Town of Red Hook, Village of Red Hook, Town of Rhinebeck, & Village of Rhinebeck

Community Resilience Building Workshop
Summary of Findings
March 2020

Table of Contents

OVERVIEW

Extreme weather events and mounting natural hazards cause social, environmental, and infrastructure damages and losses. Municipalities, regional planning organizations, states, and federal agencies will need to increase their resiliency and adapt to these conditions if they are to avoid damages today and into the future. For communities in the Hudson Valley, this need is strikingly evident. Recent devastating events such as Tropical Storm Irene and Superstorm Sandy have reinforced this urgency and compelled leading communities to proactively plan and mitigate potential risks. Ultimately, this type of leadership will reduce the exposure and vulnerability of citizens, infrastructure, and ecosystems, and will serve as a model for communities across the Hudson Valley, New York State, and the country.

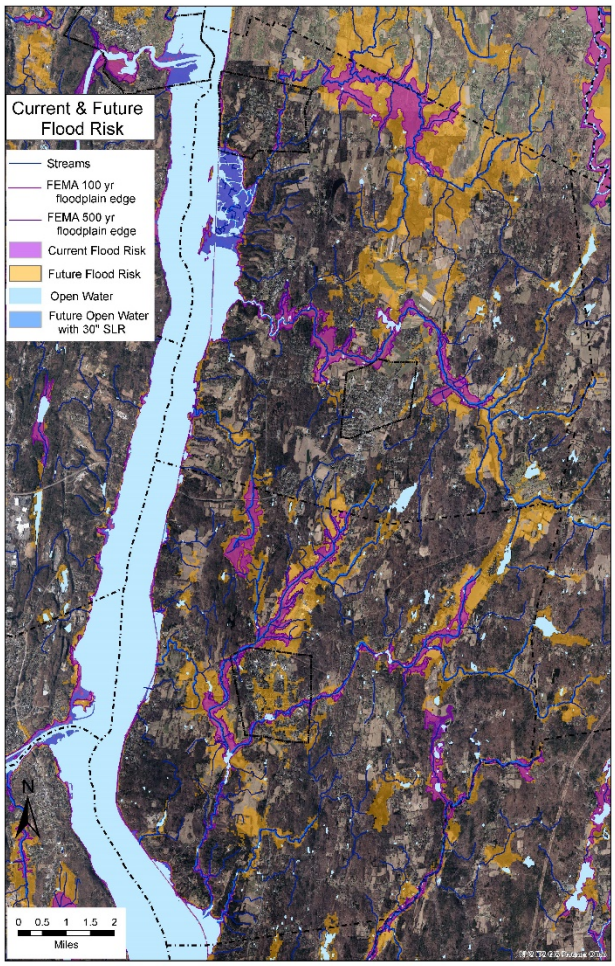

Figure 1. Current and future flood risk for the study areas including the Towns and Villages of Red Hook and Rhinebeck.

In the summer of 2019, The Nature Conservancy and the Hudson River Watershed Alliance approached municipal officials in the Towns and Villages of Red Hook and Rhinebeck to discuss and identify resilience needs relative to infrastructure, habitat restoration, and community resilience. A strategy was developed to incorporate recommendations from an existing planning and code review tool completed in 2018 with assistance from Cornell Cooperative Extension Dutchess County (NYS Climate Smart Communities Climate Smart Resiliency Planning Tool, see below) with a process that identifies community assets and areas of risk and proposes initial adaptation strategies.

The Community Resilience Building (CRB) Workshop is a unique "anywhere at any scale" community-driven process (www.CommunityResilienceBuilding.com) that provides an appropriate platform to engage elected officials, municipal staff, and other key stakeholders from participating communities. This integrated planning process offers participating communities the opportunity to identify specific next steps for local policies, planning, and assets related to climate resilience. The purpose of this facilitated, multi-community workshop was to guide

implementation of priority adaptation actions across the Town of Red Hook, Village of Red Hook, Town of Rhinebeck, and Village of Rhinebeck, with a focus on reducing the impacts of flooding (Figure 1).

The workshop's central objectives were to:

- Define extreme weather and articulate local natural and climate-related hazards
- Identify existing and future vulnerabilities and strengths
- Develop prioritized actions for the municipalities and broader stakeholder networks
- Identify opportunities for the community to advance actions to reduce risk and increase resilience.

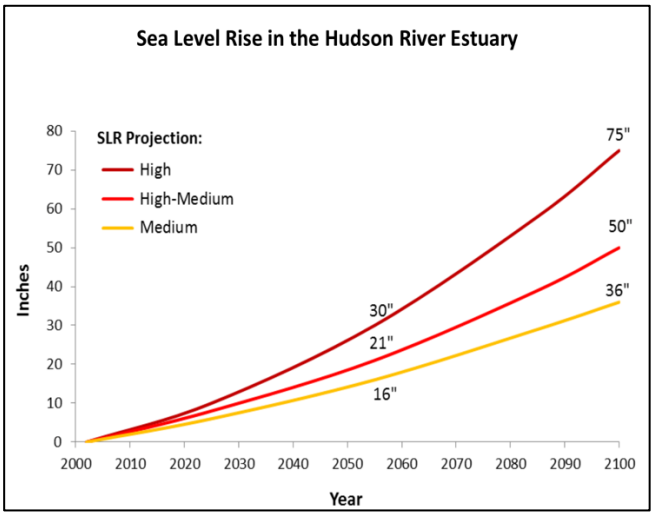

Figure 2. Projected sea level rise scenarios for the Hudson River Estuary.

A Community Resilience Building Workshop was held with representatives from all four municipalities on February 13, 2020 at the Red Hook Community Center. This report provides an overview of the top hazards, the current community strengths and concerns, and the suggested actions to improve resilience to natural and climate-related hazards in the communities today and in the future. The summary of findings will benefit from further comments, feedback, and updates from workshop attendees and additional stakeholders alike. The participation of all those concerned in the communities will help continue and expand collective leadership on hazards and community resilience.

PROJECTED FUTURE CONDITIONS

Current climate and environmental conditions are projected to change in ways that will profoundly influence current interactions with natural resources. This includes the magnitude and intensity of storms and drought, rising sea level in the Hudson River and tidal tributaries, and other changes. Various platforms are available to better understand and evaluate how different climate change scenarios are likely to impact Hudson Valley communities, including:

- The Nature Conservancy's Natural Resource Navigator
- Scenic Hudson's Sea Level Rise Mapper
- Columbia University's Hudson River Flood Decision Support Tool
- New York State Climate Change Science Clearinghouse.

