyzing the potential impacts from the repair and rehabilitation to neighborhood character through a qualitative assessment of the potential for impacts from the repair and rehabilitation based on adverse effects from one or a combination of the technical areas that could cumulatively affect a neighborhood’s defining features. If the repair and rehabilitation would potentially result in significant direct or indirect change(s) to a factor contributing to the study areas’ neighborhood character, the degree and type of such change was evaluated.

9.3.17 PUBLIC HEALTH

This section presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to public health from activities at the work sites that could alter public health due to significant unmitigated adverse impacts in related assessment areas, such as air quality, water supply (quantity and quality), hazardous materials, or noise. This section also presents the screening assessment and analyzes the potential for the repair and rehabilitation to result in changes to public health along the City’s water supply system due to chlorination proposed as part of the repair and rehabilitation. Work sites located outside the study areas include activities that would primarily be conducted within the aqueduct interior such as biofilm removal and condition assessment, as well as short-term use of existing staging areas (i.e., less than 2 weeks) that do not require improvements or altering existing structures. Because these activities would be conducted on or directly adjacent to built resources, would not result in discharge of fill or wastewater to the natural environment, and would not cumulatively affect the technical areas considered when analyzing public health, further review was not warranted.

9.3.17.1 Screening Assessment

The repair and rehabilitation has the potential to affect public health through changes in water quality and quantity as well as potential environmental exposures based on other technical

analysis areas: hazardous materials, water supply (quantity and quality), air quality, or noise. This section outlines the methodology used to assess these changes within the study areas as well as on a project-wide basis.

Based on the screening assessments presented above in Section 9.3.13, “Air Quality,” there would be no potential for air quality impacts from the repair and rehabilitation. However, an analysis is warranted for hazardous materials, water supply (quantity and quality), and noise, as discussed in the following sections: Section 9.3.10, “Hazardous Materials,” Section 9.3.11, “Water and Sewer Infrastructure,” and Section 9.3.14, “Noise.” The potential for impacts to public health on a project-wide basis in Section 9.18, “Project-wide Impact Analysis” using the methodology described below.

For water supply, chlorination proposed as part of the repair and rehabilitation would be beneficial to restoring and maintaining capacity within the Catskill Aqueduct for the duration of the RWBT temporary shutdown; however, adding an oxidant at the Ashokan Screen Chamber would introduce a chlorine or chlorine dioxide residual into the Catskill Aqueduct Water supply. By-products of these oxidants, known as DBPs may also form, and would be dependent on the two chemicals that would be introduced and the location along the aqueduct. This potential for DBP formation is relevant for the City and Kensico Reservoir and for the 15 Outside Community Connections that draw water at various points along the upper Catskill Aqueduct (see **Table 9.3-15**). Therefore, an analysis of the potential for impacts to public health from chlorinating the Catskill Aqueduct was warranted on a project-wide basis (see Section 9.18.2.5, “Public Health”).

An additional assessment was conducted to evaluate water quality associated with the source of water for private drinking water wells in the Lucas Turnpike and Mossybrook Road study areas. As previously described in Section 9.3.9, “Natural Resources,” and Section 9.3.11, “Water and Sewer Infrastructure,” water quality associated with the source of water for private drinking water wells would not be affected by the repair and rehabilitation activities, with the exception of leaks within the Lucas Turnpike and Mossybrook Road study areas. In these study areas, there are water supply wells potentially influenced by the leaks in the Rondout Pressure Tunnel, which is approximately 500 feet below the ground surface in these areas. Therefore, the potential for impacts to public health from changes in water quality due to the potential residual chlorine concentration at the nearest drinking water wells within the Lucas Turnpike and Mossybrook Road study areas from the leaks were evaluated in the respective “Public Health” sections using the methodology described below.

The impact analysis consisted of assessing the potential for an unmitigated significant adverse impact from the repair and rehabilitation in one or more of the public health-related assessment areas: water supply (quantity and quality), hazardous materials, and noise. The potential for the repair and rehabilitation to result in changes to the quality or quantity of water available from the City’s water supply system is analyzed on a project-wide basis. Detailed methodologies precede the respective analyses in Section 9.18.2, “Chlorination and Dechlorination.”

The primary source of drinking water in the Lucas Turnpike and Mossybrook Road study areas is groundwater from private drinking water supply wells in the bedrock aquifer. As described in Section 9.3.9, “Natural Resources,” and Section 9.3.11, “Water and Sewer Infrastructure,” the impact analysis methodology included an evaluation of the potential changes to the groundwater resources and private drinking water supply wells, as described below.

The potential for impacts to the drinking water quality at the Lucas Turnpike and Mossybrook Road study areas are analyzed within Section 9.5.5.15, “Public Health,” and Section 9.5.7.12, “Public Health,” respectively, by evaluating the fate and transport of chlorine dioxide and sodium hypochlorite that would be introduced to the aqueduct during the chlorination period to maintain biofilm removal. These two compounds are regulated with established standards in drinking water. They are not currently present in the groundwater but may be released through the leaks at detectable concentrations. Since the Rondout Pressure Tunnel is under pressure to a level that is above the ground surface, the leak water has the potential to travel from the leaks in groundwater within the Lucas Turnpike and Mossybrook Road study areas.

