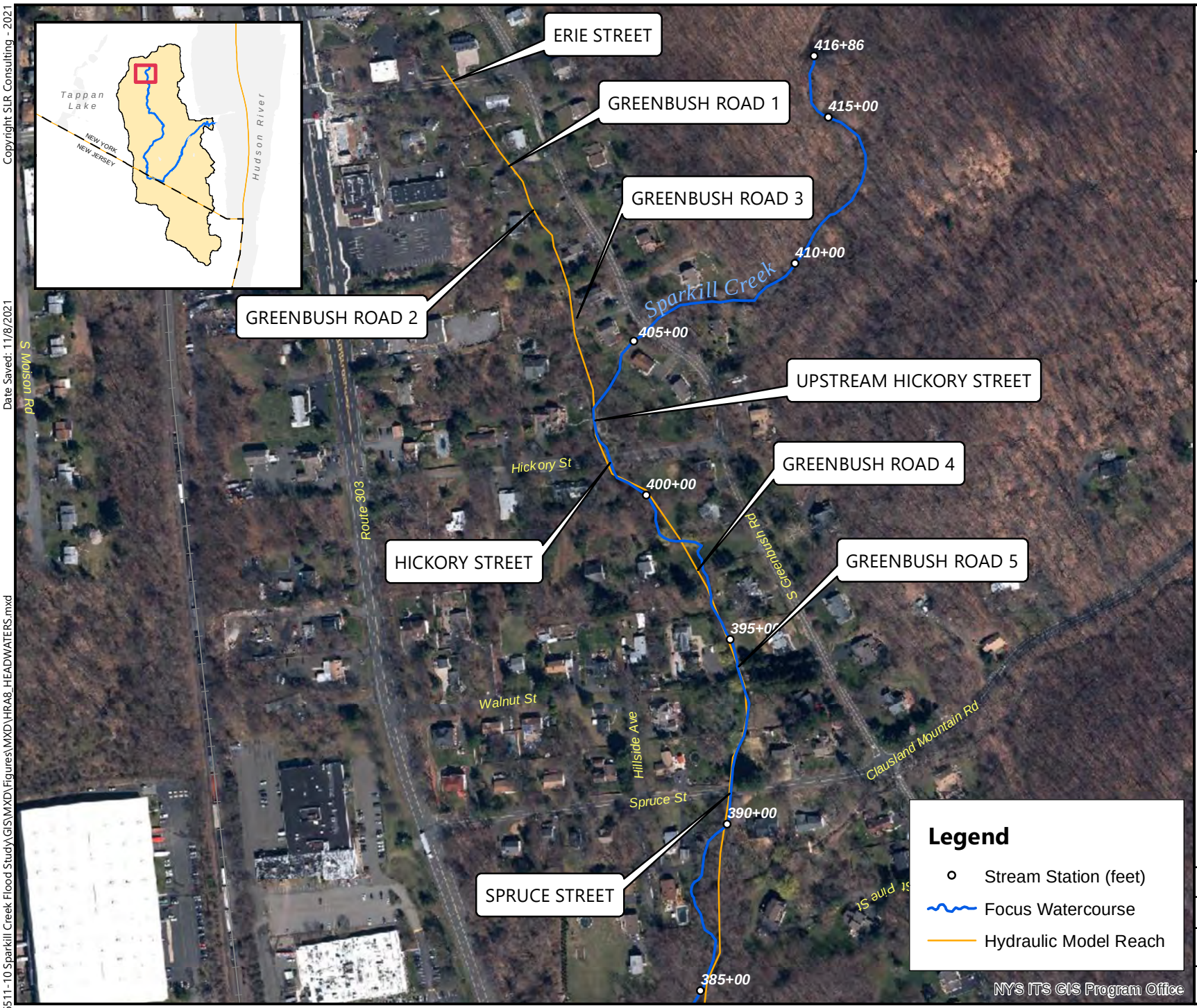

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HIGH RISK AREA #8 - SPARKILL CREEK HEADWATERS

SPARKILL CREEK FLOOD & RESILIENCE STUDY
SD115
ROCKLAND COUNTY
NEW YORK

SCALE 1 " = 350 '
DATE 11/8/2021
PROJ. NO. 16511.00010

FIG. 4-81

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HRA#8 - CONCEPT MAP

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FIG. 4-82

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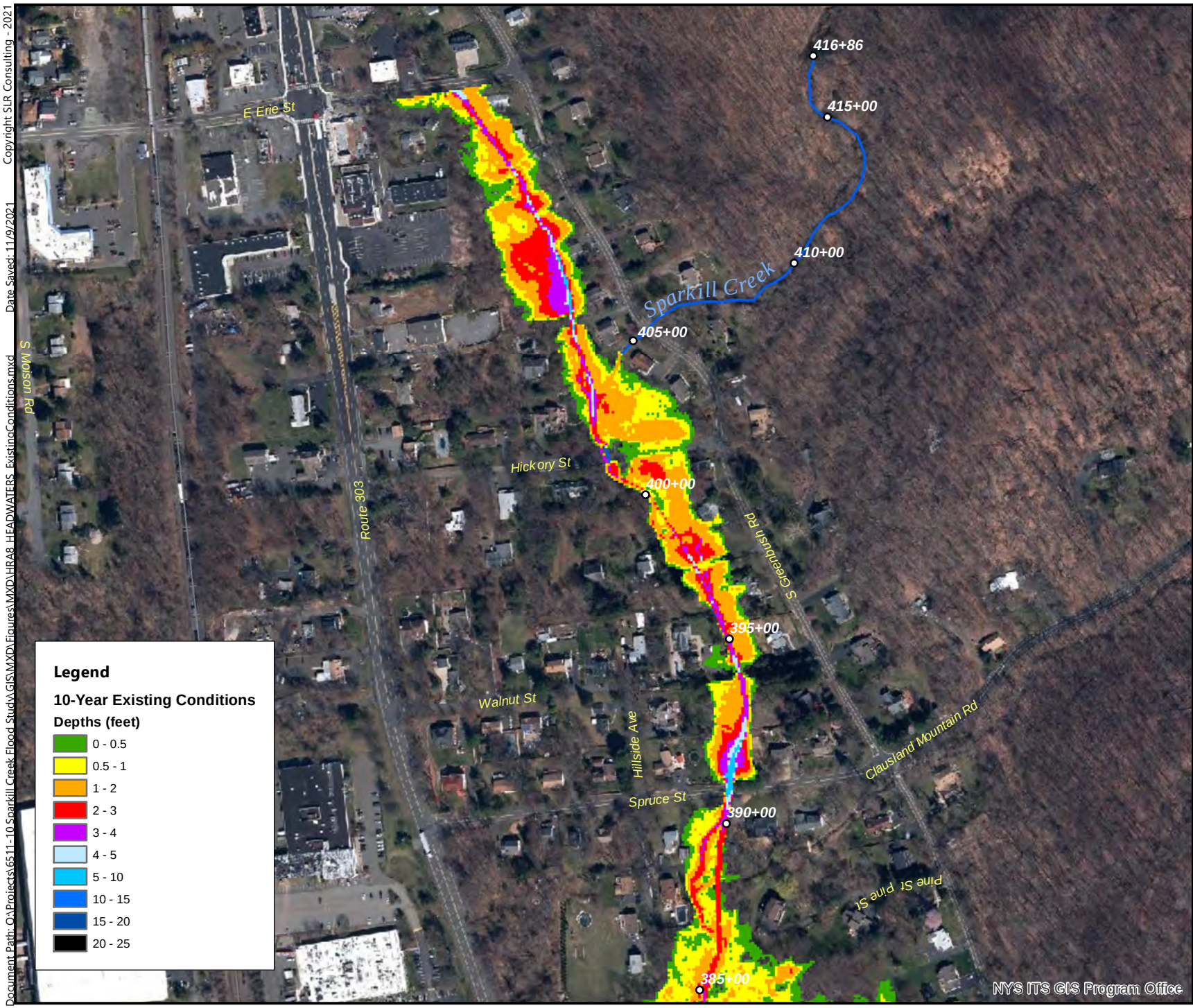

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HRA #8 - 10- YEAR EXISTING CONDITIONS FLOOD DEPTHS

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FIG. 4-83

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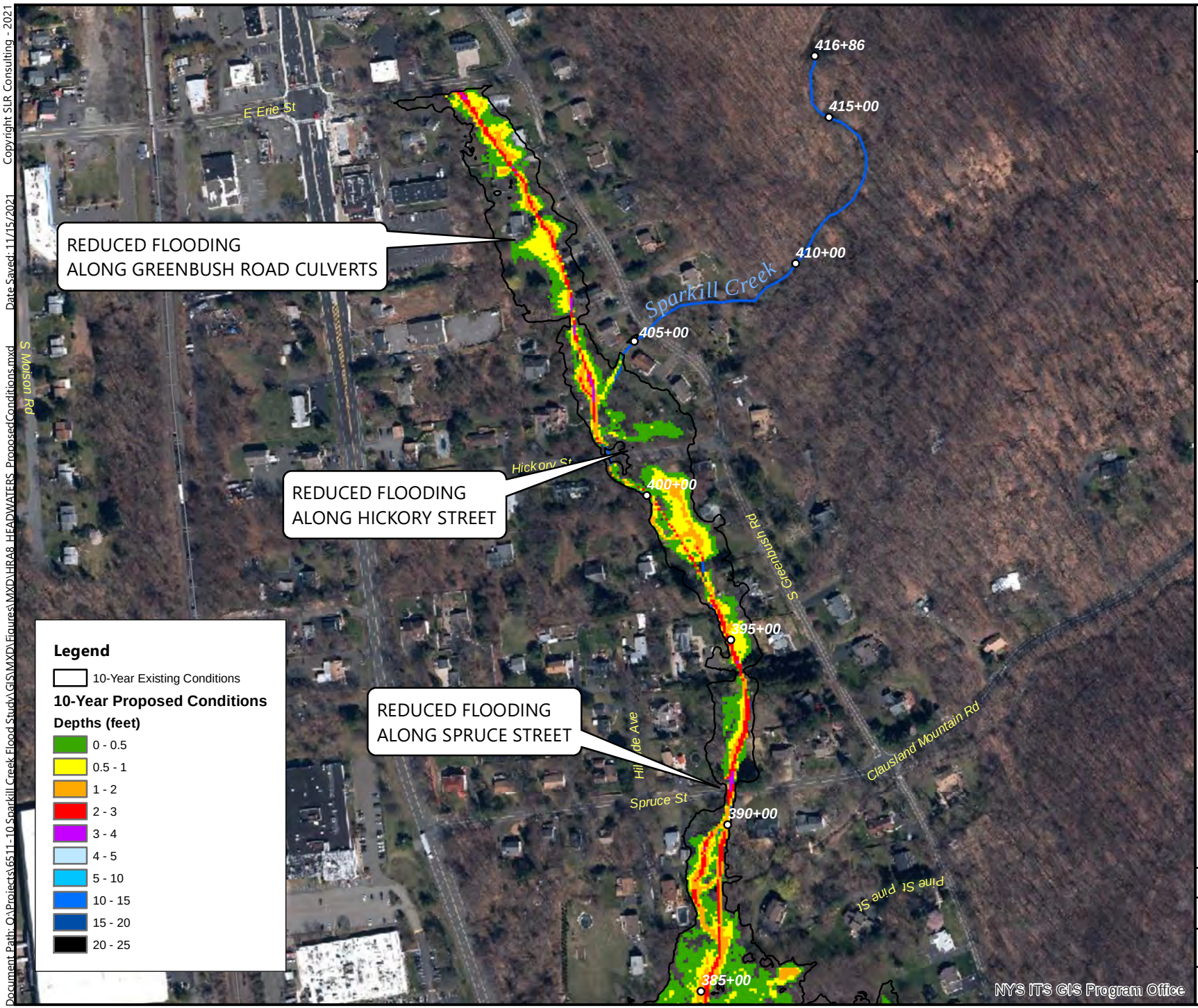