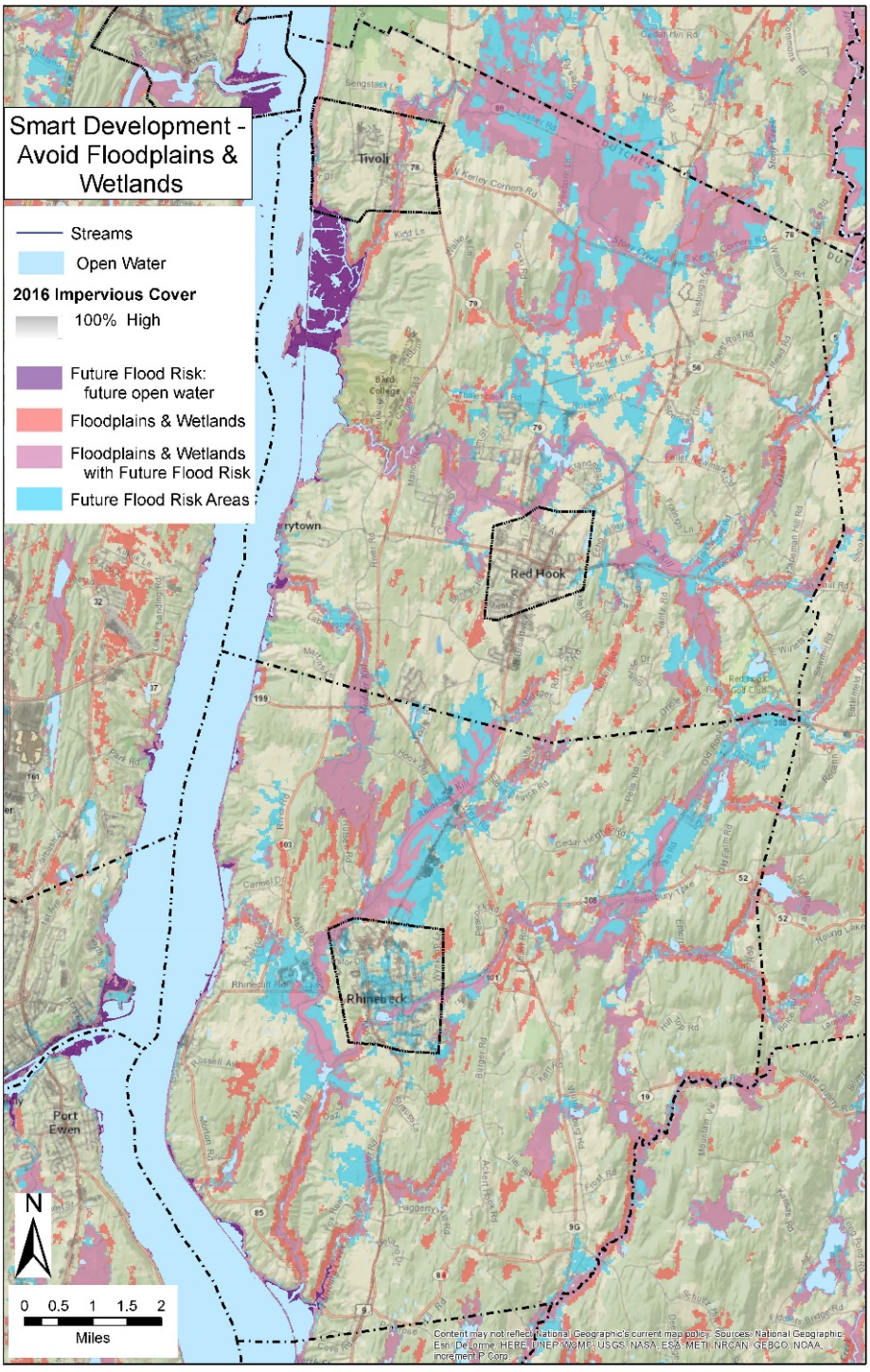

Figure 3. Projected future flood risk areas (blue shaded area) throughout the Towns and Villages of Red Hook and Rhinebeck. Pink shaded areas represent possible areas of future floodplains and wetlands as a result of higher flood levels. Development activities in areas where the blue and pink shaded areas overlap should be carefully considered and evaluated before construction is allowed to begin.

As these and other tools clearly indicate, there are many possible scenarios that could manifest themselves over the course of this century. The numerous factors, both global and local, that influence these outcomes make the extent of these scenarios difficult to predict. Thus, it is important to plan for a range of scenarios as evidenced by NY's Community Risk and Resiliency Act.

For the purpose of adaptation planning, general trends and rough estimates can be employed. For example, riverfront communities in the Mid-Hudson region should be preparing for a *minimum* of 3-6 feet of mean sea level rise by 2100. All communities in the Hudson Valley should consider the potential ramifications of:

- Increased severity and frequency of big storms, including
  - More winter precipitation (if rain, then more flooding, if snow, then 10" of snow or more per storm)
  - More flooding due to increased precipitation and increased development and impervious surfaces
- Hotter summers
- Increased frequency and length of heat waves and droughts
- Shorter, milder winters.

Details on the ranges of projected future conditions are available through the New York State Water Resources Institute and through the previously referenced tools (Figures 1-3 and Table 1).

Table 1. Community assets (Infrastructure, Environment, and Social) at risk with various sea level rise scenarios and current 100-year storm in the Towns of Red Hook and Rhinebeck, as modeled by the Hudson River Flood Decision Support Tool. The output was produced using Columbia University's Center for International Earth Science Information Network Hudson River Flood Decision Support Tool 2.0. This tool only evaluates to the Town level, not to the village or hamlet levels.

Impact Scenarios for Towns of Rhinebeck and Red Hook						
Type of Impact	**18" of SLR with current 100 YR Storm**		**30" of SLR with current 100 YR Storm**		**48" of SLR with current 100 YR Storm**	
Municipality	**Town of Red Hook**	**Town of Rhinebeck**	**Town of Red Hook**	**Town of Rhinebeck**	**Town of Red Hook**	**Town of Rhinebeck**
Infrastructure						
Total Damaged Buildings	1	5	2	6	3	6
Bridges		4		5		5
Roads (linear miles)	1	1	1	1	1	1
Rails (linear miles)	5	8	6	8	6	8
Railroad Passenger Stations		1		1		1
Environment						
Inundated Land Area (Acres)	520	171	529	173	533	173
Inundated Impervious Surface Area (Acres)	1	3	2	3	2	3
Inundated NWI and Tidal Wetlands (Acres)	878	163	880	163	881	163
Social						
Social Vulnerability Index of Impacted Census Blocks (Index Score is unitless)	4	4	4	4	4	4
Social Vulnerability Index of Entire Municipality	3	4	3	4	3	4

CLIMATE SMART RESILIENCY PLANNING TOOL RECOMMENDATIONS

Cornell Cooperative Extension Dutchess County worked with the Town of Red Hook and Village of Red Hook in 2018 to complete a Climate Smart Resiliency Planning Tool (CSRPT). The CSRPT, an action of the NYS Climate Smart Communities (CSC) Certification program, reviews a municipality's existing plans and ordinances to identify opportunities to help the community work toward becoming more resilient. The municipality receives a copy of the finished tool, as well as a recommendations document to use as a roadmap to move forward with resiliency projects. Cornell Cooperative Extension Dutchess County will be working with the Town of Rhinebeck and Village of Rhinebeck to complete the resiliency planning tool in 2020.

The resiliency planning tool is comprised of the following six sections. The first section is a list of all the relevant plans and ordinances that were considered throughout the tool. Section 2 examines how well the municipality addresses climate vulnerabilities and assesses climate risk. Section 3 looks at how the municipality includes the public in resiliency discussions and informs them about how to be more climate resilient. Section 4 assesses the degree to which the plans are integrated with one another. Section 5 examines the municipality's preparedness level for climate events and recovery procedures. Finally, Section 6 looks at how well the municipality attempts to mitigate climate hazards.