The following steps were conducted to assess the potential for these chlorination compounds and their residuals to impact the quality of the drinking water and public health:

- *Step 1: Review Aquifer and Chlorination Chemistry:* It is anticipated that once the chlorinated leak water reaches the bedrock aquifer it would chemically react with the native groundwater. Depending on the chemical composition of the aquifer water, this could result in chemical reactions that would oxidize the chlorine residuals and eventually eliminate residuals in the groundwater.

The analysis was conducted to determine how quickly oxidation of chlorine residuals would occur. Collectively, reactions are commonly accounted for as an R factor and the literature reports an R factor of 2.5 to 3.8 for chlorination by-products in carbon poor aquifer materials (Ivahnenco and Barbash 2004). Both the referenced aquifer and the aquifer in the Lucas Turnpike and Mossybrook Road study areas were considered to have low values of organic carbon. The R values referenced were used in this evaluation. The chemistry of the chlorination process was reviewed to establish initial chlorine concentrations in the groundwater and which reactions are likely to be favorable in the groundwater to reduce the chlorine residuals concentrations.

- *Step 2: Conduct the Fate and Transport Analysis:* The leaks are located within a section of the Catskill Aqueduct that is a pressure tunnel, so conceptually the leak was examined as a point source of water (and solutes) to the bedrock aquifer. The influence from the leak radiates outward along groundwater flowpaths that occur within the fractured rock. The network of fractures and their degree of interconnections is likely complex and would be difficult to characterize without extensive study. Therefore, by simplifying the fracture network to a single fracture, a general estimate of the likely travel distance and expected concentration was prepared using the analytical solution presented in the equations below.⁶

⁶ Chen, C-S., Yates, S. R. 1989. Approximate and Analytical Solutions for Solute Transport from an Injection Well into a Single Fracture, Ground water Computer Notes, Vol. 27, No. 1, January to February 1989.

Analytical Solution:

$$C_1 = \exp \left[\left(-E_1 \lambda - E_2 \lambda^{\frac{1}{2}} \right) \bar{r} \right] \quad \text{Units}$$

where:

$C_1 = \text{Concentration in fracture}$

$$E_1 = \frac{R_1}{A} \quad \left(\frac{s}{m^2} \right)$$

$R_1 = \text{Fracture retardation factor}$

$$A = \text{Advection, equal to } \frac{Q}{4\pi b} \quad \left(\frac{m^2}{s} \right)$$

$\lambda = \text{First order rate constant} \quad (s^{-1})$

$$E_2 = \frac{n_2(R_2 D_m)^{1/2}}{(bA)} \quad \left(\frac{s^{\frac{1}{2}}}{m^2} \right)$$

$n_2 = \text{Porosity of porous matrix}$

$R_2 = \text{Retardation factor for porous matrix}$

$D_m = \text{Diffusion coefficient of porous matrix} \quad \left(\frac{m^2}{s} \right)$

$b = \text{Half fracture aperture} \quad (m)$

$$\bar{r} = \frac{(r^2 - r_0^2)}{2} \quad (m^2)$$

$r = \text{Radial distance} \quad (m)$

$r_0 = \text{Well radius} \quad (m)$

$Q = \text{Flow rate into fracture, injection rate} \quad \left(\frac{m^3}{s} \right)$

The input parameters used to estimate the concentration and transport distance of chlorine residual in a single fracture were based on published values used in similar hydrogeologic conditions. The variables, selected values, and source are shown in **Table 9.3-18** and **Table 9.3-19**.

Table 9.3-18: Published Values for the Lucas Turnpike Study Area Analytical Solution used in Similar Hydrogeologic Conditions

Variables		Values
D_m	Effective Diffusion Coefficient ¹	$3.2 \times 10^{-9} \text{ m}^2/\text{s}$
Q	Constant Injection Rate ²	600 to 1,200 gpm
R_1	Retardation factor in fracture ³	1
R_2	Retardation factor in porous matrix ³	3
λ	First order rate constant ⁴	Sodium Hypochlorite: $2.831 \times 10^{-5} \text{ s}^{-1}$ Chlorine Dioxide: $4.029 \times 10^{-5} \text{ s}^{-1}$
b	Aperture thickness ⁵	2.0 mm
n_2	Matrix Porosity ⁶	0.15

Notes:
gpm: gallons per minute
 m^2/s : meters squared per second
mm: millimeter
 s^{-1} per second

Sources:
¹ Zhou, Q., Lie, H., Molx, F. J., Zhang, Y, Bodvarsson, G.S., 2007, Field-Scale Matrix Diffusion Coefficient for Fractured Rock: Results from Literature Survey, journal of Contaminant Hydrology, 93(1-4), pp. 161-187.
² White, L. 1913. *The Catskill water supply of New York City, history, location, sub-surface investigations and construction.* pp.812.
³ Ivahnenko, T., Barbash, J.E., 2004, Chloroform in the Hydrologic System- Sources, Transport, Fate, Occurrence, and Effects on Human and Aquatic Organisms: U.S. Geological Survey (USGS) Scientific Investigations Report 2004-5137.
⁴ See text for discussion of the first order rate constants.
⁵ Gudmundsson, A., 2011, Rock Fractures in Geological Processes, Cambridge Publishing, p. 591.
⁶ Freeze, R. A., Cherry, J.A., 1979, Groundwater, Prentice-Hall Inc., p. 604.

