



The Ellicott City Flood Mitigation Plan



Allan H. Kittleman, Howard County Executive

Jonathan Weinstein, Howard County Council, District 1

August 23, 2018

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I. Introduction

In the aftermath of the unprecedented flooding in Ellicott City, Maryland on July 30, 2016, Howard County launched a detailed engineering analysis of the Tiber-Hudson watershed, known as the [Hydrologic and Hydraulic Analysis](#) (H&H). Led by McCormick Taylor, Inc., the analysis examined projects suggested by the community, as well as by other engineers, so that all flood mitigation options would receive careful and deliberate review and consideration. The information collected from this analysis was used to inform how the Ellicott City Master Plan addresses flood mitigation. Keeping the community informed about the flood recovery efforts and outreach has been a priority for the County. Information is available at [ECfloodrecovery.org](#) including the H&H analysis and the Master Plan.

The H&H analysis identified 18 large infrastructure projects which could mitigate the impact of flooding in the Tiber-Hudson Watershed with a cost estimate of \$84 million. While those projects collectively would significantly reduce the amount of flooding, they still would not eliminate it entirely. County Executive Allan H. Kittleman and Councilmember Jon Weinstein announced shortly after the completion of the analysis, the pursuit of four of these identified projects that had the greatest immediate and significant impact in mitigating future flood damage.

The County was in process of the design and engineering of these large infrastructure improvements and the Ellicott City Master Plan was ninety percent complete when another devastating flood occurred on May 27, 2018. The frequency of these high-intensity, short-duration storms has presented Ellicott City with an immediate threat to life safety that must be addressed. While other communities, such as Frederick, MD, were able to build large infrastructure improvements to mitigate flooding over several decades, Ellicott City does not have that time.

The recent flooding in May 2018, has shifted the conversation in dealing with this issue due to the increased threat to life safety it presents. Ellicott City must adapt to a new future.

II. Guiding Principles of the Plan

The guiding principles for this flood mitigation plan were articulated by County Executive Allan Kittleman and Councilmember Jon Weinstein at the Town Hall on June 28, 2018. They are as follows:

- **Protect Lives** - Too many lives have already been lost due to the recent devastating flooding in Ellicott City. Mitigating the life safety risk for residents, business and property owners, as well as visitors to the town, must be the top priority.
- **Continue to Engage the Community** - Efforts to date, including the Ellicott City Master Plan and the Hydrologic and Hydraulic Analysis, have received substantial community input and feedback, and any efforts moving forward will seek to continue to engage the community in a collaborative, open and transparent fashion.
- **Make Economically Sound Investments** - Investments made in Ellicott City must yield the largest impact per dollar.
- **Safeguard the Environment** - The environment that serves as such an important visual and natural asset to Ellicott City must be protected.
- **Preserve Historic Character** - The town of Ellicott City and its character must be preserved for generations to come, and changes will have to be made to adapt to the changing weather patterns that contribute to the new future now faced.

III. Components of the Plan

A. Background

Extensive rainfall on May 27, 2018 caused catastrophic flooding throughout Howard County which resulted in the loss of life. The most significant flooding occurred in Ellicott City, with dangerous flash flooding in the Main Street area that necessitated numerous swift water rescues. Approximately 7.5 inches of rain fell in 5 hours, the majority of which fell in a 3-hour period. In a 6-hour period from 4:00pm, the 911 Center received over 1100 calls. The Emergency Operations Center opened to a Level 1 at 4:40pm. Multiple roads were completely washed away, the Old Courthouse near Ellicott Mills Drive was demolished, and there was massive damage to streets, sidewalks, and buildings. Additionally, there were two fires caused by lightning strikes, one of which was a two alarm fire.

Howard County Executive Allan H. Kittleman signed an executive order declaring a local disaster for Howard County at 6:45pm and Governor Larry Hogan declared a State of Emergency shortly thereafter. The Governor toured the affected area and held a joint press conference with County Executive Kittleman.

This is the second significant flooding of Historic Ellicott City in two years, and each time the flooding was considered a 1000-year event. Four lives have been lost due to these two floods. Experienced forecasters from the National Weather Service have told the County that storms capable of producing devastating flash floods are becoming more likely in the entire mid-Atlantic region. The County must adapt to this likelihood, with the protection of life safety driving the changes necessary.

B. Considerations

Many options for reducing the impact of flooding in Ellicott City, particularly the significant damage to the lower end of Main Street, were considered and modeled. On lower Main Street, the ability to open the first floor of the buildings to allow floodwaters to enter the roadway was examined so that the existing buildings could remain. The results showed that the stream channel remained constricted. Additionally, the models identified the continued possibility of debris catching on the supporting structures, forcing the floodwaters back into the roadway. Thus, the ability to mitigate the impact of flooding on Main Street is limited.

Another option was explored to remove the backs of buildings that spanned over the channel and were often built years after the original building. By removing the additions, the channel would not have constraints of a building blocking the flow of water to a specific height. Although this option would preserve the facades, the result showed that the water depth on lower Main Street did not decrease significantly.

Expanding the stream channels and floodplain in strategic locations was explored. The reduction in floodwater resulting from expanding the stream channel and floodplain resulted in the best plan to mitigate the life safety risk of flooding in Ellicott City, particularly on the lower end of Main Street.