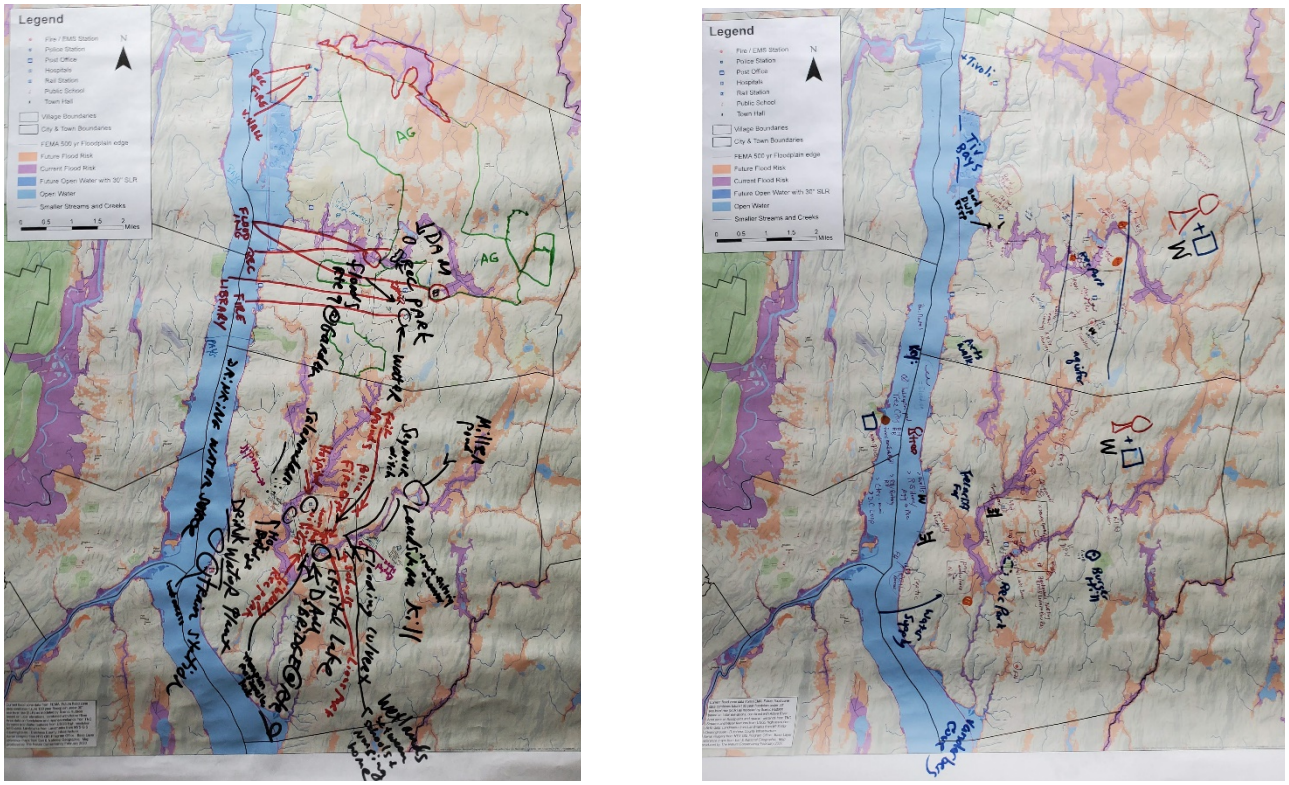

Figure 4. Maps showing the location of identified assets were developed by each sub-group during the Community Resilience Building workshop.

Recommendations shared with both municipalities include:

- Create a Resiliency Plan and include community visioning, a full vulnerability assessment, content from various other plans, and strategies to reduce vulnerability.
- Complete a full Climate Vulnerability Assessment, based on the criteria in Climate Smart Communities Pledge Element 7 Action.
- Consider creating maps of vulnerabilities in relationship to risks, including vulnerable populations, natural resources, cultural resources, landslides, sea-level rise.
- Improve public outreach on storm preparedness. Add links to municipal websites to direct residents and businesses to Dutchess County's web page on storm preparedness and other resources.
- Update Comprehensive Plan with Sustainability Elements. Integrate plans and initiatives such as the Complete Streets initiative and Saw Kill Watershed Assessment (2018), address flood hazards, and identify strategies to mitigate flood risk.
- Collaborate on an Emergency Response Plan and Evacuation Plan.

Some of the recommendations shared with the Town of Red Hook are highlighted below:

- Publicize the availability of floodplain information to property owners, businesses, insurance, agents, real estate agents, and lenders through trainings or other means.
- Consider incorporating the Planning for Resilient Connected Natural Areas and Habitats (2014) report into a Natural Resources Inventory.
- Update the Town's local Climate Action Plan (2012).

Some of the recommendations shared with the Village of Red Hook are highlighted below:

- Involve the public in more opportunities to identify historic storm effects, including storm-surge elevations, flood-prone streets, or property loss.
- Consider developing a public outreach plan for climate outreach and engagement

Figure 5. Michelle Gluck of Cornell Cooperative Extension Dutchess County shared findings from Climate Smart Community Resilience Tools during the workshop. ©E. Vail, HRWA 2020.

COMMUNITY RESILIENCE BUILDING WORKSHOP SUMMARY OF FINDINGS

Top Hazards

During the core team meetings that took place prior to the workshop and at the start of the Community Resilience Building workshop, workshop participants confirmed their top natural climate hazards as the following:

1. ***Sea level rise and storm surge:*** Projected rises in future mean sea levels, combined with severe coastal storms such as Superstorm Sandy, capable of producing storm surge and coastal flooding.
2. ***Inland flooding:*** Inland flooding caused by intense precipitation, storms and subsequent runoff from rain or snow.
3. ***Drought and wildfires:*** Higher peak temperatures in summer with sporadic precipitation events which may stress municipal and private resources, especially public water supplies and private wells. The threat of wildfires was brought up as an additional hazard, related to drought and dry conditions.

The above hazards have a growing impact on residents and businesses in the Towns and Villages of Red Hook and Rhinebeck, all located in Dutchess County. During the Community Resilience Building Workshop, participants were asked to identify environmental, infrastructural, and social assets in their communities; determine whether those assets are strengths, vulnerabilities or both; and identify and prioritize actions. These assets and actions were identified by a diverse mix of participants from both municipalities. The following sections summarize the results of this process.

Key Assets and Areas of Concern

Numerous environmental, infrastructural, and social assets were identified, which have been grouped in several categories.

There were four major areas of concern related to **environmental assets**:

- **Waterbodies and wetlands**, including the Hudson River, Landsmankill, Saw Kill, Stony Creek, Rhinebeck Kill, Crystal Lake, and Sepasco Lake.
- **Open space**, including agriculture, forests, and street trees in the Villages of Red Hook and Rhinebeck.
- **Parks and recreational facilities**, including public parks, private parks (Ferncliff Forest, Poets' Walk, Burger Hill, etc.), and boating access on the Hudson River. These spaces are strengths, but they may be vulnerable to flooding impacts.
- **Wildlife**, including beavers, salamanders, and pollinators. Beaver dams may pose a risk for infrastructure, as water is impounded in new locations.

There were seven major areas of concern related to **infrastructural assets**:

- **Drinking water infrastructure** for all four municipalities, including treatment plants, distribution systems, pump stations, water towers, and private and municipal wells.
- **Wastewater infrastructure**, including sewage treatment plants in the Village of Red Hook, Village of Tivoli, Village of Rhinebeck, and Bard College; Vanderburg Cove sewer district; pump stations; conveyance systems; and private septic systems.
- **Transportation infrastructure**, including the Amtrak railroad and several roads, culverts, and bridges that are vulnerable to flooding.
- **Dams** that could reduce flooding by drawing down ponded water ahead of events, but that may exacerbate flooding if they are at risk for failure.
- **Municipal facilities**, such as town and village halls, Department of Public Works garages, highway departments, fire houses, public buildings, and ambulance centers.
- **Electric infrastructure**, including substations and Red Hook's solar Community Solar Array (CSA).
- **Stormwater infrastructure** to improve drainage, including catch basins and culverts in urbanized areas.

Figure 6. Participants discussed a wide array of community assets during the workshop, and most were associated with infrastructure elements. © E. Vail, HRWA 2020.

There were three major areas of concern related to **social assets**:

- **Emergency Management Planning**, including shelters, emergency services, evacuation planning, etc.
- Protecting **vulnerable populations**, including residents of nursing homes, senior housing, private facilities, and specific at-risk neighborhoods.
- **Communications in case of emergency**, including statewide and municipal alert systems.

Current Vulnerabilities

Most of the environmental assets identified by workshop participants were characterized as strengths that are vulnerable to the three hazard categories of sea level rise/storm surge, inland flooding, and drought. Environmental assets capture community elements such as water resources, open space, and other ecosystem services. In some instances, these resources are also vulnerable to damage from flood waters and storm surge with increasing storm frequency and intensity, and potential susceptibility to drought and wildfires.

Though many environmental assets are contributing to resilience, they may also be vulnerable to climate hazards. Waterbodies across the four municipalities include the Hudson River, Landsmankill, Saw Kill, Stony Creek, Rhinebeck Kill, Crystal Lake, Sepasco Lake, and small streams. Parks and recreational facilities along these waterbodies may be vulnerable to flooding. Groundwater resources and aquifers are vulnerable to heat and drought, along with potential impacts to water quality by floods. Street trees and forested areas are vulnerable strengths that require active management to maintain. Agriculture, particularly small farms or farms located in floodplain areas, are vulnerable community strengths. Beaver dams in several locations have made infrastructure vulnerable to new inundation.