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HRA #8 - 10-YEAR PROPOSED CONDITIONS FLOOD DEPTHS

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FIG. 4-84

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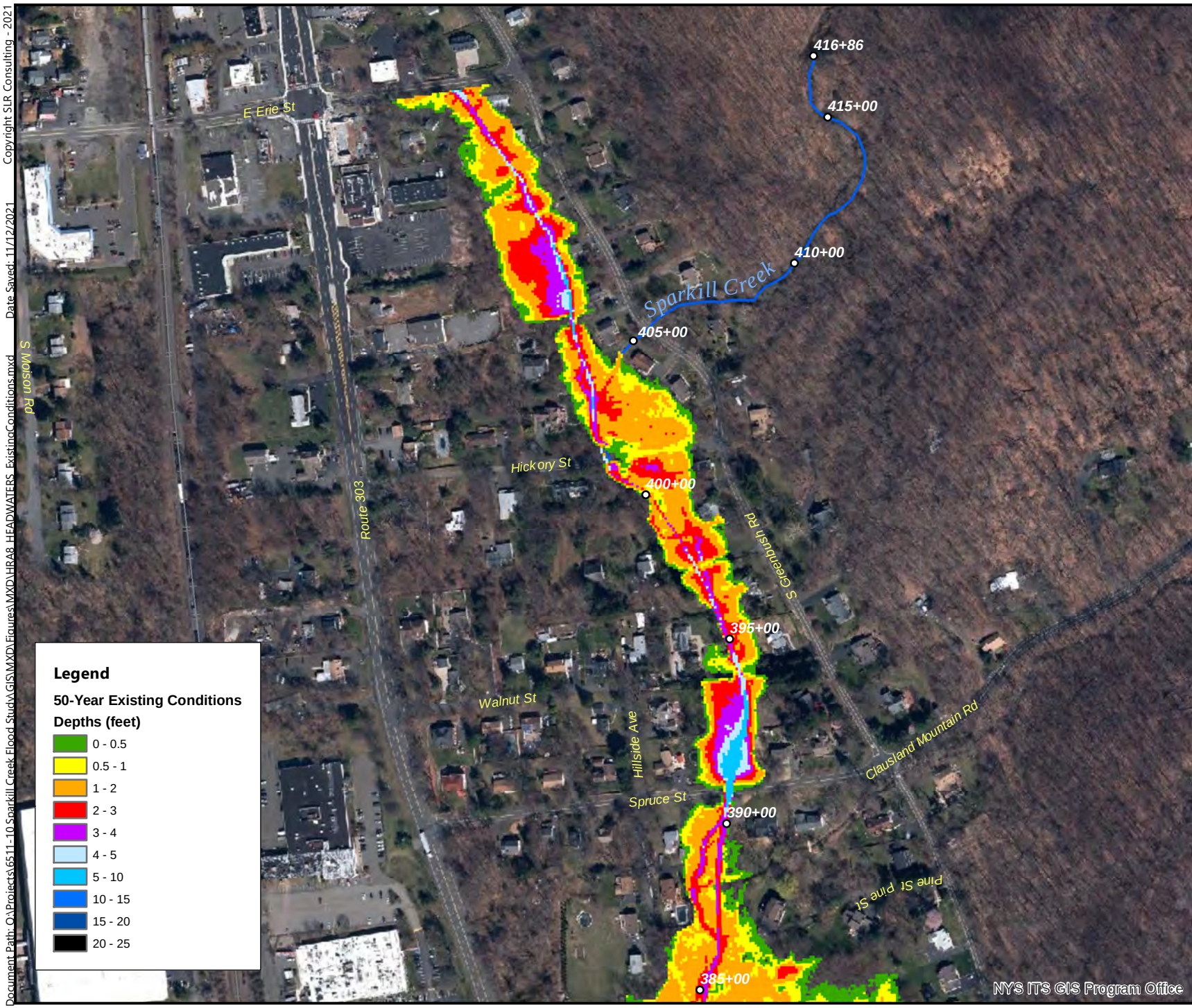

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HRA #8 - 50-YEAR EXISTING CONDITIONS FLOOD DEPTHS

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FIG. 4-85

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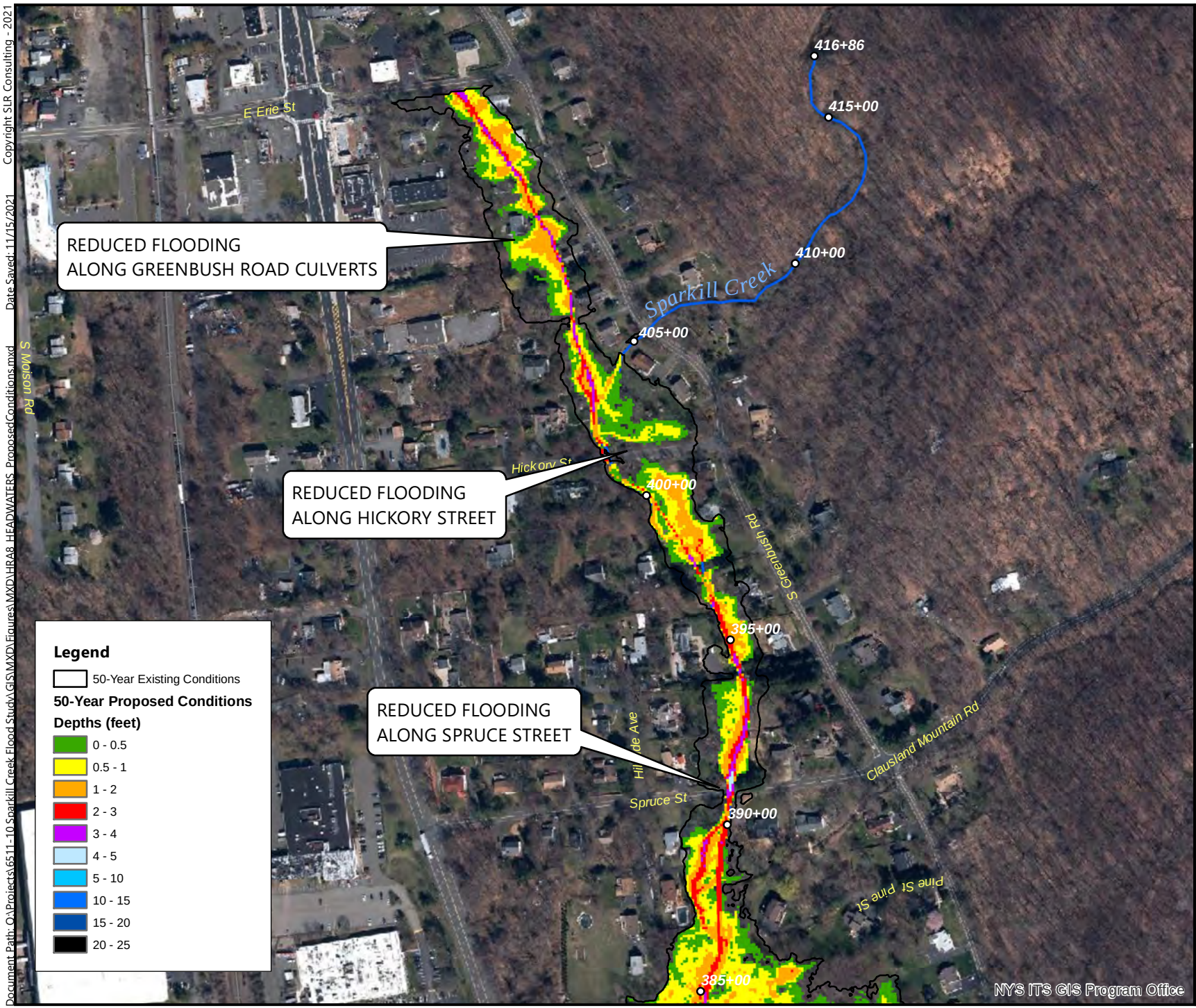

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HRA #8 - 50-YEAR PROPOSED CONDITIONS FLOOD DEPTHS

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FIG. 4-86

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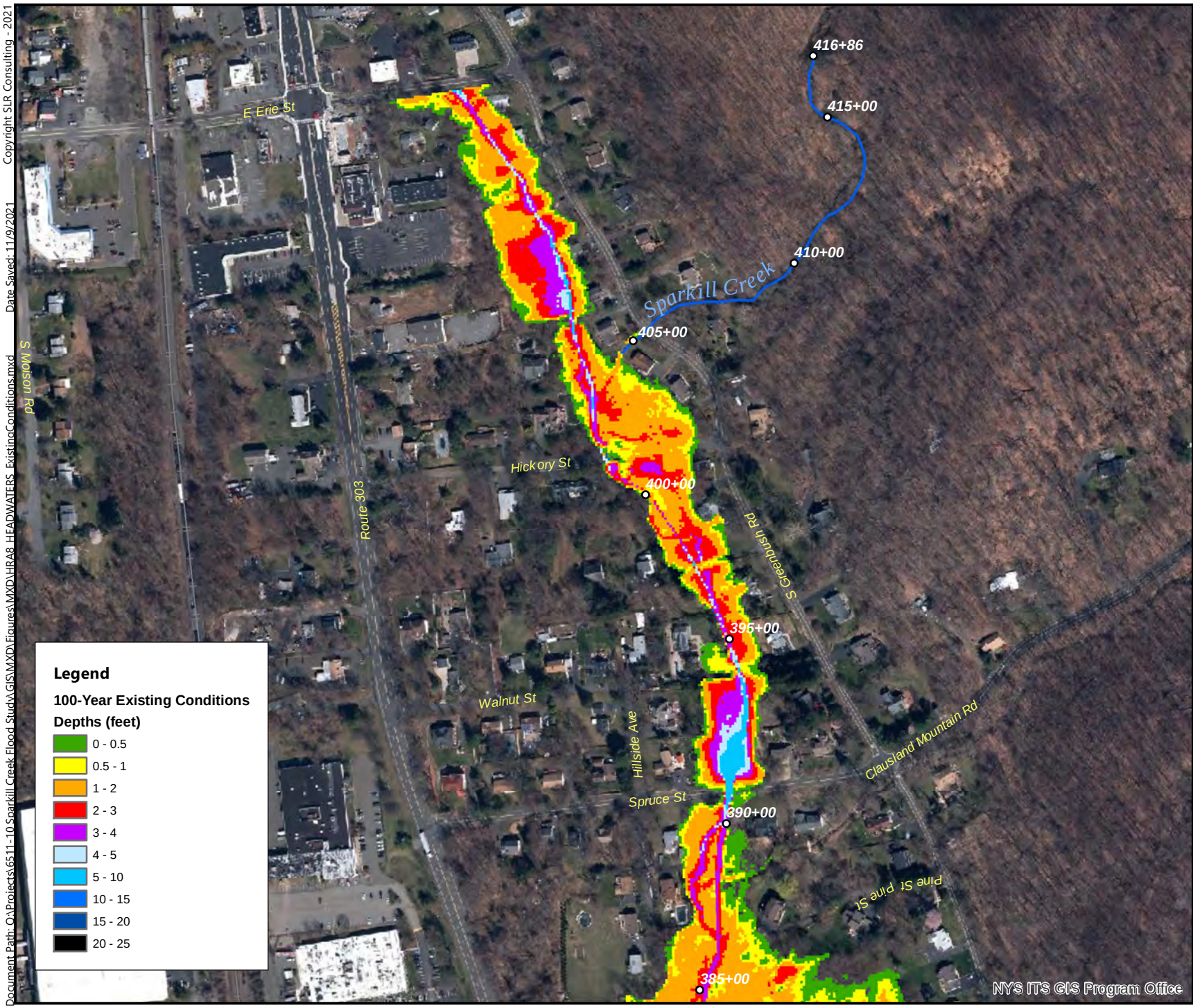