Table 9.3-19: Published Values for the Mossybrook Road Study Area Analytical Solution used in Similar Hydrogeologic Conditions

Variables		Values
D _m	Effective Diffusion Coefficient ¹	1.5 x 10 ⁻¹⁰ m ² /s
Q	Constant Injection Rate ²	10 to 100 gpm
R ₁	Retardation factor in fracture ³	1
R ₂	Retardation factor in porous matrix ³	3
λ	First order rate constant ⁴	Sodium Hypochlorite: 2.831 x 10 ⁻⁵ s ⁻¹ Chlorine Dioxide: 4.029 x 10 ⁻⁵ s ⁻¹
b	Aperture thickness ⁵	2.0 mm
n ₂	Matrix Porosity ⁶	0.15

Notes:
gpm: gallons per minute
m²/s: meters squared per second
mm: millimeter
s⁻¹: per second

Sources:
¹ Zhou, Q., Lie, H., Molx, F. J., Zhang, Y, Bodvarsson, G.S., 2007, Field-Scale Matrix Diffusion Coefficient for Fractured Rock: Results from Literature Survey, journal of Contaminant Hydrology, 93(1-4), p. 161-187.
² White, L. 1913. *The Catskill water supply of New York City, history, location, sub-surface investigations and construction.* pp. 812.
³ Ivahnenko, T., Barbash, J.E., 2004, Chloroform in the Hydrologic System- Sources, Transport, Fate, Occurrence, and Effects on Human and Aquatic Organisms: U.S. Geological Survey (USGS) Scientific Investigations Report 2004-5137.
⁴ Please see in-text discussion of the first order rate constants.
⁵ Gudmundsson, A., 2011, Rock Fractures in Geological Processes, Cambridge Publishing, p. 591.
⁶ Freeze, R. A., Cherry, J.A., 1979, Groundwater, Prentice-Hall Inc., p. 604.

The flow at Leaks 3A and 4 have been measured at the surface (flow measurements at Leaks 3B, the Private Well, and Shaft 7 Leak are not feasible); however, the exact rate of water leaking from the aqueduct to the bedrock aquifer is not known. Based on the historical accounts during construction and the known pressure in the aqueduct tunnel the flow of the leaks at depth was estimated to range from approximately 600 to 1,200 gpm.

The flows at the Shaft 7 Leak have also been estimated at the surface; however, the exact rate of water leaking from the aqueduct to the bedrock aquifer is also not known. Based on the historical accounts during construction, water inflow into the tunnel upstream and downstream of Shaft 7 was observed to be a maximum of 9 gpm after the shaft plug was installed. Thus, assuming some slight degradation of the grout would occur over time, the flow of the leaks at depth was estimated to be 10 gpm. If a higher rate of grout degradation is assumed, then the leak could increase order of magnitude (100 gpm).

The first order rate constants were determined by a disinfection study that used a two-site empirical model to calculate the concentration of both sodium hypochlorite and chlorine dioxide in the aqueduct using a variety of initial doses made at the Ashokan Screen Chamber. The two-site model used a fast site rate constant and a slow site rate constant. The observed decay rates of sodium hypochlorite and chlorine dioxide tend to match the fast site constant well in the first few hours after the initial dose. Afterwards, the slow site rate constants tend to match better. Since the leaks at the Lucas Turnpike and Mossybrook Road study areas are located in proximity to the High Falls Community Tap, that location was selected as representative for the first order rate constants at the leak sites. Since it takes approximately 3.5 hours for chlorinated water to travel from the Ashokan Screen Chamber to the High Falls Community Tap, the slower rate constants were used in the analytical solution. An important note is that the rate constants are conservative estimates based on the methods of the kinetics study. The oxidant decay was measured in clean bottles under laboratory conditions, and the decay would be more rapid in the aqueduct and around the leaks where there are more sources of chlorine demand.

The first order rate constant for sodium hypochlorite was based on an initial maximum dose of 1.25 mg/L at the Ashokan Screen Chamber for winter. The first order rate constant for chlorine dioxide was based on an initial maximum dose of 0.8 mg/L at the Ashokan Screen Chamber for summer. The doses and seasonal selection of the rate constants corresponds to the doses and the time of year the DEP plans to use either oxidant, and the maximum doses do not exceed the established levels for residual disinfectants in drinking water for either compound.