There were many public infrastructure assets identified as vulnerabilities in these municipalities, particularly drinking water and wastewater infrastructure. Vulnerable components of drinking water infrastructure include water treatment plants for Village of Rhinebeck (located in the Town of Rhinebeck) and Bard College, the water tower in Village of Tivoli, pump stations, Town of Red Hook and Village of Red Hook municipal wells, and private wells. Vulnerable wastewater infrastructure includes wastewater treatment plants, conveyance system, pump stations, and septic systems. Stormwater infrastructure such as catch basins in Village of Rhinebeck, Town of Rhinebeck, and Rhinecliff is a vulnerability, especially if not sized appropriately. A number of dams and culverts were identified as vulnerable to flooding, with impacts on roads and public transportation. Rail transportation, especially the Amtrak railroad lines along the Hudson River and the train station in Rhinecliff, are at risk for coastal flooding through sea level rise or storm surge. Municipal facilities such as Department of Public Works garages, Rhinebeck highway department facilities, Red Hook village hall, public schools, and ambulance centers may have limited access or be impacted during floods. Northern Dutchess Hospital and various public and private ambulance centers are vulnerable strengths. Central Hudson utility substations for electric were also identified as vulnerable strengths.

Social vulnerabilities include vulnerable populations and facilities, such as Astor Home for Children, nursing homes, Red Hook Senior Housing, mobile home parks, Red Hook Residential Center, Thompson House (Northern Dutchess Residential Health Care Facility), Daytop Village, Wells Manor, and Bard College. Public libraries, public and private transportation, and access to resources like grocery stores were also highlighted.

Current Strengths

Many environmental assets serve as both vulnerabilities and strengths, but the greatest strengths among the environmental assets are associated with open space. Parks such as Ferncliff Forest, Burger Hill, and Poets' Walk need maintenance to continue to be strong community assets. Forested areas and street trees help improve resiliency, while also requiring active management. Recent land acquisition to protect the Town of Red Hook's drinking water supply improves the system's vulnerability to climate hazards and potential development. Tivoli Bay and South Bay on the Hudson River are tidal wetlands that can help protect against coastal flooding. There are also a number of plans or local laws that are

strengths, including Local Waterfront Revitalization Plans, zoning, wetland laws, and burn bans. These plans and policies should be reviewed and updated if necessary.

While there are many drinking water and wastewater assets that are vulnerable, several were also identified as strengths. These include the Village of Red Hook's wellfield and existing water towers. Other drinking water infrastructure components were flagged as vulnerable strengths. The Village of Rhinebeck's wastewater treatment plant is a strength, as it has backup power generators to continue operation in case of power outage and the intake pipes were recently improved to protect against the impacts of sea level rise. Facilities like public buildings, community centers, transfer stations, and recycling centers are strengths, but may require backup power generators or emergency planning to maintain these assets during or after extreme weather events. Electric infrastructure including substations, an underground transmission line, and Town of Red Hook's solar CSA were all strengths, with some vulnerability for certain facilities.

There were more assets identified as strengths in the social category than any other, indicators of an integrated community network of private and public resources. These include fire departments, Northern Dutchess EMT, police stations, schools, libraries, churches, and community centers. Community organizations like American Legion and Rotary Club also contribute to social strength. Existing emergency plans are a strength, though these plans could be updated. They include town and village emergency evacuation plans, along with Bard College's Emergency Plan. Strong communications systems are already in place, including Red Hook's Town Emergency Alert System, Bard College's Emergency Alert System, and New York State's NY Alerts. Raising public awareness of these systems and getting more people to sign up would increase this strength, as would adding this type of system in Rhinebeck.

Top Recommendations to Improve Resilience

Highest Environmental Priorities:

The highest environmental priorities included protecting waterbodies, agriculture, open space, and recreation.

- The Hudson River serves as the drinking water source for the Village and Town of Rhinebeck, in addition to being an important site for recreation in all communities. The Town and Village of Rhinebeck should continue meeting with the Hudson 7 intermunicipal council to work collectively on issues related to source water protection for the Hudson River. Planning, including emergency response planning, Dutchess County's hazard mitigation plan, and revisiting the Local Waterfront Revitalization Plan would be valuable. A study of river flooding impacts could help identify locations that are vulnerable to coastal flooding, along with erosion issues or opportunities to improve drainage along the Hudson River.

- There is public boating access on the Hudson River at Tivoli and Rhinecliff, and private boating access at Barrytown. The Village of Tivoli was recently awarded a grant to stabilize the shoreline and erosion issues present near the launch. At Rhinecliff, which is a small but popular launch site, consider design work to adapt to sea level rise. The private boat club at Barrytown is subject to coastal and inland flooding. Bulkhead improvements should be made and maintained.
- Crystal Lake in the Village of Rhinebeck includes the pond and a recreational area. There is a need for improved stormwater management to mitigate drainage into the lake. There is an ongoing study of stormwater runoff and dam control, along with a project with Marist College to better understand conditions at this site. Riparian plantings around the lake could also improve resilience.
- Streams in general were flagged as high priority, particularly for culvert studies and replacement/rightsizing in the short term. Specific streams include the Landsmankill, Rhinebeck Kill, Saw Kill, and Stony Creek. The Saw Kill was the subject of a recent flood study; recommendations from the study should be implemented, such as protecting floodplains and surrounding areas, updating zoning, creating larger buffers, and replacing culverts. A culvert replacement project on the Stony Creek in Town of Red Hook is underway. Other actions to protect the Stony Creek include updating zoning, protecting buffers, and replacing infrastructure.

Figure 7. Discussion of environment concerns in the area were prevalent and thoroughly considered. © E. Vail, HRWA 2020.

- Protecting farms and open space, especially farms in floodplains, is a key concern. Planning should be conducted with farmers to better understand and communicate vulnerabilities and what locations may be most at risk. There may be opportunities for education, improving riparian buffers, or other practices to mitigate issues such as erosion. To increase resilience to drought, work with farmers to identify and implement best management practices to reduce risk. The Town of Red Hook has a zoned agricultural district that is at risk of flooding, and recommended actions in this area include improving stormwater management, fencing to keep animals out of streams, and working with farmers on best practices, such as protecting buffers, absorbing floods, and reducing erosion. For small farms in Rhinebeck, work to map existing farms, communicate with farmers, and assess vulnerability.
- Municipal planning and local laws can also contribute to resilience. Adopt and enforce zoning and wetland laws to protect natural resources.

Highest Infrastructural Priorities:

Infrastructural assets included drinking water infrastructure, wastewater infrastructure, culverts, dams, transportation, and electric. The highest priorities in all areas of concern include the following:

- Drinking water infrastructure included many different components across the municipalities. In general, water conveyance systems need better mapping, and there are active projects to redo water lines.
- In Red Hook, a valve connects Town and Village drinking water supplies in case of emergency. This valve needs to be upgraded to a pump station and needs a backup power generator. The Village of Red Hook wellfield in Town of Red Hook is a strength, but the water supply needs to be protected. The Town of Red Hook's drinking water pump station is vulnerable to flooding but will be protected by new land acquisition. The pump station's access road is currently a dirt road that is impacted by flooding and should be improved. In the Town of Rhinebeck, the Hilee Road drinking water pump station serves 30 homes and is highly susceptible to brush fire. It is a priority to work on an irrigation system and vegetation management. The Village of Tivoli's water tower is vulnerable and needs to be redone.
- The Village of Rhinebeck drinking water treatment plant is located adjacent to the Hudson River, where it withdraws drinking water. This facility serves the Village of Rhinebeck, Hamlet of Rhinecliff, The Gardens, nursing homes and schools . Flood assessments have been done, and the facility has a backup generator and recently modified intake pipes to protect against sea level rise. While the most critical work has been done to protect infrastructure from flooding, additional work could still be done. Access routes to the plant should be improved. A backup supply of drinking water should be considered in case of emergency. The water treatment plant lagoon in the Town of Rhinebeck is also vulnerable, and funding needs to be identified to change the process. In addition, the Hilee Road tank structure needs mixer to reinforce the quality and sustainability of the resource.
- A number of wastewater infrastructure components were highlighted. The Village of Red Hook's sewage treatment plant is currently private but is about to transition to a public system to serve the business district. In addition to ongoing maintenance, identify locations of inflow/infiltration (I/I) and test water quality in the Saw Kill to see if the facility is having water quality impacts to the stream. Village of Tivoli's sewage treatment plant is owned by Dutchess County and is high priority. The wastewater treatment plant in the Village of Rhinebeck serves most of the Village and some of the Town of Rhinebeck. The facility has backup generators run by the Village, which should be maintained. This facility is old, and planning is necessary for upgrades and expansion.
- Inventory and assess Village of Rhinebeck culverts, including identifying locations and potential funding sources to make repairs.
- Priority dams include Mill Pond dam at the Town of Red Hook recreational park and Asher Dam at Crystal Lake, owned by the Village of Rhinebeck. Create flow management plans and continue to work with Marist College to refine a flood warning system for the Landsmankill at Crystal Lake.