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HRA #8 - 100- YEAR EXISTING CONDITIONS FLOOD DEPTHS

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FIG. 4-87

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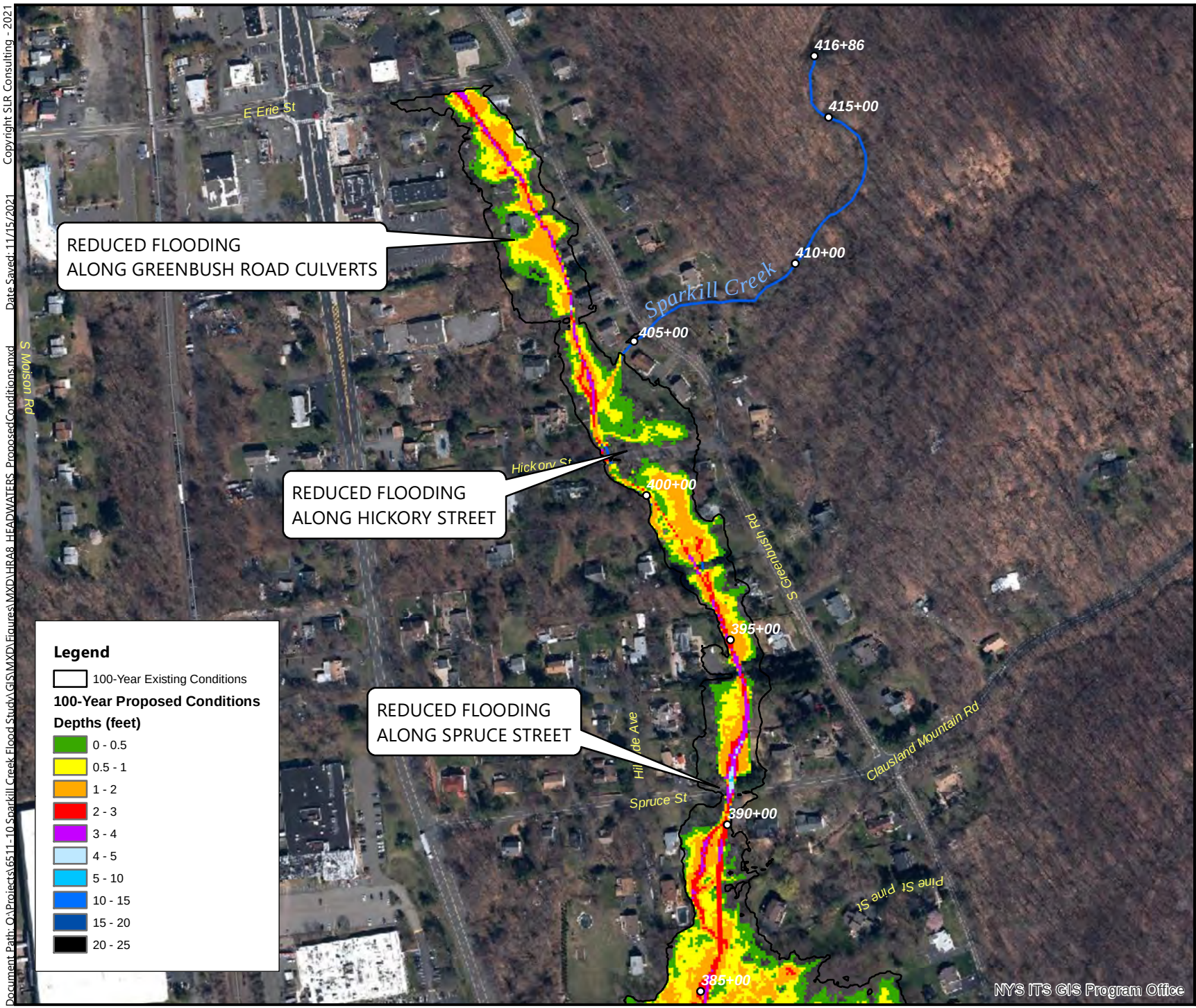

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HRA #8 - 100-YEAR PROPOSED CONDITIONS FLOOD DEPTHS

SPARKILL CREEK FLOOD & RESILIENCE STUDY

SD115

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SCALE 1 " = 350 '

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FIG. 4-88

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Table 4-4 Summary of Hydraulic Modeling Analysis for HRA 8

Stream Crossing	Existing Structure	NAACC Crossing Code / Aquatic Passability Score	Existing Flood Capacity	Modeled Replacement Structure	Replacement Structure Flood Capacity	
					Current Hydrology	Projected Future Flows to Account for Climate Change
Erie Street	9.5' span x 3.3' rise Concrete Ellipse Culvert	*N/A* No NAACC Assessment Available	<10-Year	28' Span x 3' Rise Concrete Box Culvert	500-Year	500-Year
Greenbush Road 1	3.5' span x 1.8' rise Twin-Barrel Corrugated Metal Arch Pipes	*N/A* No NAACC Assessment Available	<10-Year	28' Span x 2' Rise Concrete Box Culvert	<10-Year	<10-Year
Greenbush Road 2	3' Diameter Concrete Pipe Culvert	*N/A* No NAACC Assessment Available	<10-Year	28' Span x 3' Rise Concrete Box Culvert	10-Year	10-Year
Greenbush Road 3	5.8' span x ~3.9' rise Open Bottom Culvert	*N/A* No NAACC Assessment Available	<10-Year	28' Span x ~3.9' rise Open Bottom Culvert	500-Year	500-Year
Upstream Hickory Street	13' span x ~3' rise Open Bottom Pedestrian Bridge	*N/A* No NAACC Assessment Available	<10-Year	Recommended Removal	N/A	N/A
Hickory Street	2' Diameter Concrete Pipe	*xy4106113173946070* / 0.13 out of 1.0 *Severe Barrier*	<10-Year	28' Span x 4' Rise Concrete Box Culvert	500-Year	100-Year
Greenbush Road 4	2' Diameter Twin-Barrel Concrete Pipes	*N/A* No NAACC Assessment Available	<10-Year	28' Span x 3' Span Concrete Box Culvert	50-Year	10-Year
Greenbush Road 5	4' span x 3' rise Twin-Barrel Concrete Ellipse Pipes	*N/A* No NAACC Assessment Available	<10-Year	28' Span x 3' Span Concrete Box Culvert	10-Year	10-Year

Stream Crossing	Existing Structure	NAACC Crossing Code / Aquatic Passability Score	Existing Flood Capacity	Modeled Replacement Structure	Replacement Structure Flood Capacity	
					Current Hydrology	Projected Future Flows to Account for Climate Change
Spruce Street	6' span x 3' rise (squished) Twin-Barrel Corrugated Metal Ellipse Pipes	*xy4105869273945374* / 0.81 out of 1.0 *Insignificant Barrier*	10-Year	28' Span x 3' Span Concrete Box Culvert	500-Year	100-Year

4.8.2 SOUTH GREENBUSH ROAD/GREENBUSH ROAD CULVERTS

Anecdotal reports indicated that flow from unnamed tributaries of Sparkill Creek have overwhelmed the crossings that carry South Greenbush Road and Greenbush Road over these watercourses. The structure under South Greenbush Road consists of a four-sided concrete box culvert that measures 10 feet wide by 3 feet high and an auxiliary 4-foot-diameter corrugated metal pipe (CMP), which is buried at its outlet (Figure 4-89). The NAACC crossing code for this structure is *xy4105872873943714*, and it received an aquatic passability score of 0.66 out of 1.0, a *minor* barrier. The unnamed watercourse drains off Clausland Mountain situated to the east and has a contributing watershed of approximately 0.45 square miles at the road crossing.

Approximately 1,400 feet to the northwest of the South Greenbush Road structure is another unnamed tributary of Sparkill Creek that runs under Greenbush Road (Figure 4-90). The structure under Greenbush Road is a four-sided concrete box culvert square-edge headwall. The structure is 10 feet wide by 3.6 feet high and has a contributing watershed of 0.54 square miles. Its NAACC crossing code is *xy4106206073945976*, and it received an aquatic passability score of 0.74 out 1.0, a *minor barrier*. Figure 4-91 shows the location of the two crossings at the headwaters of the Sparkill Creek. The hydraulic performance of each stream crossing was evaluated using FHWA's *HY-8 Culvert Hydraulic Analysis* program.

Figure 4-89: Looking Downstream at the South Greenbush Road Culvert Inlet

Figure 4-90: Looking Upstream at the Culvert that Carries Greenbush Road

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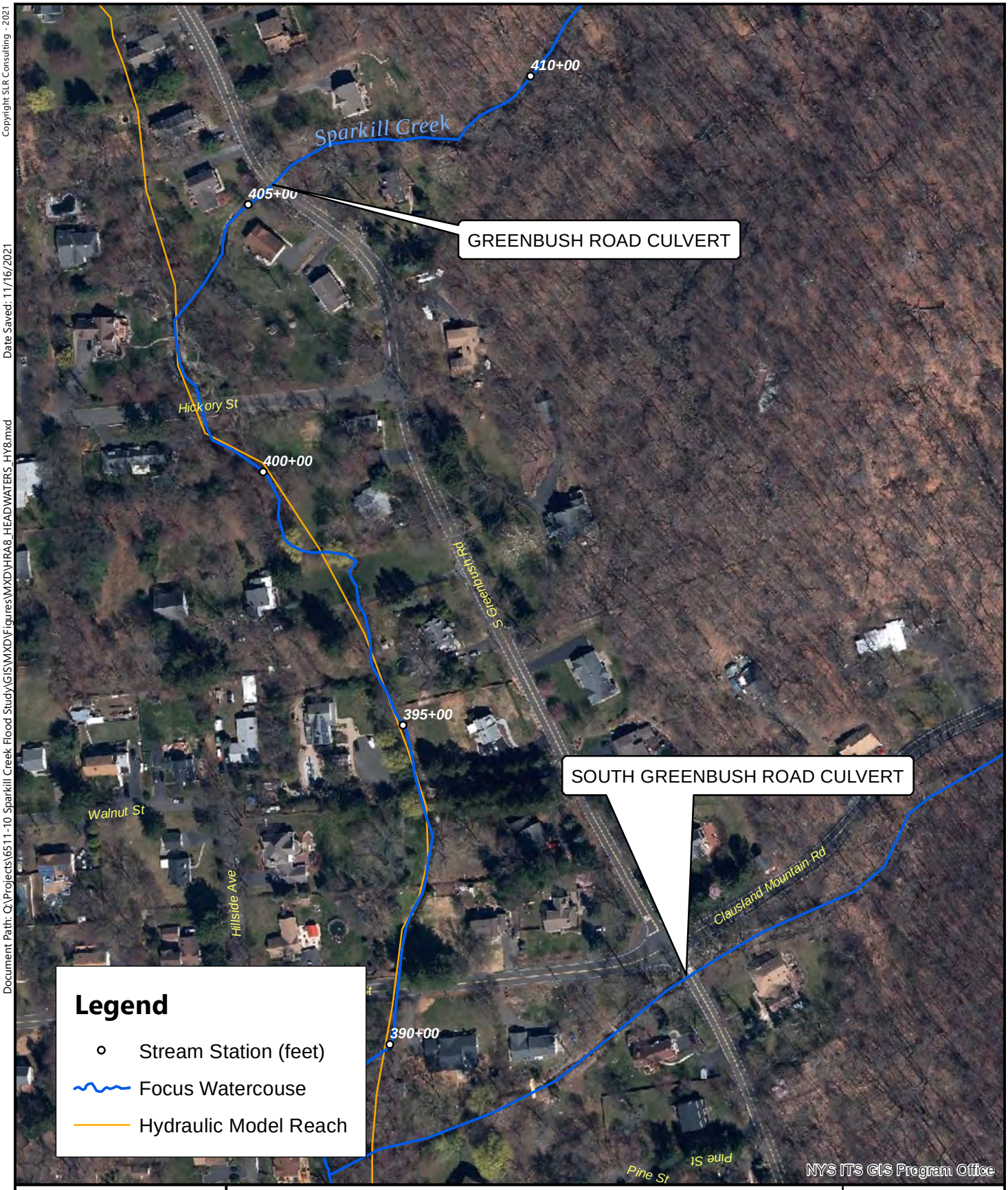

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HRA#8 - HY-8 CULVERT ANALYSIS

SPARKILL CREEK FLOOD & RESILIENCE STUDY
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ROCKLAND COUNTY
NEW YORK

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SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

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FIG. 4-91

According to the analysis, the South Greenbush Road crossing has a capacity of 191 cubic feet per second (cfs) or greater than the current 100-year peak discharge. The crossing at Greenbush Road is shown to have a capacity of 182 cfs, which is just above the current 50-year peak discharge. Under future flow conditions, peak discharges would increase anywhere from 10 percent to 13 percent along each watercourse. This would reduce the current capacity closer to the future 25-year flow at Greenbush Road and the future 50-year flow at South Greenbush Road. The peak-flow values used in this assessment are listed in Table 4-5.

Table 4-5 Modeled Peak-Flow Discharges at South Greenbush Road and Greenbush Road

Recurrence Interval (Years)	Regional Regression Peak Flow (cfs)		Future Flows Explorer Peak Flows (cfs)		Percent Increase (%)	
	South Greenbush Road	Greenbush Road	South Greenbush Road	Greenbush Road	South Greenbush Road	Greenbush Road
5-Year	64	74	71	81	11%	10%
10-Year	88	101	98	113	11%	12%
25-Year	123	142	138	158	12%	11%
50-Year	154	177	173	199	12%	12%
100-Year	188	216	213	244	13%	13%

Based on this analysis, the culvert under South Greenbush Road is not a significant hydraulic constriction and is shown to pass the future 50-year peak discharge under unobstructed conditions. In addition to routinely scheduled inspections and maintenance to keep the inlet free of debris, it is recommended that the fill material over the outlet of the auxiliary culvert be removed to further improve flow conveyance at this crossing.

An analysis was performed at Greenbush Road to determine the necessary culvert dimensions required to fully convey the future 50-year peak flow. Increasing the span of the culvert from 10 feet to 12 feet would be sufficient to pass the future 50-year peak flow without overtopping the roadway. When the culvert is due for replacement, it is recommended that a rigorous hydrologic and hydraulic study be conducted to properly size the replacement structure.

5. RECOMMENDATIONS

Sparkill Creek originates in southeastern Rockland County, drains to the Hudson River Estuary, and has a watershed of 11.2 square miles. This report identifies HRAs within the Sparkill Creek watershed. Flood mitigation recommendations are provided either as HRA-specific recommendations or as overarching recommendations that apply to the entire watershed or stream corridor. Flood mitigation scenarios such as floodplain enhancement and channel restoration, road closures, and replacement of undersized bridges and culverts are investigated and are recommended where appropriate.