- Amtrak's train lines are along the Hudson River, and their vulnerability to coastal flooding impacts multiple communities. Build a community coalition to have discussions with Amtrak about raising the tracks and other actions to reduce the impact of flooding. The train station in Rhinecliff is also vulnerable to Hudson River flooding, and cars parked in the parking lot have been flooded. Upgrades should be made to improve parking and access.
- Route 9 is a state road with known flooding problems at several locations. Coordinate with New York State Department of Transportation on strategies and funding. In general, it would be helpful to better understand tributary flooding with culvert studies at locations where Route 9 crosses over streams to inventory drainage blocks. Garden Street in the Village of Red Hook is a location that regularly floods, and the section of Route 9 near Hannaford in Red Hook was also flagged. In the Village of Rhinebeck, Crystal Lake's dam and where the Landsmankill crosses under Route 9 is a concern. The dam was redone after Hurricane Irene, and the municipality will need to work with NYS Department of Transportation on the bridge that's downstream. There is a need for monitoring, drawing down the lake in case of a storm, funding to approach this problem, and flood zone planning at this site.
- Mount Rudsen Road in the Town of Rhinebeck needs an assessment to determine the best strategy to reduce flood risk.
- The Village of Rhinebeck and Town of Rhinebeck need funding and mapping of catch basins to understand their stormwater systems. In the Village of Rhinebeck, ongoing construction on water mains represents an opportunity to rethink the stormwater system and consider the use of green infrastructure and dry wells. In Red Hook's Forest Park and Liden Acres neighborhoods, the stormwater system needs to be re-sized with more capacity, to be able to handle larger storms.
- Central Hudson utility substations may require elevation or relocation. In Rhinebeck, consider a municipality demand action plan with Central Hudson.
- Public buildings and community centers are strengths and provide a place for people to go in case of emergencies. They will need backup generators to ensure that this function can be maintained during power outages.

Highest Social Priorities:

Actions related to social assets were associated with support institutions, emergency communication and management facilities, and municipal programming. The following represent the highest priorities identified by workshop participants:

- Red Hook has a Town Emergency Alert System to share information with the public. Increase awareness and the number of people who have signed up for emails and text alerts. Consider a municipal alert system in Rhinebeck.
- Cell phone towers in the Town and Village of Rhinebeck are a strength but need to be maintained to maintain communications in case of an emergency.
- Fire departments are strengths but need to be maintained. Hillside Fire Department and Rhinebeck Fire Department have backup power generators, which increases their resilience. For the Rhinebeck Fire Department, consider long-term relocation of equipment and the building. Rhinecliff Fire Department has a backup generator, but

the facility is old and needs maintenance. Village of Red Hook Fire Department has access issues during floods. Maintain Village of Tivoli Fire Department.

- Emergency evacuation plans need to be updated, including evacuation routes for public and private transportation in all four municipalities.
- Emergency shelters are strengths but may require new access routes in case of inland flooding. Bard College and Rhinebeck High School will also require access route alternatives when the primary routes are flooded. Creating emergency shelter plans for public schools, town halls, village halls, and Bard College is high priority, including a new access route for Rhinebeck High School.
- The Red Hook Community Center, while privately owned, plays an important community function. It would benefit from an emergency shelter plan and a backup power generator. The facility itself has some flood vulnerability. Maintain nearby open space, and study nearby culvert to understand flood risk.
- Village of Rhinebeck schools (elementary, middle, and high school) are strengths, and should be maintained. There are backup power generators at the middle and high school, but not at elementary school. The elementary school is surrounded by wetlands, which can cause access issues. The high school experienced some flooding during Hurricane Irene.
- Northern Dutchess Hospital in the Village of Rhinebeck is a strength that needs to be maintained. It does not experience flooding and has a backup generator for power.
- Nursing homes in the Town of Rhinebeck include Brookmead Community Center and Ferncliff. Improve road access and evacuation routes for these facilities, including evacuating to cooling centers and water sources in case of extreme heat and drought. Consider a relocation plan and floodplain management. Access to these facilities has been cut off during extreme storms.

Medium Environmental Priorities:

- The Landsmankill in the Town and Village of Rhinebeck is vulnerable to inland flooding. Continue working with Marist College to understand conditions for proactive planning.
- Beavers in the Town of Rhinebeck are building dams that may put infrastructure at risk for flooding. Continue work to monitor and evaluate, removing beavers when necessary and identifying solutions.
- Enforce existing aquifer protection ordinances to maintain groundwater resources.
- Town recreational parks in Red Hook and Rhinebeck are vulnerable to inland flooding. For both parks, manage stream buffers and use of pesticides. For Rhinebeck's park, work with the Village and Town of Rhinebeck to maintain the wetland complex's health. For Red Hook's park, create or implement the Saw Kill's management plan, improve drainage infrastructure, and consider permeable parking lots.
- Lion's Club Mini Park in the Village of Rhinebeck is a vulnerable strength. Consider more water-absorbing vegetation in the park, along with shore stabilization and improved stormwater management.

- Large forested areas are vulnerable strengths. Create a forest management plan or inventory to maintain these resources. This is important for all three climate hazards that were the focus of this workshop (coastal flooding, inland flooding, and drought). Educate residents on burn bans to protect forests from wildfires.
- Maintain street trees in the Villages of Red Hook and Rhinebeck. While street trees are a strength, they are also vulnerable to climate change. The Village of Rhinebeck recently completed a street tree inventory and found that they will need more diversity of trees to adapt to a new climate. Sick and aging trees need to be managed, so they do not damage infrastructure during extreme weather events. Next steps include an analysis of current conditions, grants to do tree work, and continue the work of the street tree committee.

Medium Infrastructural Priorities:

- Assess and right size bridges and culverts in the Town of Rhinebeck and Town of Red Hook. Specific locations mentioned in Rhinebeck include crossings at Miller Road, Fox Hollow, White School House, Cove Road, and behind the hospital. Red Hook has a list of 10 priority culverts to address from a previous study. The Route 308 and Grossmore crossing in the Village of Rhinebeck would benefit from floodplain management. Work with New York State and Dutchess County to fortify bridges, including the Crystal Lake bridge and Landsmankill bridge, which has washed out. Bridges may need to be rebuilt and elevated. The Kingston Rhinecliff Bridge over the Hudson River was identified as a strength.
- Consider a stormwater management plan for drainage, and talk with Dutchess County Soil and Water Conservation District about opportunities for MS4s (municipal separate stormwater systems).
- Three privately-owned dams were highlighted in the Town of Rhinebeck: Miller Pond, Cooper Dam, and Mill Road Dam. Consider advanced lowering of impounded water prior to a storm. Cooper Dam would benefit from floodplain management and improved riparian buffer areas. Conduct a feasibility study for Mill Road Dam, with removal as a potential long-term action.
- Both private and public wells may be vulnerable to climate hazards. For private wells, conduct public education campaigns. The Town of Red Hook's private wells will be protected with new land acquisition, but they will need to improve access during floods. Currently, the access route is a dirt road. The Village of Red Hook needs a backup power generator for drinking water supply. The water towers in the Town of Red Hook, Village of Red Hook, and Town of Rhinebeck need ongoing maintenance, and sufficient capacity to store water during droughts.
- Conduct a microgrid feasibility study for the Central Hudson substation in the Town of Rhinebeck.
- There are multiple ambulance centers in the municipalities, including privately owned facilities. The Village of Rhinebeck will need a long-term relocation plan, but in the short term, store equipment elsewhere in cases of a storm.
- Town and village halls are strengths, and operations will need to be maintained in case of an extreme event. Access to Village Hall in Red Hook could be prevented by road

flooding. Rhinebeck Town Hall and Rhinebeck Village Hall both have backup generators for power.