5.1 HRA 1 RECOMMENDATIONS

Floodproofing and elevation of pumps and electrical equipment is recommended at the sanitary pump station on Ferdon Avenue to ensure that it can continue to function as required during extreme weather events and under projected sea level rise scenarios.

As demonstrated by sea level rise projections, it will become impractical for homes and businesses to remain at their current locations along Sparkill Creek. The following recommendations are provided:

- Relocation of the Department of Public Works facility on Piermont Avenue to a location that is not prone to flooding is recommended.
- Relocations or elevations of flood-prone homes and businesses in flood-prone and tidally inundated areas are recommended.
- Consideration should be given to a bundled relocation of flood-prone homes and businesses, the Department of Public Works facility, and other municipal buildings to a single site or location within the village that is outside of the SFHA and not prone to current or future projected flooding.
- Removal of the Piermont Paper Company Dam and restoration of the channel are recommended.

5.2 HRA 2 RECOMMENDATIONS

The replacement of the William Street bridge with a new structure with a span of approximately 60 feet is recommended. A new bridge would reduce flooding at the Sparkill Palisades Fire Department, a critical facility, and of the homes along Route 340. Flooding frequency and depth at the sanitary pump station would also be reduced.

Consideration should be given to the undersized crossing at William Street and the potential to combine the benefits from its replacement with replacement of the undersized crossing that conveys Sparkill Creek under the PIP.

Floodproofing and elevation of pumps and electrical equipment are recommended at the William Street sanitary pump station in Sparkill to ensure that it can continue to function as required during extreme weather events. Floodproofing should extend above the modeled 100-year flooding depths of 2.0 feet,

plus adequate freeboard of at least 2 feet. It is recommended that the State Flood Risk Guidelines that were developed as part of CRRA be consulted for guidance.

Removal of the Boss Pond Dam is recommended. Removing the structure and restoring the river reach upstream of the dam to a more natural condition would reduce water surface elevations during flood events. The dam serves no apparent function and creates a barrier to aquatic organism passage.

5.3 HRA 3 RECOMMENDATIONS

The flood mitigation scenario described in Section 4-3 is recommended. This entails the following components:

- Replace the former railroad bridge with an adequately sized structure of approximately 60 feet in width, or completely remove the bridge if it is not a necessary component of the Joseph B. Clarke Rail Trail.
- Replace the current PIP crossing with a new structure with a 60-foot span, with accompanying detailed hydrologic and hydraulic analyses.
- Replace the Oak Tree Road bridge with a new structure with a span of 73 feet, with accompanying detailed hydrologic and hydraulic analyses.
- Relocate businesses on the right bank of Sparkill Creek, downstream of the Oak Tree Road bridge.
- Create and enhance the floodplain and increase the channel size downstream of the Oak Tree Road bridge from STA 139+00 to STA 148+00.

Implementing the measures described above without replacing the PIP culvert with a larger structure would negate the flood reduction benefits. The PIP culvert is influenced by the tailwater condition created by the William Street bridge and should be considered when evaluating alternatives at the PIP crossing. A rigorous and detailed hydraulic and hydrologic analysis is recommended as a component of the design of these replacement structures.

5.4 HRA 4 RECOMMENDATIONS

The flood mitigation scenario described in Section 4.4 is recommended. The scenario includes the following components:

- Replace the Kings Highway bridge with an adequately sized structure with a minimum span of 50 feet, with accompanying detailed hydrologic and hydraulic analyses.
- Replace the Washington Street bridge with an adequately sized structure with a minimum span of 50 feet, with accompanying detailed hydrologic and hydraulic analyses.
- Replace the Oak Tree Road bridge with an adequately sized structure with a minimum span of 60 feet, with accompanying detailed hydrologic and hydraulic analyses.
- Relocate businesses and remove parking lot adjacent to Sparkill Creek.
- Enhance and enlarge the floodplain along both sides of Sparkill Creek in key areas.

- Widen undersized and channelized sections of the Sparkill Creek channel to the bankfull width of approximately 39 feet.
- Realign Sparkill Creek through Tappan Memorial Park, eliminating two hard bends and better aligning the channel with the Oak Tree Road bridge, leaving the existing channel through the park to act as an overflow during large flood events.
- Remove pedestrian bridge in the park.

5.5 HRA 5 RECOMMENDATIONS

When the PIP and State Route 303 culverts are due for replacement, an updated detailed hydrologic and hydraulic analysis is recommended as part of replacement design. The most current regulations and guidance from NYSDOT and NYSDEC regarding stream crossing geometry and hydraulic performance should be applied, as well as updated assessments of projected future flows. As part of the recommended analysis, the installation of additional culverts adjacent to the existing PIP culverts should be evaluated.

Individual flood protection measures or property buyouts are recommended for residential structures along Bell Lane and Julia Court that currently experience flooding.

Flood protection measures are recommended for the CubeSmart facility and the Rockland County Sewer Facility if these buildings experience flooding.

5.6 HRA 6 RECOMMENDATIONS

The following actions are recommended in HRA 6:

- Replacement of the Joseph B. Clarke Rail Trail bridge with a new structure with a span of at least 44 feet
- Removal of the railroad embankment to accommodate the larger span
- Widening of the Sparkill Creek channel to a bankfull width of 34 feet
- Widening the floodplain immediately upstream and downstream of the crossing
- Flood protection measures for the Rockland County Sewer Facility if vulnerable components experience flooding

5.7 HRA 7 RECOMMENDATIONS

5.7.1 ROUTE 303/MOUNTAIN VIEW AVENUE RECOMMENDATIONS

North of the intersection of State Route 303 and Mountain View Avenue, the following actions are recommended:

- Replacement of the existing bridge at State Route 303 with a new structure span of 50 feet, with accompanying detailed hydrologic and hydraulic analyses
- Widening the channel upstream and downstream to the bankfull width of 31 feet

- Creation of a floodplain where space allows

West of the intersection of State Route 303 and Mountain View Avenue, the following actions are recommended:

- Replacement of the existing bridge at Mountain View Avenue with a new structure span of 50 feet, with accompanying detailed hydrologic and hydraulic analyses
- Widening the channel upstream and downstream to the bankfull width of 31 feet
- Creation of a floodplain where space allows

5.7.2 INNOVATIVE PLASTICS BRIDGE/OLD SCHOOL LANE AND ORANGEBURG ROAD

It is recommended that the bridge that spans Sparkill Creek at the private drive to Innovative Plastics be removed and the channel widened to the bankfull width of 31 feet from STA 340+30 to STA 345+30.

The twin-barreled culvert at Old School Lane and Orangeburg Road passes up to the 500-year flows and does not create a substantial backwater. It is recommended that debris be cleared from the inlet and the left bank be widened immediately upstream of the structure to optimize the culvert capacity.

5.7.3 ROUTE 303 BRIDGE/ROUTE 340 CULVERTS/ROCKLAND COUNTY SEWER

The following recommendations are provided at the Route 303, Route 340, and Sewer crossings:

- Replacement of the existing crossings with new structures with spans of 40 feet, with accompanying detailed hydrologic and hydraulic analyses
- Increasing the floodplain on the left bank upstream and downstream of the sewer facility driveway
- Widening the channel to the bankfull width of 31 feet

5.8 HRA 8 RECOMMENDATIONS

5.8.1 GREENBUSH ROAD NEIGHBORHOOD RECOMMENDATIONS

Replacement of nine crossings is recommended along Sparkill Creek as it flows along the west side of Greenbush Road between Spruce Street and Erie Street.

- It is recommended that new structures have spans of 28 feet. Accompanying detailed hydrologic and hydraulic analysis is recommended at each crossing.
- Widening of undersized areas of the channel to a bankfull width of 22 feet is recommended.
- Increasing the rise of the Hickory Street culvert from 2 feet to 4 feet and removing the pedestrian bridge just upstream of this crossing would further reduce flooding.
- Because many of the crossings are privately owned culverts under residential driveways, close cooperation with residents will be required and is recommended.

5.8.2 SOUTH GREENBUSH ROAD/GREENBUSH ROAD RECOMMENDATIONS

At the culvert under South Greenbush Road, routinely scheduled inspections and maintenance are recommended to keep the inlet free of debris. It is recommended that the fill material over the outlet of the auxiliary culvert be removed to further improve flow conveyance at this crossing. At the culvert under South Greenbush Road, increasing the span of the culvert from 10 feet to 12 feet is recommended when the culvert is due for routine replacement, with accompanying detailed hydrologic and hydraulic analyses.

5.9 FLOODPROOFING AT WASTEWATER PUMP STATIONS AND TREATMENT PLANTS

Several municipal sewage treatment facilities and sanitary pump stations are located along Sparkill Creek. Many of these critical facilities are located within FEMA's SFHA, indicating that they are prone to flooding. Floodproofing and elevation of pumps and electrical equipment are recommended to ensure that these facilities can continue to function as required during extreme weather events.

5.10 REPLACEMENT OF UNDERSIZED STREAM CROSSINGS

Hydraulically undersized stream crossings along Sparkill Creek can contribute to flooding and washout of roadways. In addition to the recommendations for the replacement of stream crossings within each of the HRAs described above, it is recommended that undersized stream crossings elsewhere in the Sparkill Creek watershed be identified and prioritized for replacement. Guidance for this prioritization should be based on capacity modeling and aquatic organism passage data for culverts in Rockland County that have been assessed through the NAACC program. Where multiple stream crossings are slated for replacement along a reach of watercourse, it is recommended that replacements begin at the downstream end and progress sequentially in an upstream direction.

5.11 INSTALLATION AND MONITORING OF STREAM GAUGE

There is currently no active stream gauge on Sparkill Creek, making statistical analysis difficult. Stream gauges provide valuable data that can be used in future hydrologic analyses and to improve flood monitoring and forecasting. Installation of a permanent stream gauge is recommended.

5.12 INDIVIDUAL PROPERTY FLOOD PROTECTION

A variety of measures is available to protect existing public and private properties from flood damage. While broader mitigation efforts are most desirable, they often take time and money to implement. On a case-by-case basis where structures are at risk, individual floodproofing should be explored. This is especially emphasized within HRA 1 in Piermont, where the potential for flooding is influenced by sea level rise. Property owners within FEMA-delineated floodplains should also be encouraged to purchase flood insurance under the NFIP and to make claims when damage occurs. Potential measures for property protection include the following:

Elevation of the structure – Home elevation involves the removal of the building structure from the basement and elevating it on piers to a height such that the first floor is located at least 2 feet above the level of the 100-year flood event. The basement area is abandoned and filled to be no higher than the existing grade. All utilities and appliances located within the basement must be relocated to the first-floor level or installed from basement joists or similar mechanism.

Construction of property improvements such as barriers, floodwalls, and earthen berms – Such structural projects can be used to prevent shallow flooding. There may be properties within the basin where implementation of such measures will serve to protect structures.

Dry floodproofing of the structure to keep floodwaters from entering – Dry floodproofing refers to the act of making areas below the flood level watertight and is typically implemented for commercial buildings that would be unoccupied during a flood event. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents can be either permanently closed or covered with removable shields. Flood protection should extend only 2 to 3 feet above the top of the concrete foundation because building walls and floors cannot withstand the pressure of deeper water.

Wet floodproofing of the structure to allow floodwaters to pass through the lower area of the structure unimpeded – Wet floodproofing refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures. Wet floodproofing should only be used as a last resort. If considered, furniture and electrical appliances should be moved away or elevated above the 100-year flood elevation.

Performing other home improvements to mitigate damage from flooding – The following measures can be undertaken to protect home utilities and belongings:

- Relocate valuable belongings above the 100-year flood elevation to reduce the amount of damage caused during a flood event.
- Relocate or elevate water heaters, heating systems, washers, and dryers to a higher floor or to at least 12 inches above the BFE (if the ceiling permits). A wooden platform of pressure-treated wood can serve as the base.
- Anchor the fuel tank to the wall or floor with noncorrosive metal strapping and lag bolts.
- Install a backflow valve to prevent sewer backup into the home.
- Install a floating floor drain plug at the lowest point of the lowest finished floor.
- Elevate the electrical box or relocate it to a higher floor and elevate electric outlets.

Encouraging property owners to purchase flood insurance under the NFIP and to make claims when damage occurs – While having flood insurance will not prevent flood damage, it will help a family or business put things back in order following a flood event. Property owners should be encouraged to submit claims under the NFIP whenever flooding damage occurs in order to increase the eligibility of the property for projects under the various mitigation grant programs.

5.13 ROAD CLOSURES

Approximately 75 percent of all flood fatalities occur in vehicles. Shallow water flowing across a flooded roadway can be deceptively swift and wash a vehicle off the road. Water over a roadway can conceal a washed out section of roadway or bridge. When a roadway is flooded, travelers should not take the chance of attempting to cross the flooded area. It is not possible to tell if a flooded road is safe to cross just by looking at it.

One way to reduce the risks associated with the flooding of roadways is their closure during flooding events, which requires effective signage, road closure barriers, and consideration of alternative routes.

According to FEMA modeling and anecdotal reporting, flood-prone roads exist within the Sparkill Creek watershed. In some cases, small, unnamed tributaries and even roadside drainage ditches can cause washouts or other significant damage to roadways, culverts, and bridges. Drainage issues and flooding of smaller tributary streams are generally not reflected in FEMA modeling, so local public works and highway departments are often the best resource for identifying priority areas and repetitively damaged infrastructure.

5.14 COST RANGE OF RECOMMENDED ACTIONS

To assist with planning and prioritization of the above recommendations, Table 5-1 provides an estimated cost range for key recommendations.

Table 5-1: Cost Range of Recommended Actions

	< $100k	$100k - $500k	$500k - $1M	$1M - $5M
HRA 1 - Floodproofing and elevation of pumps and electrical equipment at the sanitary pump station			X	
HRA 1 - Relocation of Department of Public Works facility				X
HRA 1 – Removal of Piermont Paper Company Dam and restoration of channel			X	
HRA 2 - Replacement of William Street bridge				X
HRA 2 - Removal of Boss Pond Dam			X	
HRA 2 - Floodproofing and elevation of pumps and electrical equipment at the sanitary pump station			X	
HRA 3 - Replace former railroad bridge with an adequately sized structure, or remove the bridge		X		
HRA 3 - Replace PIP crossing				X
HRA 3 - Replace Oak Tree Road bridge				X
HRA 3 - Create and enhance floodplain and increase channel size downstream of Oak Tree Road bridge			X	
HRA 4 - Replace Kings Highway bridge				X
HRA 4 - Replace Washington Street bridge				X
HRA 4 - Replace Oak Tree Road bridge				X
HRA 4 - Enhance and enlarge floodplain along Sparkill Creek in key areas			X	
HRA 4 - Widen undersized and channelized sections of channel				X
HRA 4 - Realign creek through Tappan Memorial Park				X
HRA 4 - Remove pedestrian bridge in park	X			
HRA 6 – Replace Rail Trail bridge			X	
HRA 6 - Widening of Sparkill Creek channel and floodplain			X	
HRA 6 - Floodproofing and elevation of pumps and electrical equipment at Rockland County Sewer Facility				X
HRA 7 – Bridge replacement and channel improvements at State Route 303 crossing north of intersection of State Route 303 and Mountain View Avenue				X
HRA 7 – Bridge replacement and channel improvements at Mountain View Avenue crossing west of intersection of State Route 303 and Mountain View Avenue				X
HRA 7 – Removal of bridge and channel improvements at private drive to Innovative Plastics			X	
HRA 7 – Bridge replacement and channel improvements at Route 303 and Route 340				X
HRA 8 - Replacement of crossings along Sparkill Creek on west side of Greenbush Road between Spruce Street and Erie Street (each crossing)		X		

5.15 FUNDING SOURCES

Several funding sources may be available for the implementation of recommendations made in this report. These and other potential funding sources are discussed in further detail below. Note that these may evolve over time as grants expire or are introduced.

Emergency Watershed Protection (EWP) Program

Through the EWP program, the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) can help communities address watershed impairments that pose imminent threats to lives and property. Most EWP work is for the protection of threatened infrastructure from continued stream erosion. NRCS may pay up to 75 percent of the construction costs of emergency measures. The remaining costs must come from local sources and can be made in cash or in-kind services. EWP projects must reduce threats to lives and property; be economically, environmentally, and socially defensible; be designed and implemented according to sound technical standards; and conserve natural resources.

FEMA Pre-Disaster Mitigation (PDM) Program

The PDM program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 U.S.C. 5133. The PDM program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and implementation of mitigation projects prior to disasters, providing an opportunity to reduce the nation's disaster losses through PDM planning and the implementation of feasible, effective, and cost-efficient mitigation measures. Funding of pre-disaster plans and projects is meant to reduce overall risks to populations and facilities. The PDM program is subject to the availability of appropriation funding as well as any program-specific directive or restriction made with respect to such funds.
https://www.fema.gov/pre-disaster-mitigation-grant-program

FEMA Hazard Mitigation Grant Program (HMGP)

The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.

The HMGP is one of the FEMA programs with the greatest potential fit to potential projects recommended in this report. However, it is available only in the months subsequent to a federal disaster declaration in the State of New York. Because the state administers the HMGP directly, application cycles will need to be closely monitored after disasters are declared in New York.
https://www.fema.gov/hazard-mitigation-grant-program

FEMA Flood Mitigation Assistance (FMA) Program

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.

The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) programs and made the following significant changes to the FMA program:

- The definitions of repetitive loss and SRL properties have been modified.
- Cost-share requirements have changed to allow more federal funds for properties with RFC and SRL properties.
- There is no longer a limit on in-kind contributions for the nonfederal cost share.

One limitation of the FMA program is that it is used to provide mitigation for *structures* that are insured or located in SFHAs. Therefore, the individual property mitigation options are best suited for FMA funds. Like PDM, FMA programs are subject to the availability of appropriation funding as well as any program-specific directive or restriction made with respect to such funds.
http://www.fema.gov/flood-mitigation-assistance-grant-program

NYS Department of State

The Department of State may be able to fund some of the projects described in this report. In order to be eligible, a project should link water quality improvement to economic benefits.

NYS Department of Environmental Conservation – Municipal Waste Reduction and Recycling (MWRR) Program

The NYS Department of Environmental Conservation (DEC) administers MWRR funding to local government entities for waste reduction and recycling projects. The overall goal of this funding program is to assist municipalities in expanding or improving local waste reduction and recycling programs and to increase participation in those programs.

The MWRR state assistance program can help fund the costs of the following:

- Capital Investment in Facilities and Equipment

Eligible projects are expected to enhance municipal capacity to collect, aggregate, sort, and process recyclable materials. Recycling equipment includes structures, machinery, or devices providing for the environmentally sound recovery of recyclables including source separation equipment and recyclables recovery equipment.

U.S. Army Corps of Engineers (USACE)

The USACE provides 100 percent funding for floodplain management planning and technical assistance to states and local governments under several flood control acts and the Floodplain Management Services Program (FPMS). Specific programs used by the USACE for mitigation are listed below.

- Section 205 – Small Flood Damage Reduction Projects: This section of the 1948 Flood Control Act authorizes the USACE to study, design, and construct small flood control projects in partnership with nonfederal government agencies. Feasibility studies are 100 percent federally funded up to $100,000, with additional costs shared equally. Costs for preparation of plans and construction are funded 65 percent with a 35 percent nonfederal match. In certain cases, the nonfederal share for construction could be as high as 50 percent. The maximum federal expenditure for any project is $7 million.

- Section 14 – Emergency Stream Bank and Shoreline Protection: This section of the 1946 Flood Control Act authorizes the USACE to construct emergency shoreline and stream bank protection works to protect public facilities such as bridges, roads, public buildings, sewage treatment plants, water wells, and nonprofit public facilities such as churches, hospitals, and schools. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $1.5 million.

- Section 208 – Clearing and Snagging Projects: This section of the 1954 Flood Control Act authorizes the USACE to perform channel clearing and excavation with limited embankment construction to reduce nuisance flood damages caused by debris and minor shoaling of rivers. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $500,000.

- Section 206 – Floodplain Management Services: This section of the 1960 Flood Control Act, as amended, authorizes the USACE to provide a full range of technical services and planning guidance necessary to support effective floodplain management. General technical assistance efforts include determining the following: site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. Types of studies conducted under FPMS include floodplain delineation, dam failure, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, floodproofing, and inventories of flood-prone structures. When funding is available, this work is 100 percent federally funded.

In addition, the USACE provides emergency flood assistance (under Public Law 84-99) after local and state funding has been used. This assistance can be used for both flood response and post-flood response. USACE assistance is limited to the preservation of life and improved property; direct assistance to individual homeowners or businesses is not permitted. In addition, the USACE can loan or issue supplies and equipment once local sources are exhausted during emergencies.

New York State Grants

All New York State grants are now announced on the NYS Grants Gateway. The Grants Gateway is designed to allow grant applicants to browse all NYS agency anticipated and available grant opportunities, providing a one-stop location that streamlines the way grants are administered by the State of New York.
https://grantsmanagement.ny.gov/

Bridge NY Program

The Bridge NY program, administered by NYSDOT, is open to all municipal owners of bridges and culverts. Projects are awarded through a competitive process and support all phases of project development. Projects selected for funding are evaluated based on the resiliency of the structure, including such factors as hydraulic vulnerability and structural resiliency; the significance and importance of the bridge including traffic volumes, detour considerations, number and types of businesses served and impacts on commerce; and the current bridge and culvert structural conditions.
https://www.dot.ny.gov/BRIDGENY.

Private Foundations

Private entities such as foundations are potential funding sources in many communities. Communities will need to identify the foundations that are potentially appropriate for some of the actions proposed in this report.

In addition to the funding sources listed above, other resources are available for technical assistance, planning, and information. While the following sources do not provide direct funding, they offer other services that may be useful for proposed flood mitigation projects.

Land Trust and Conservation Groups

These groups play an important role in the protection of watersheds, including forests, open space, aquatic ecosystems, and water resources.

Communities will need to work closely with potential funders to ensure that the best combinations of funds are secured for the proposed alternatives and for the property-specific mitigation such as floodproofing, elevations, and relocations. It will be advantageous for the communities to identify combinations of funding sources in order to reduce their own requirements to provide matching funds.

6. LAND USE ANALYSIS

6.1 LAND USE AND ZONING REVIEW AND ANALYSIS

Potential changes to land use, particularly development proposals in close proximity to a waterbody or within a riparian buffer, can bring about issues and consequences both for the impact on those developments should a flood occur but also as a contributor to the flooding problem itself. In New York State, land use is controlled at the municipal level through zoning, subdivision, and other related regulations including wetlands and floodplain ordinances.

In Rockland County, there has been a significant amount of work conducted by the state, county, and local municipalities, typically following a flood event such as Hurricane Sandy, which creates an immediate need to respond to the disaster as well as an understanding that situations surrounding such disasters need to be assessed and plans developed to mitigate likely future repeat events.

One agency in Rockland County that has regulatory jurisdiction over activities within 100 feet of specified streams, including portions of Sparkill Creek, is the Rockland County Drainage Agency.

http://rocklandgov.com/departments/highway/drainage-agency/

This analysis reviewed publicly available project-relevant documents found online to identify recommendations and opportunities identified for communities to address issues related to flooding through land use and zoning. This analysis also provides "best practice" recommendations that communities in Rockland County can review and discuss implementing, if not already in the municipal code. A significant and positive finding from this effort is that every community assessed within the Sparkill Watershed has adopted a Flood Damage Prevention Ordinance. These ordinances, generally adopted in 2013 and 2014, go a long way toward addressing potential issues and concerns related to flooding and land use planning.

Our review of the following documents did not find any municipal-specific land use or zoning recommendations to carry forward for this project. We have summarized any potential recommendations related specifically to flooding that may be useful to consider when assessing potential changes to existing zoning, subdivision, and other regulations that could impact flood-related conditions:

- *Hudson River Estuary Habitat Restoration Plan - NYSDEC* (2013)
  - This plan identifies priority habitats vital to the health and resiliency of the estuary and actions for restoring them. The plan states that it is "…the basis for coordinating funding, planning, research and implementation of resources toward a single, focused goal: The enduring health and well-being of the Hudson River estuary, its inhabitants and the people of the Hudson River Valley and New York State." It states that despite improvements in the Hudson River there "…remains a profound need for habitat restoration." There was nothing specific to Rockland County communities identified in this plan. That said, riparian buffer protections and related protections of vital habitats by municipalities will generally assist with the implementation and protection efforts identified and desired by this plan.

- All Rockland County communities have a flood damage prevention ordinance. The standards adopted can vary from community to community, but they all provide construction standards for actions within flood hazard areas.

- All Rockland County communities are under the "umbrella" of the 2011 Rockland County Comprehensive Plan *Rockland Tomorrow: County Comprehensive Plan.* There are only a few specific mentions or recommendations related to flooding and flood prevention for individual municipalities, but where such a mention is made, it is included under that community below. All communities fall within the following recommendations from the Plan:
    - Land Use and Zoning Chapter
        - No key issues are identified.
    - Natural Resources Chapter - Encourage the municipalities to establish buffers along streams as appropriate, with the specific distance dictated by conditions on the ground and scientific study.
    - Infrastructure Chapter - Use planning techniques for green infrastructure and stormwater management, as provided by the NYSDEC.