- Town and Village of Red Hook highway department are strengths that should be maintained. The Village of Rhinebeck highway department is located along the Landsmankill, and flood problems should be evaluated; vegetated stream buffers are being considered for this site as well. The building will need to be updated over time. The Town of Rhinebeck facility is also vulnerable to some flooding. For both facilities, relocate equipment to higher ground and improve stream buffers to improve resilience.
- Department of Public Works garages are vulnerable to inland flooding, especially the Village of Rhinebeck's facility. Consider consolidating garages and restoring floodplains.
- Public schools have mixed vulnerability. Rhinebeck's elementary school should consider a long-term plan for relocation. There is potential for school consolidation to impact the Mill Road School. Conduct a study to determine flood mitigation options at public schools.
- The Rhinecliff train station includes a mix of public and private assets. The parking lot is particularly vulnerable. The Town of Rhinebeck will need to negotiate with Amtrak to identify strategies. It would be beneficial to meet with affected communities, Amtrak, CSX, and county legislators to start this conversation.
- Rhinecliff's stormwater system in the Town of Rhinebeck needs a feasibility study. There are also drainage issues in the Village of Rhinebeck at the business district's main intersection on Route 9. New York State and the Village of Rhinebeck are currently in discussions over responsibility, and they will evaluate drainage options and green infrastructure opportunities to reduce stormwater runoff.
- In general, the municipal wastewater conveyance systems are vulnerable to inland flooding. Stream erosion has puts pipes at risk, and there is a need for better mapping to understand impacts to systems. The Vanderburg Cove Sewer District in the Town of Rhinebeck needs upgrades and will need funding for improvements. Wastewater treatment plants in the Village Red Hook, Village of Rhinebeck, and Bard College should be maintained, and water flows could be better understood.

Medium Social Priorities:

- NY Alerts is New York State's system for communicating public notifications. Increase residents' awareness of this system, and increase sign-ups for notifications.
- The Village of Red Hook Library is located near Garden Street, and vulnerable to inland flooding. Improve access during floods.
- In the Red Hook school district, access to the elementary school should be improved. The high school is an emergency shelter. Ensure there is backup power and flood vulnerability is reduced. The Deveraux School in Red Hook is a private school that is vulnerable. Consider relocation plan, along with emergency and evacuation plans.
- Privately-owned senior housing, including Wells Manor senior housing in Village of Rhinebeck, and the Thompson House (Northern Dutchess Residential Health Care Facility) in Town of Rhinebeck could benefit from maintenance, relocation plans, and

floodplain management. The Rhinebeck at Home aging in place program in the Town and Village of Rhinebeck is a strength to support older residents.

- The Astor Home for Children in the Village of Rhinebeck is not directly vulnerable to flooding, but there have been access issues. Maintain and ensure there is a backup power generator and emergency/evacuation plan. Undertake a flood inventory study, relocation plan, and floodplain management to identify strategies.

Other actions were identified related to the municipal assets but were deemed low priority and therefore are not included in this report.

WORKSHOP PARTICIPANTS

First Name	Last Name	Municipality/Affiliation	Title
Brian	Baccomo	Village of Rhinebeck	Chief Waste Water Treatment Plant Operator
Gary	Bassett	Village of Rhinebeck	Mayor
Carolyn	Bernitt	Rhinebeck Chamber of Commerce	Executive Director
Vanessa	Bertozzi	Village of Rhinebeck	Village Climate Smart Community Coordinator
Randy	Clum	Bard College	Director, Building & Grounds
William	Dietrich	Marist College	
Lindsey	Drew	Bard College	
Peter	Dunn	Village of Rhinebeck	Officer in Charge
Kyle	Eighmy	Village of Rhinebeck	Fire Chief
John	Fenton	Village of Rhinebeck	Building Inspector, Zoning Enforcement Officer, Superintendent of Public Works
Michael	Gersho	Marist College	
John	Gomez	Bard College	Director Security
Joel	Herm	Rhinebeck	
Laurie	Husted	Town of Red Hook	Sustainability Groups/ Comm.
Dawn	Jardine	Public Library	Director
Tracey	Ledder	Delaware Engineering	
Connie	Lown	Village of Rhinebeck	Secretary of Village Tree Commission
Arica	McCarthy	Tighe & Bond	Planner
Robert	McKeon	Town of Red Hook	Supervisor
Victor	Narjal	Town of Red Hook	Water/Power Utility
Emily	Poole	Marist College	
Courtney	Schneeberger	Delaware Engineering	
Elizabeth	Spinzia	Town of Rhinebeck	Supervisor
Rickie	Stokes	Rhinebeck Highway Department	
Sheldon	Tieder	Rhinebeck School District	Facilities Director, Rhinebeck Fire Department EMT
Michael	Trimble	Rhinebeck Planning Board	
Michelle	Turck	Town of Rhinebeck	Zoning Board

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RECOMMENDED REPORT CITATION

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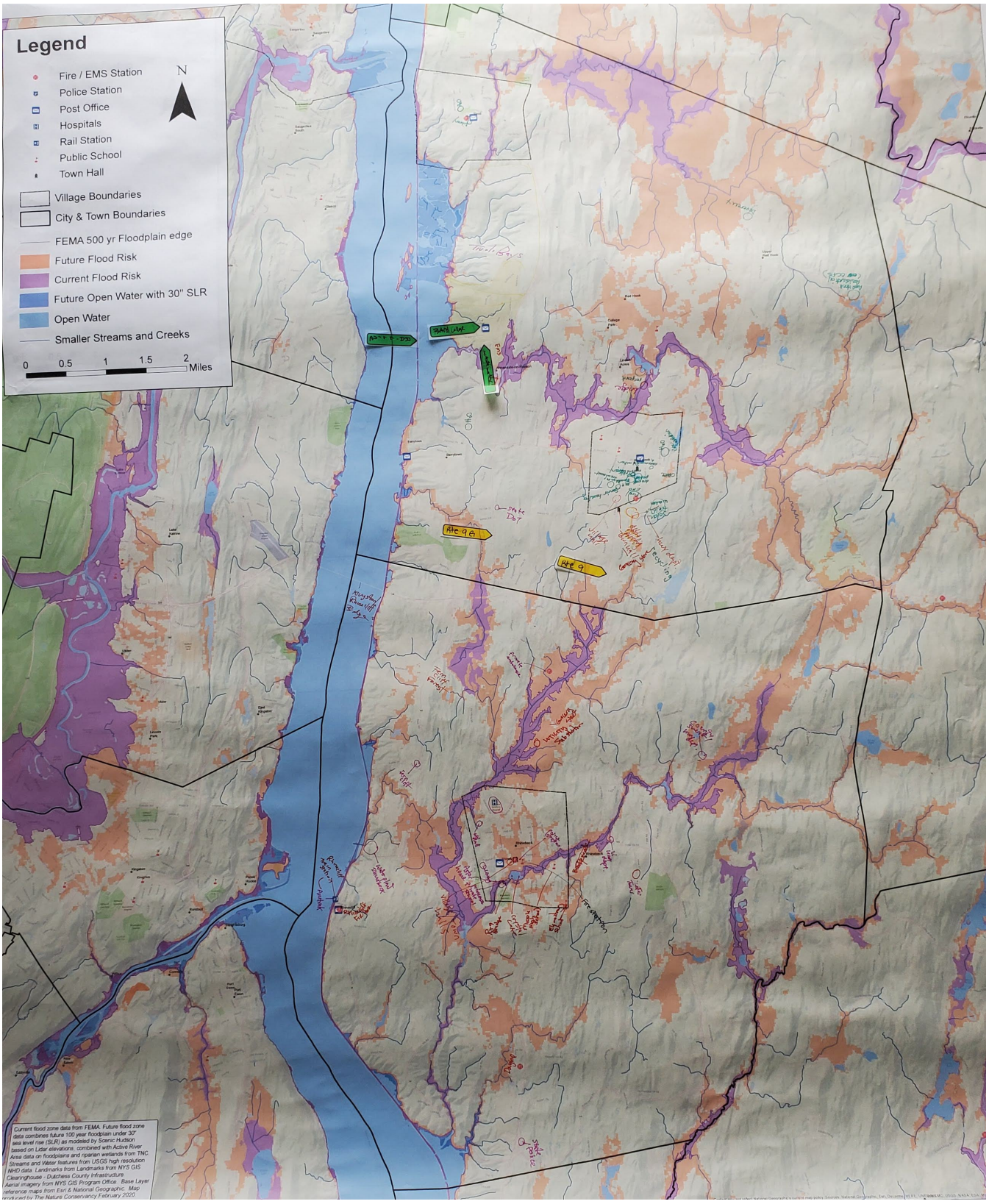
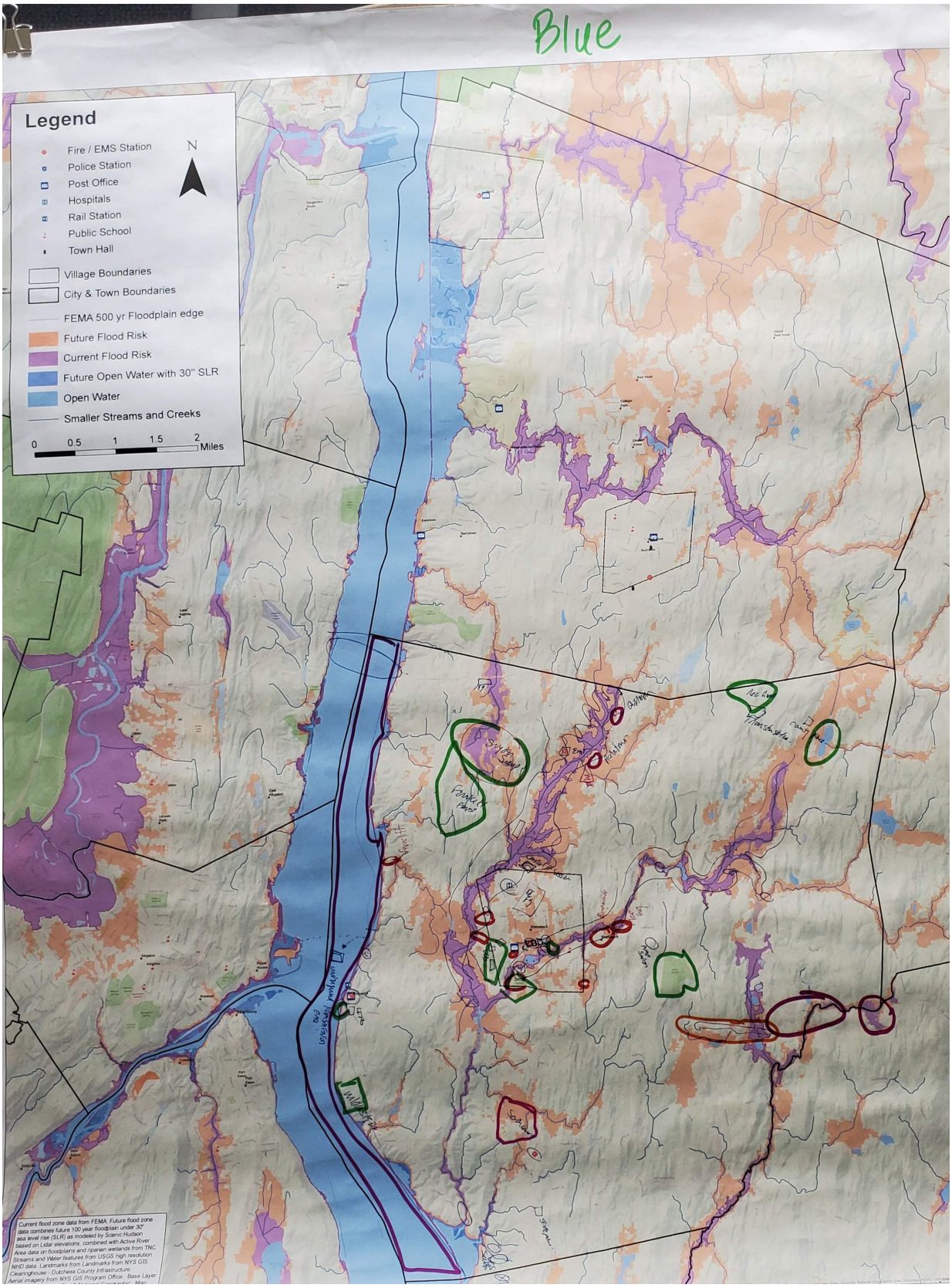
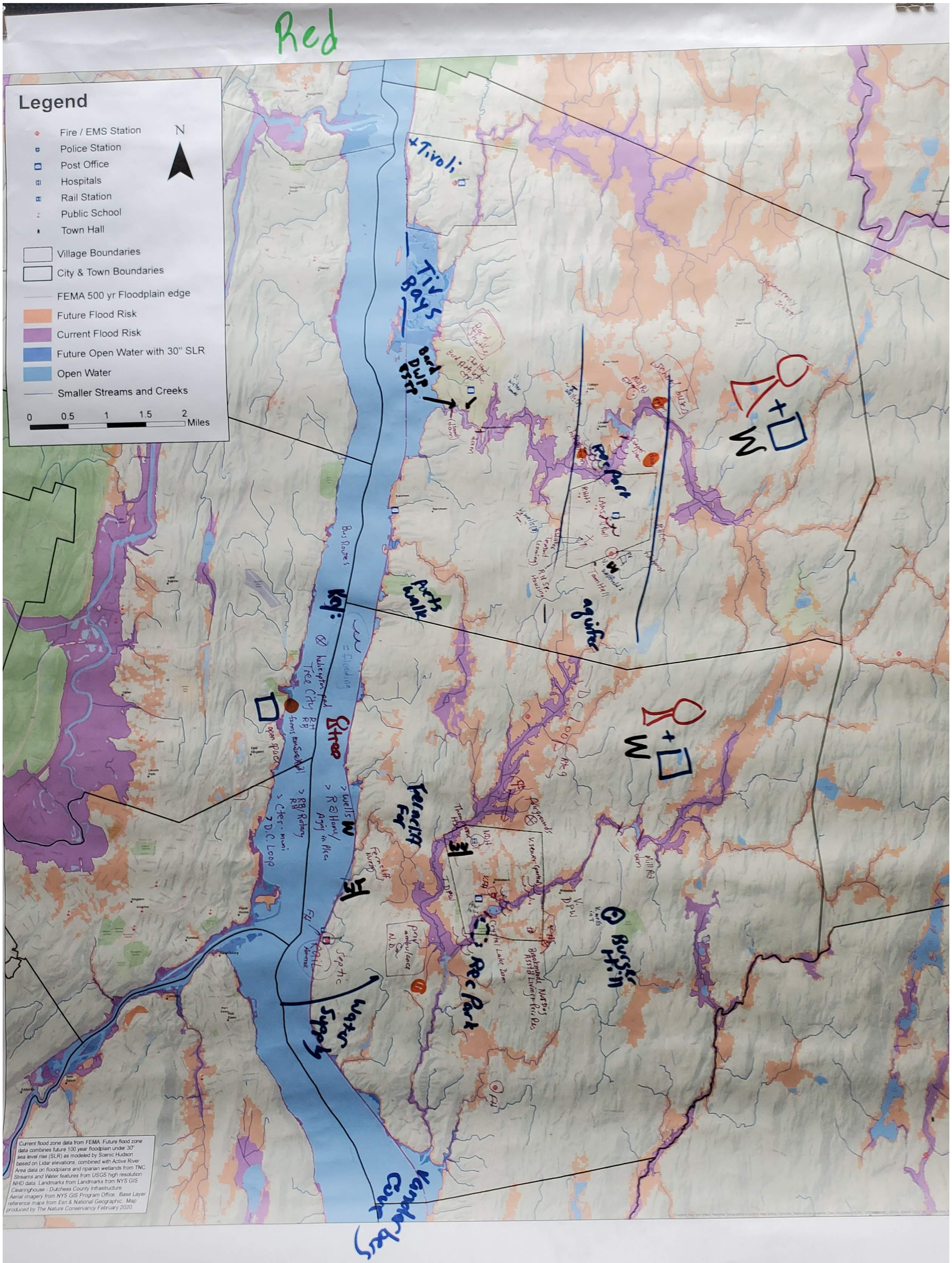
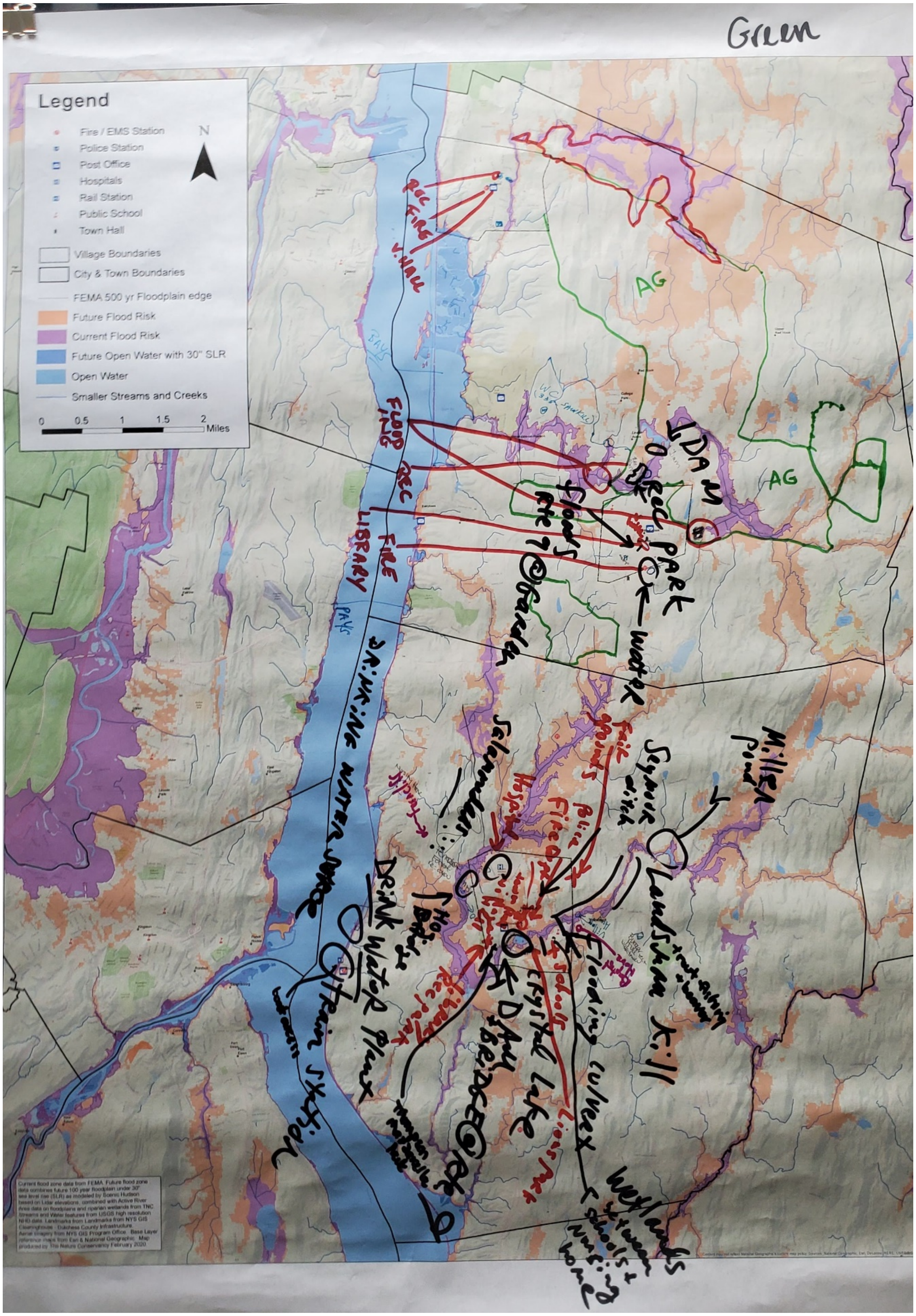
APPENDIX I: CRB Workshop Asset Identification Maps