- *Cleaner, Greener Communities Mid-Hudson Regional Sustainability Plan (Mid-Hudson Planning Consortium)* 2013
    - This plan was developed to "…set realistic yet ambitious objectives for the long term sustainable development of the Region, each of which is supported by initiatives and projects that can be implemented in the short-, medium-, and long-term." The plan lists 218 project ideas, some of which are directed toward Rockland County specifically, but none of those projects is flood or land use/zoning focused. That said, there are Mid-Hudson wide recommended projects related to flooding that are relevant including the following:
        - Project 6 – Scenic Hudson is working with 16 land trusts and government agencies to save ridgelines with iconic views, forests, and wetlands critical to maintaining the Hudson Valley's extraordinary biological diversity and farmland.
        - Project 44 – Hudson River Greenway Water Trail – a 256-mile, 96-site water trail for kayakers and boaters extending from the Adirondack Park and Lake Champlain to Manhattan
        - Project 63 – Install porous pavement in municipalities.
        - Project 188 – Increases in the extent of riparian buffers
        - Project 203 – Watershed remediation. This project will help identify and target funds to specific vulnerable locations to protect roads and other facilities from flooding.
        - Project 212 – Get municipalities involved in green infrastructure. Enable more green infrastructure projects by removing cost and knowledge barriers.
- Rockland County Hazard Mitigation Plan (HMP)

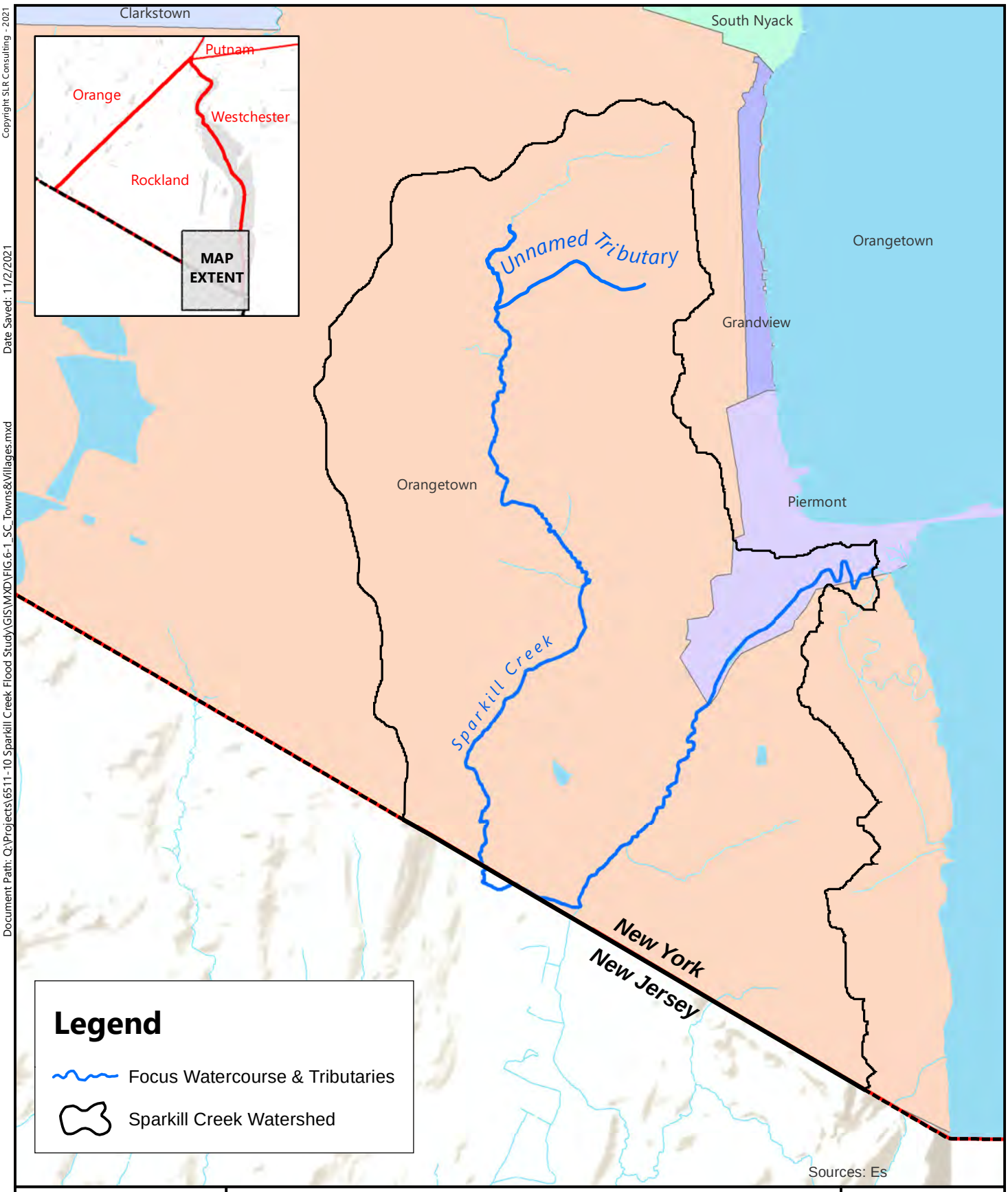
- This plan "…demonstrates county and community commitment to reducing risks from all hazards and serves as a guide for decision makers as they commit resources to minimize the effects of hazards. The HMP is the blueprint for reducing the county's vulnerability to disasters and hazards. The HMP is intended to integrate with county and municipal planning mechanisms already in place, such as building and zoning regulations, environmental planning, and long-range planning mechanisms."
    - All Rockland County communities had a Jurisdictional Annex developed detailing information about their community. A summary of the relevant information from these Annexes is provided below.

The following section details individual recommendations for each community being assessed within the Sparkill Watershed. Following these write-ups are "best practices" that each community can review to assess whether or not they are already in their municipal code or are an opportunity to enhance the code to further protect municipal resources, residents, businesses, and the natural environment from unplanned and unwanted impacts from flooding.

This Sparkill Watershed planning effort undertook an initial assessment of best practices that could be identified as already in existence in the Sparkill Watershed municipalities. All municipalities are encouraged to continue the work to conduct an audit of their codes, design documents, and practices to identify and assess the potential to implement as many best practices in their municipalities as are realistically feasible.

6.2 MUNICIPAL ASSESSMENTS

The following section details individual recommendations for each community being assessed within the Sparkill Creek Watershed. A map with the boundaries of the Sparkill Creek watershed and the towns and villages that fall within it is depicted in Figure 6-1. In the recommendations section of this report are "best practices" that each community can review to assess whether or not they are already in their municipal code or are an opportunity to enhance the code to further protect municipal resources, residents, businesses, and the natural environment from unplanned and unwanted impacts from flooding.



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SLR

231 MAIN STREET
SUITE 102
NEW PALTZ, NY 12561
845.633.8153

SPARKILL RIVER WATERSHED TOWNS & VILLAGES

SPARKILL CREEK FLOOD & RESILIENCY STUDY
SD115
ROCKLAND COUNTY
NEW YORK

N

0 1,500 3,000
Feet

SCALE 1 " = 3,500 '
DATE 11/4/2021
16511.00010
PROJ. NO.

FIG. 6-1

6.2.1 TOWN OF ORANGETOWN

Zoning & Other Code(s) Analysis

https://ecode360.com/26866922

The town has a "Flood Damage Prevention" code (Chapter 14B) that regulates development activities and outlines requirements to prevent flood-related damage. Article XIV of the Town Code provides regulations for the Sparkill Hamlet Center Overlay Zoning District. This section does not include regulations regarding flooding-related issues; however, the Overlay Zoning District does note that said regulations within the Overlay do not impact preexisting structures that are damaged by flood, fire, or other natural disaster. The Zoning *Notes to Use and Bulk Chart* restricts the amount of land that counts toward lot area if said land is underwater. The Conservation Easements Section (21-7.1) provides the Planning Board with authorization to require a conservation easement on real property with unique scenic value in the Critical Environmental Area; any land under water; any land within a freshwater wetland; land subject to flooding or within the one-hundred-year-frequency floodplain; land with slopes (unexcavated) of over 25 percent; and on any other real property for the purpose of protecting environmentally sensitive land, or to otherwise protect the environment or land due to special characteristics or the character of the neighborhood wherein subdivision is sought. The code allows the Planning Board to require conservation easements for flood-prone areas.

Chapter 42 "Zoning and Building Permits: Moratorium" states that the town *had* a law requiring that building permits for residential and nonresidential construction and subdivisions not be approved in areas designated as one-hundred-year "storm frequency" as set forth in the Weaver Report concerning the Sparkill Creek, the Velzy Report concerning the Nauraushaun Creek, and the Larkin Report concerning the Pascack Creek. These regulations expired in 1974 but are still listed in the code.

Other Land Use Documents Reviewed:

The town website includes links to many different plans and projects that have been undertaken in recent years.

- The Sparkill Watershed Flood Mitigation project page includes pictures of Sparkill Creek Watershed flooding and existing conditions. Linked to these pictures are three documents – a list of documents relevant to the Sparkill Creek (summarized below); notes detailing information pulled from the 2014 FEMA FIS, flood events by date, and documented Irene flooding sites; and a May 1999 Sparkill Creek Flood Control Analysis.
  - The relevant documents listed included the following:
    - Rockland County Comprehensive Plan
    - Orangetown Comprehensive Plan (2003) and an update in 2011
    - Flood Analyses from 1999
    - A Drainage District analysis from 2006
    - A note that flooding studies have been conducted with proposed engineering solutions downstream of Oak Tree Road and at the Piermont skating pond area
    - A note that the drawbridge over the Sparkill is on the National Register of Historic Places
    - A note that the Piermont marsh is a significant natural resource and is a Hudson River National Estuarine Research Reserve site

- The summary of the 2014 FEMA FIS noted that the town is subject to flooding from the Sparkill Creek in the eastern portion of the town and the Muddy Creek in the western portion of the town. The flooding is the result of inadequate drainage facilities and increased urbanization of the area(s). Three areas along the Sparkill Creek were noted to have the most severe flooding issues. These included the area west of Greenbush Road in the vicinity of Spruce and Hickory Streets, along State Route 303 in the Orangeburg Road area, and areas along State Route 340 and Valentine Avenue. This summary of the FEMA plan also noted that Piermont is subject to flooding from both the Sparkill Creek and Hudson River. When drafted in 2018, the author of the summary noted that it appeared that many of the specific flooding issues listed were outdated as improvements and changes to the landscape had since taken effect.
- The Comprehensive Plan and 2011 update included significant relevant information. The plan is noted to include frequent mentions of the Sparkill Creek as an environmental and flooding concern. The summary quotes plan language stating that areas abutting the creek have been encroached upon by past development and are affected by uncontrolled runoff and that flooding is the result of activities that took place prior to the "current" regulations (current as of 2011). These problems are noted to include development within the flood zone, lack of retention/detention facilities, stream encroachment, filling of wetlands, insufficient drainage system sizing of culverts, and removal of vegetation. Flooding has also been an issue in the Clausland Mountain Area. Recommendations noted in the plan included protection along the Sparkill Creek, creation of a drainage district, requiring existing development along the creek to mitigate any adverse environmental impacts that took place in the past, implementation of new Stormwater Regulations, and efforts to protect the creek from future development and redevelopment adverse impacts.

  The 2011 Comprehensive Plan Update summary noted that the Sparkill Creek runs along portions of Route 202 in existing drainage basins that are unattractive. It was noted that the creek in these locations could become a design element, as was previously suggested in the 2004 Comprehensive Plan.

The County Comprehensive Plan, Rockland Tomorrow: County Comprehensive Plan (2011) included one element specific to the Town of Orangetown:

- Historic and Cultural Resources Chapter
  - The Sparkill Creek Drawbridge is on both the State and National Register of Historic Places.

6.2.2 VILLAGE OF PIERMONT

Zoning & Other Code(s) Analysis

https://ecode360.com/9172885

The village has a "Flood Damage Prevention" code (Chapter 112) that regulates development activities and outlines requirements to prevent flood-related damage. The Village of Piermont has a Waterfront Resiliency Commission authorized through Chapter 50 of the Village Code and a Harbor Advisory Commission authorized through Chapter 15.

Other Land Use Documents Reviewed:

The Village of Piermont has several readily publicly available municipal planning documents for review in addition to documents developed by other agencies (like Rockland County).

- Village of Piermont Flood Preparedness Guide
  - This document provides links to CodeRed and NY Alert, defines important flood-related terms, and provides a map showing the location of flood-prone routes, emergency services locations/shelters, unsafe parking areas (during floods), evacuation routes, and flood hazard areas. This document also provides a detailed flood preparedness checklist with links to websites with more information.