Legend
Fire / EMS Station
Police Station
Post Office
Hospitals
Rail Station
Public School
Town Hall
Village Boundaries
City & Town Boundaries
FEMA 500 yr Floodplain edge
Future Flood Risk
Current Flood Risk
Future Open Water with 30" SLR
Open Water
Smaller Streams and Creeks
0 0.5 1 1.5 2 Miles
N
Rte 9 G
Rte 9
Current flood zone data from FEMA. Future flood zone data combines future 100 year floodplain under 30" sea level rise (SLR) as modeled by Scenic Hudson based on Lidar elevations, combined with Active River Area data on floodplains and riparian wetlands from TNC. Streams and Water features from USGS high resolution NHD data. Landmarks from Landmarks from NYS GIS Clearinghouse - Dutchess County Infrastructure. Aerial imagery from NYS GIS Program Office. Base Layer reference maps from Esri & National Geographic. Map produced by The Nature Conservancy February 2020


Blue
Legend
Fire / EMS Station
Police Station
Post Office
Hospitals
Rail Station
Public School
Town Hall
Village Boundaries
City & Town Boundaries
FEMA 500 yr Floodplain edge
Future Flood Risk
Current Flood Risk
Future Open Water with 30" SLR
Open Water
Smaller Streams and Creeks
0 0.5 1 1.5 2 Miles
N


Red
Legend
Fire / EMS Station
Police Station
Post Office
Hospitals
Rail Station
Public School
Town Hall
N
Village Boundaries
City & Town Boundaries
FEMA 500 yr Floodplain edge
Future Flood Risk
Current Flood Risk
Future Open Water with 30" SLR
Open Water
Smaller Streams and Creeks
0 0.5 1 1.5 2 Miles
Tivoli
Tiv Bays
aquifer
Rec Park
Water Supply
Current flood zone data from FEMA. Future flood zone data combines future 100 year floodplain under 30" sea level rise (SLR) as modeled by Scenic Hudson based on Lidar elevations, combined with Active River Area data on floodplains and riparian wetlands from TNC. Streams and Water features from USGS high resolution NHD data. Landmarks from Landmarks from NYS GIS Clearinghouse - Dutchess County Infrastructure. Aerial imagery from NYS GIS Program Office. Base Layer reference maps from Esri & National Geographic. Map produced by The Nature Conservancy February 2020


Green
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Future Open Water with 30" SLR
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Smaller Streams and Creeks
0 0.5 1 1.5 2 Miles
N
AG
AG
LIBRARY
FIRE
PARK
Landsman Kill
Crystal Lake
Flooding culvert
Drinking Water Plant
Train Station
Miller Pond
wetlands

APPENDIX 2: Climate Smart Community Resilience Tool Recommendations: Town of Red Hook