- Piermont Waterfront Resiliency Commission (PWRC)
  - This is a volunteer commission tasked with helping Piermont prepare for, develop, and implement resiliency strategies related to waterfront resilience. It is established within the Town Code (Chapter 50).
  - The 2020 PWRC Annual Report documents funding secured, what the current flood risk looks like via mapping showing flood extents and likely depths, and discussion of sea level rise, among other items.
  - The report states that with 16" of sea level rise, several streets, parking lots, and properties on the east side of Piermont Avenue north of the firehouse will flood regularly. It was noted that these risks could have a financial impact on property values and tax revenue for the village. Recommendations include considering relocation to higher ground and assessing impacts on traffic and emergency services with roads that are flooded regularly.
    - There were four action items noted: Securing NFIP Community Rating System (CRS) discounts which were in progress, updating the Comprehensive Plan and code to include Transfer of Development Rights (TDR), securing land suitable for relocation development and funds to redevelop, and facilitating mitigation funding for both public and private projects.
  - A letter from the NYSDEC regarding the Hudson River Estuary Restoration Program – Draft Piermont Marsh Reserve Management Plan of December 2017 focused on the removal of phragmites from the marsh but also discussed stormwater quality entering the marsh from the Sparkill Creek. This letter noted that the DEC permit for the New NY Bridge directed the NYS Thruway Authority to design and implement a green infrastructure project intended to improve the quality of stormwater entering the creek.
  - A 2018 Resiliency presentation prepared by the commission outlined efforts to plan for sea level rise and respond to flood events as well as inform residents about what they can do to build a resilient Piermont.
    - The village, at the time of this presentation, had updated the building code and undertaken FEMA Advisory Base Flood Elevation (ABFE) adoption, updated the Local Waterfront Revitalization Plan (LWRP), designated flood parking areas, and elevated Ferry Road, among other

implementation items. There were plans for the future to undertake community outreach, utilize Cornell and City College of New York (CCNY) Climate Adaptive Design Studio efforts, use the Climate Smart Communities program, secure NFIP-CRS discounts for residents, and work on the Neighbor to Neighbor (N2N) program (this program has an online registration on the village website).

- Harbor Advisory Commission
  - This commission is established in Town Code (Chapter 15). While this commission is primarily focused on developing a Piermont Harbor Management Program and consulting with other boards and commissions, it is responsible for consulting on matters related to the construction of marine structures and dredging in the harbor and ecology of the harbor. Its role includes assessing applications made to the USACE and NYSDEC for potential support or opposition by the village, acting as the liaison to county, state, and federal officials on related matters, and advising and assisting property owners in obtaining necessary permits to maintain bulkheads and seawalls.

- Village of Piermont Local Waterfront Revitalization Program (LWRP) June 2018
  - The LWRP discusses historic sites within the Sparkill Creek floodplain. There is additional discussion about flooding during Hurricane Sandy and Hurricane Irene and areas of frequent flooding along the Piermont waterfront along the Sparkill Creek. Flooding is common at the historic drawbridge on Bridge Street and in the low-lying Bogertown neighborhood. The bulkhead at Parelli Park has had to be repaired. The Piermont Marsh is also highlighted as a critical environmental area as well as the tidal portion of the Sparkill Creek, Brookside Sanctuary, and the Clausland Mt. Ridgeline. The LWRP also focuses on sea level rise risk. Proposed projects related to flooding include Comprehensive Emergency Management Planning, becoming a Climate Smart Community, improving the sewage and stormwater systems (to separate them to reduce dangerous overflows during flooding events), participation in the NFIP CRS, practicing managed retreat, protective measures (seawalls, levees), building elevations, and protection of Piermont Marsh. There is a specific project related to the Sparkill Creek Corridor Flooding and Pollution, and it includes working with the Sparkill Creek Watershed Alliance, Riverkeeper, and other organizations and also petitioning Orangetown, Bergen County, and the Rockland County Drainage Agency authorities to require upstream retention basins or equivalent to mitigate runoff and to limit development in its wetlands.

- A 2014 FEMA FIS done for the Town of Orangetown noted that Piermont is subject to flooding from both the Sparkill Creek and Hudson River. When drafted in 2018, the author of the summary noted that it appeared that many of the specific flooding issues listed were outdated as improvements and changes to the landscape had since taken effect.

- Rockland Tomorrow: County Comprehensive Plan 2011
  Specific elements detailed in the plan specific to the village of Piermont include the following:

- Natural and Environmental Resources Chapter
  - The Sparkill Creek area has been designated as a Critical Environmental Area (CEA) by the village.

6.3 BEST PRACTICES RECOMMENDATIONS

As a component of this flood analysis, a Flood Resiliency Best Practices Audit was conducted for each watershed community. A map with the boundaries of the Sparkill Creek watershed and the towns and villages that fall within it is depicted in Figure 6-1. Results of the audit are presented in the following tables:

Table 6-1: Town of Orangetown
Table 6-2: Village of Piermont

6.3.1 ELEVATION DESIGN AND SCREENING BEST PRACTICES

Based on the preliminary analysis undertaken through the Flood Resiliency Best Practices Audit Checklist, neither community appeared to have specific elevation design and screening criteria in its zoning code for flood-elevated structures. All communities should consider assessing and revising their codes to incorporate specific elevation design and screening best practices.

6.3.2 BULK AND AREA REQUIREMENT FLEXIBILITY

Both communities should consider assessing and revising bulk and area requirements to provide flexibility to permit modifications to setbacks, impervious coverage, and potentially even maximum heights to permit structures to be elevated above the BFE and still provide floor area possibilities that take into account a "loss" of ground floor habitable space. While modifications of such setbacks can be obtained through a Zoning Board of Appeals or similar process and are sometimes waived by a Planning Board, specific regulations permitting deviations from the standard bulk and area requirements, subject to Planning Board approval and proven necessary through the appropriate data and documentation, could bring about more resilient, better designed, and less controversial developments.

6.3.3 FLOODPLAIN CONSTRUCTION PERMITTING

The codes could benefit from tightening up the regulations permitting construction within a floodplain. Consideration of severely restricting or outright banning construction within significant riparian buffer areas and removing these areas from development could be considered. Areas that continually flood could be required to be removed from a density calculation. These areas should be assessed and likely mapped with the rationale for such a strict application. If a community is interested in identifying concepts or efforts to compensate landowners for the inability to now utilize these areas for development, likely by providing increased density or smaller lot sizes (thereby resulting in less infrastructure and site preparation cost) or purchase as public open space, they should also be considered.

Table 6-1 Flood Resiliency Best Practices Code Audit Checklist

Town of Orangetown Preliminary Audit	*In Existing Code*	*Consider for Implementation*	*N/A*	*Notes*
Zoning Code Ordinance Best Practices				
Elevation Design & Screening				
Require design interventions to screen and mitigate elevation impacts on the streetscape for elevated buildings.	☐	☐	☐	
Use hedges and fencing to separate private and public realms. Screen on-site parking located beneath a structure with foundation plantings and vegetative screening. Screen piers and columns that have been used to raise structures.	☐	☐	☐	
Building entries must face the street on which the building fronts, and walkways should provide direct access from the sidewalk to the front door.	☐	☐	☐	
Building fronts, entry porches and similar features must use materials, colors and proportions appropriate for the local architectural context. Large and multi-family building should use treatments similar to ensure local architectural consistency.	☐	☐	☐	
Guidelines for specific design elements such as canopies, galleries, and local significant materials, colors and design strategies to mitigate height and size perceptions are encouraged.	☐	☐	☐	
Bulk & Area Requirements				
Ensure that uses below the building Base Flood Elevation are restricted to access, parking and storage.	☑	☐	☐	The code restricts the lowest floor in certain zones to parking, access or storage and to automatically equalize hydrostatic flood forces.
Permit relief from height limits where possible for developers and property owners who wish to go above the Design Flood Elevation.	☐	☐	☐	
Enact new height limits where possible that are based on the new local design flood elevation (one to two feet over the BFE) where side and rear yard relief is possible.	☐	☐	☐	
Given the increased height of buildings due to elevation, turrets, towers and cupolas, ensure total building height does not exceed maximum height(s) desired, but also ensure that maximum building height requirements allow for building elevations without the need for a variance.	☐	☐	☐	
Require an additional 3’ of freeboard above the base flood elevation for buildings within the Special Flood Hazard Area and 18” of freeboard in the “shaded X” area, which includes buildings between the 100-year and 500-year floodplains. All new single family detached dwellings outside of defined flood hazard areas need to be elevated 16-24”. This approach acknowledges the likelihood of more extreme flooding inside of and more extensive flooding outside of the FEMA-defined flood hazard area (based on historic flooding and not sea-level rise).	☑	☐	☐	The code includes residential and non-residential structure coastal high-hazard area construction standards. Standards are included that require between 2' and 3' above BFE in certain zones as well as requirements for drainage paths in other zones for residential structures. For non-residential structures, the lowest floor should be elevated 2' above BFE if no FIRM number is specified. Structures are to be floodproofed including utilities and sanitary facilities. Within the A, when no base flood data are available, the lowest floor (including basement) shall be elevated at least 3' above the highest adjacent grade.
Permit reduced side or rear yards relative to overall height to allow squatter and more proportional buildings.	☐	☐	☐	
Require riparian and/or floodplain buffers - See also Subdivision Regulations.	☐	☐	☐	
Utilize net density calculations that exclude wetland and floodplain areas in a developable area.	☑	☐	☐	Note 16 in the Notes to Use and Bulk Tables only permits a percentage of land underwater count toward minimum lot area
Establish a maximum percentage of impermeable surface coverage on a lot which limits the density of development and addressing stormwater runoff.	☐	☐	☐	

Other Code Revisions				
Coastal Resilience Overlays could be applied to areas with the highest flood risk. These areas require higher elevations of the first floor, limit parking and hard pavement, and require additional landscaping and open space.	☑	☐	☐	This exists in a way in the code. Within special flood hazard areas, construction or improvements are prohibited without a valid floodplain development permit. For encroachments, assessments and/or a technical evaluation is required and when the Village agrees to apply to FEMA for conditional Firm and floodway revision and approval is received, only then can construction or substantial improvements move forward.
Upland Resilience Overlays could be applied to lower-risk areas capable of accommodating growth. New construction within an Upland Resilience Overlay is also permitted to reduce its own resilience requirements in exchange for placing conservation easements on higher-risk properties.	☑	☐	☐	
Neighborhood Resilience Overlays could be applied to lower-risk areas, and are intended for more typical cases. They allow for customized design standards that are appropriate to the local context.	☑	☐	☐	
Permit property owners to reallocate lost floor area from the ground floor and sub-grade spaces to elsewhere in the structure.	☐	☐	☐	
Ensure that well heads are above the BFE.	☑	☐	☐	The Code requires water supply systems to minimize or eliminate infiltration of floodwaters into the system.
Add flood resistant construction (flood-proofing) standards such as ensuring buildings are watertight, utilities and sanitary facilities are above the BFE, enclosed within the building's watertight walls, or made watertight and resistance. Standards should also ensure that the building's structural components are also flood resistant.	☑	☐	☐	The Code requires anchoring of new structures and substantial improvements as well as the use of materials, utility equipment, and methods and practices that are resistant to flood damage and that minimize flood damage. Utilities must be at least 2' above BFE. Water supply systems must minimize or eliminate infiltration of floodwaters. On-site waste disposal systems must be located to avoid impairment to them, or contamination from them, during flood events.
Prohibit new development unless effect on flooding is minimal or zero.	☑	☐	☐	Code prohibits development encroachment if increases base flood by >1 foot (see encroachment note above). The code requires details of any watercourse alteration or relocation. There are detailed permit application requirements including a technical analysis to determine whether or not proposed development will result in physical damage to any other property.
Prohibit substantial improvements to nonconforming uses or structures in flood prone areas.	☐	☐	☐	
Consider acquisition of flood-prone lands, particularly where they include vital riparian areas and/or could provide a public benefit such as a park or passive open space.	☐	☐	☐	

Subdivision Ordinance Best Practices				
Subdivision Ordinance				
Conservation subdivision (cluster development) to encourage development be built in suitable areas of development that protects important natural features.	☐	☐	☐	
Prohibit subdivisions in floodprone areas.	☑	☐	☐	The Flood Damage Prevention Ordinance requires subdivisions to be consistent with the need to minimize flood damage, utilities and facilities must be located and constructed to minimize flood damage, and adequate drainage needs to be provided to reduce exposure to flood damage. There are code requirements that only a percentage of land underwater count toward minimum lot area (*see above*). When no based flood elevation data are available from other sources in Zone A, the permit applicant for a subdivision or other development shall provide the data for projects greater than 5 acres or 50 lots.

Require and maximize the width of riparian buffers. Provide riparian buffer requirements for the following:	☐	☐	☐	
Stream stabilization - A few dozen feet to a few hundred feet.	☐	☐	☐	
Water quality protection – A few dozen to a few hundred feet (a longer distance if sediment removal is desired)	☐	☐	☐	
Flood attenuation – A few dozen to several hundred feet	☐	☐	☐	
Riparian & wildlife habitat – A few dozen feet up to a mile, though the average minimum is approximately 100' to several hundred or a few thousand feet.	☐	☐	☐	
Protection of cold water fisheries – A few dozen feet to a few hundred feet	☐	☐	☐	
Prohibit development immediately adjacent to streams, rivers, lakes, wetlands and other water bodies.	☐	☐	☐	
Inventory riparian areas as part of the subdivision process and preserve unimpaired riparian areas in natural conditions.	☐	☐	☐	
Require restoration of impaired riparian zones as a condition of subdivision approval.	☐	☐	☐	
Restrict potentially problematic uses (Hazardous materials uses, for example)	☐	☐	☐	
Dedicate land for public facilities and services.	☐	☐	☐	
Require adequate access where evacuation may be necessary or where emergency vehicle access may be required.	☐	☐	☐	
Ensure utilities such as electric, natural gas, water and wastewater are hardened. Require electrical components to be mounted above flood levels. Major utility equipment should be considered a critical facility and be required to be located outside of the 500 year floodplain.	☐	☐	☐	
Consider the long-term needs of the community when discussing the potential for a homeowner's association to operate and/or maintain an area prone to flooding.	☐	☐	☐	
Require flood hazard information to be provided on a subdivision plat. Require the 100-year floodplain elevation to be shown on all subdivision plats. Information such as finished building pad elevation or proposed lowest finished floor elevation can also be detailed.	☐	☐	☐	
Any property with a floodplain should be required to show such information on the plan.	☐	☐	☐	
Require conservation easements around flood-prone areas or floodplains.	☑	☐	☐	Code allows Planning Board to require conservation easements for floodprone areas. The code includes Stormwater Pollution Prevention Plan (SWPPP) requirements.
Require green infrastructure or low-impact development techniques, where feasible	☑	☐	☐	
Each proposed lot must have a designated buildable site above the special flood hazard area (SFHA) as shown on the most current Flood Insurance Rate Map.	☐	☐	☐	

See Chapter 3 for source information.

Code Sections Reviewed:

Flood Damage Prevention - Chapter 14B

Land Development Regulations - Chapter 21

Sediment and Erosion Control and Stormwater Management - Chapter 30D

Watercourse Diversion and Pollution - Chapter 41

Conservation Easements - Section 21-7.1

Table 6-2 Flood Resiliency Best Practices Code Audit Checklist

Village of Piermont Preliminary Audit	*In Existing Code*	*Consider for Implementation*	*N/A*	*Notes*
Zoning Code Ordinance Best Practices				
Elevation Design & Screening				
Require design interventions to screen and mitigate elevation impacts on the streetscape for elevated buildings.	☐	☐	☐	
Use hedges and fencing to separate private and public realms. Screen on-site parking located beneath a structure with foundation plantings and vegetative screening. Screen piers and columns that have been used to raise structures.	☐	☐	☐	
Building entries must face the street on which the building fronts, and walkways should provide direct access from the sidewalk to the front door.	☐	☐	☐	
Building fronts, entry porches and similar features must use materials, colors and proportions appropriate for the local architectural context. Large and multi-family building should use treatments similar to ensure local architectural consistency.	☐	☐	☐	
Guidelines for specific design elements such as canopies, galleries, and local significant materials, colors and design strategies to mitigate height and size perceptions are encouraged.	☐	☐	☐	
Bulk & Area Requirements				
Ensure that uses below the building Base Flood Elevation are restricted to access, parking and storage.	☑	☐	☐	The code restricts the lowest floor in certain zones to parking, access or storage and to automatically equalize hydrostatic flood forces.
Permit relief from height limits where possible for developers and property owners who wish to go above the Design Flood Elevation.	☐	☐	☐	
Enact new height limits where possible that are based on the new local design flood elevation (one to two feet over the BFE) where side and rear yard relief is possible.	☐	☐	☐	
Given the increased height of buildings due to elevation, turrets, towers and cupolas, ensure total building height does not exceed maximum height(s) desired, but also ensure that maximum building height requirements allow for building elevations without the need for a variance.	☐	☐	☐	
Require an additional 3’ of freeboard above the base flood elevation for buildings within the Special Flood Hazard Area and 18” of freeboard in the “shaded X” area, which includes buildings between the 100-year and 500-year floodplains. All new single family detached dwellings outside of defined flood hazard areas need to be elevated 16-24”. This approach acknowledges the likelihood of more extreme flooding inside of and more extensive flooding outside of the FEMA-defined flood hazard area (based on historic flooding and not sea-level rise).	☑	☐	☐	The code includes residential and non-residential structure coastal high-hazard area construction standards.Standards are included that require between 2' and 3' above BFE in certain zones as well as requirements for drainage paths in other zones for residential structures. For non-residential structures, the lowest floor should be elevated 2' above BFE if no FIRM number is specified. Structures are to be floodproofed including utilities and sanitary facilities. Within the A, when no base flood data are available, the lowest floor (including basement) shall be elevated at least 3' above the highest adjacent grade.
Permit reduced side or rear yards relative to overall height to allow squatter and more proportional buildings.	☐	☐	☐	
Require riparian and/or floodplain buffers - See also Subdivision Regulations.	☑	☐	☐	25 feet for water resources and 50 feet of a natural vegetative buffer for wetlands
Utilize net density calculations that exclude wetland and floodplain areas in a developable area.	☐	☐	☐	
Establish a maximum percentage of impermeable surface coverage on a lot which limits the density of development and addressing stormwater runoff.	☐	☐	☐	

Other Code Revisions				
Coastal Resilience Overlays could be applied to areas with the highest flood risk. These areas require higher elevations of the first floor, limit parking and hard pavement, and require additional landscaping and open space.	☑	☐	☐	This exists in a way in the code. Within special flood hazard areas, construction or improvements are prohibited without a valid floodplain development permit. For encroachments, assessments and/or a technical evaluation is required and when the Village agrees to apply to FEMA for conditional Firm and floodway revision and approval is received, only then can construction or substantial improvements move forward.
Upland Resilience Overlays could be applied to lower-risk areas capable of accommodating growth. New construction within an Upland Resilience Overlay is also permitted to reduce its own resilience requirements in exchange for placing conservation easements on higher-risk properties.	☑	☐	☐	
Neighborhood Resilience Overlays could be applied to lower-risk areas, and are intended for more typical cases. They allow for customized design standards that are appropriate to the local context.	☑	☐	☐	
Permit property owners to reallocate lost floor area from the ground floor and sub-grade spaces to elsewhere in the structure.	☐	☐	☐	
Ensure that well heads are above the BFE.	☑	☐	☐	The Code requires water supply systems to minimize or eliminate infiltration of floodwaters into the system.
Add flood resistant construction (flood-proofing) standards such as ensuring buildings are watertight, utilities and sanitary facilities are above the BFE, enclosed within the building's watertight walls, or made watertight and resistance. Standards should also ensure that the building's structural components are also flood resistant.	☑	☐	☐	The Code requires anchoring of new structures and substantial improvements as well as the use of materials, utility equipment, and methods and practices that are resistant to flood damage and that minimize flood damage. Utilities must be at least 2' above BFE. Water supply systems must minimize or eliminate infiltration of floodwaters. On-site waste disposal systems must be located to avoid impairment to them, or contamination from them, during flood events.
Prohibit new development unless effect on flooding is minimal or zero.	☑	☐	☐	Code prohibits development encroachment if increases base flood by >1 foot (see encroachment note above). The code requires details of any watercourse alteration or relocation. There are detailed permit application requirements including a technical analysis to determine whether or not proposed development will result in physical damage to any other property.
Prohibit substantial improvements to nonconforming uses or structures in flood prone areas.	☐	☐	☐	
Consider acquisition of flood-prone lands, particularly where they include vital riparian areas and/or could provide a public benefit such as a park or passive open space.	☐	☐	☐	

Subdivision Ordinance Best Practices				
Subdivision Ordinance				
Conservation subdivision (cluster development) to encourage development be built in suitable areas of development that protects important natural features.	☐	☐	☐	
Prohibit subdivisions in floodprone areas.	☑	☐	☐	The Flood Damage Prevention Ordinance requires subdivisions to be consistent with the need to minimize flood damage, utilities and facilities must be located and constructed to minimize flood damage, and adequate drainage needs to be provided to reduce exposure to flood damage. When no based flood elevation data are available from other sources in Zone A, the permit applicant for a subdivision or other development shall provide the data for projects greater than 5 acres or 50 lots.Land subject to flooding. Land identified as a floodplain or land deemed by the Planning Board to be uninhabitable shall not be platted for residential occupancy nor for such other uses as may increase danger to health, life or property or aggravate the flood hazard. Such land within the plat shall be set aside for such uses as shall not be endangered by periodic or occasional inundation or improved in accordance with flood zone regulations and in compliance with New York State Wetlands Regulations.
Require and maximize the width of riparian buffers. Provide riparian buffer requirements for the following:	☐	☐	☐	
Stream stabilization - A few dozen feet to a few hundred feet.	☐	☐	☐	
Water quality protection – A few dozen to a few hundred feet (a longer distance if sediment removal is desired)	☐	☐	☐	
Flood attenuation – A few dozen to several hundred feet	☐	☐	☐	
Riparian & wildlife habitat – A few dozen feet up to a mile, though the average minimum is approximately 100' to several hundred or a few thousand feet.	☑	☐	☐	Natural vegetative buffer. To the extent practicable, a natural vegetative buffer of 100 feet shall be maintained adjacent to surface waters and wetlands to absorb floodwaters and trap sediment.
Protection of cold water fisheries – A few dozen feet to a few hundred feet	☐	☐	☐	
Prohibit development immediately adjacent to streams, rivers, lakes, wetlands and other water bodies.	☐	☐	☐	
Inventory riparian areas as part of the subdivision process and preserve unimpaired riparian areas in natural conditions.	☐	☐	☐	
Require restoration of impaired riparian zones as a condition of subdivision approval.	☐	☐	☐	
Restrict potentially problematic uses (Hazardous materials uses, for example)	☐	☐	☐	
Encourage dedication of land related to parks, open space, and natural features.	☑	☐	☐	Dedication of parks, playgrounds, or open space can be offered to the Village. The Planning Board shall, wherever possible, establish the preservation of all natural features which add value to residential developments and to the community, such as large trees or groves, watercourses and falls, waterfront areas, historic spots, viewscapes and vistas and similar irreplaceable assets. No tree with a diameter of eight inches or more as measured three feet above the base of the trunk shall be removed unless such tree is within the right-of-way of a street as shown on the final subdivision plat. Removal of additional trees shall be subject to the approval of the Planning Board. In no case, however, shall a tree with a diameter of eight inches or more as measured three feet above the base of the trunk be removed without prior approval by the Planning Board.

Require adequate access where evacuation may be necessary or where emergency vehicle access may be required.	☐	☐	☐	
Ensure utilities such as electric, natural gas, water and wastewater are hardened. Require electrical components to be mounted above flood levels. Major utility equipment should be considered a critical facility and be required to be located outside of the 500 year floodplain.	☐	☐	☐	
Consider the long-term needs of the community when discussing the potential for a homeowner's association to operate and/or maintain an area prone to flooding.	☐	☐	☐	
Require flood hazard information to be provided on a subdivision plat. Require the 100-year floodplain elevation to be shown on all subdivision plats. Information such as finished building pad elevation or proposed lowest finished floor elevation can also be detailed.	☐	☐	☐	
Any property with a floodplain should be required to show such information on the plan.	☐	☐	☐	
Require conservation easements around flood-prone areas or floodplains.	☐	☐	☐	
Construction discouraged within 100 feet of the upland boundary of a tidal wetland.	☑	☐	☐	Construction near wetlands. Construction should not be located within 100 feet of the upland boundary of a tidal wetland. This includes the introduction of impervious surfaces, roads, utility equipment and other infrastructure. An exception is made for a private dock, provided that no other opportunity for water access exists on the lot except through wetlands.
Require green infrastructure or low-impact development techniques, where feasible	☑	☐	☐	The code includes Stormwater Pollution Prevention Plan (SWPPP) requirements.
Each proposed lot must have a designated buildable site above the special flood hazard area (SFHA) as shown on the most current Flood Insurance Rate Map.	☐	☐	☐	

See Chapter 3 for source information.

Code Sections Reviewed:

Flood Damage Prevention - Chapter 112
Subdivision of Land - Chapter 163
Soil Erosion and Sediment Control - Chapter 168
Stormwater Control - Chapter 169
Stormwater Management - Chapter 170
Subdivision of Land - Chapter 174
Waterfront and Waterways - Chapter 198 (related to the LWRP)
Waterfront Resilience Commission - Chapter 50
Zoning - Chapter 210

6.3.4 SUBDIVISION REGULATIONS

The subdivision codes could use review and assessment for additional flood resiliency revisions. Since subdivisions can be the first step in larger land development applications, assessing potential regulatory changes in this part of the code could provide a significant resiliency benefit to address development-based flooding concerns. While the codes do generally require proposals to minimize flood-related damage and data for projects greater than a certain number of lots or acres when no BFE data is available, there are specific code regulations that could be enacted that provide specific protections and that could increase resiliency without taking away the potential to reasonably develop a property.

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