These considerations are demonstrated in the Hydrologic and Hydraulic analysis models that follow.

The Ellicott City flood mitigation plan focuses on a multi-faceted strategy to resolve the complex challenge faced by this historic town. The two essential elements of this plan include increasing the retention of water higher up in the watershed, and, simultaneously, increasing the floodplain throughout the town so that the force of the water is contained in the stream channel to the highest level possible. Many ideas were explored, and as explained below, the recommended plan will provide the most immediate impact in addressing the significant life safety threat in Ellicott City.

C. Hydrologic and Hydraulic Analysis Models

1. July 30, 2016 Flood Model

The hydrologic and hydraulic analysis model in Diagram 1 below shows the amount of water on Main Street under the conditions experienced during the Ellicott City flooding on July 30, 2016. The model depicts the water depth in the channel as well as on the street and around the buildings. The stream channel is typically defined with over 8 feet of water, and as shown in the map below, that same amount of water is also seen on Main Street during the July 30, 2016 event. This event is used as the baseline for the modeling purposes.

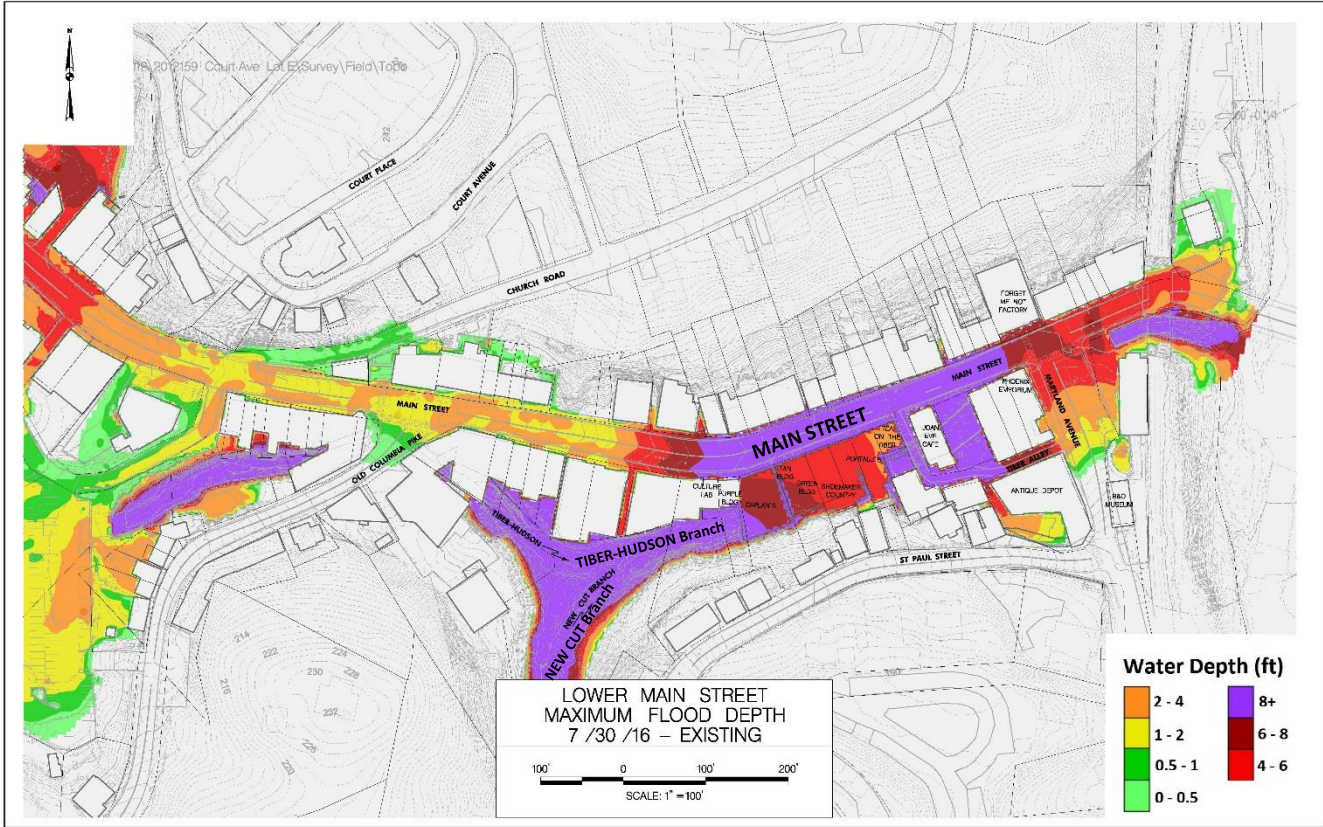


Diagram 1

During the July 30, 2016 flooding event, not only were water levels in the Tiber-Hudson Branch, New Cut Branch, and on Main Street over 8 feet in depth, the rushing water’s velocity of approximately 11.1 feet per second created a significant risk for life safety and major destructive damage to buildings, particularly on lower Main Street.

2. Open First Floor Model

The model in the figure below shows flooding conditions if there was a 10-foot clearance underneath the buildings on the south side of Main Street from the Caplan's Building to Maryland Avenue:

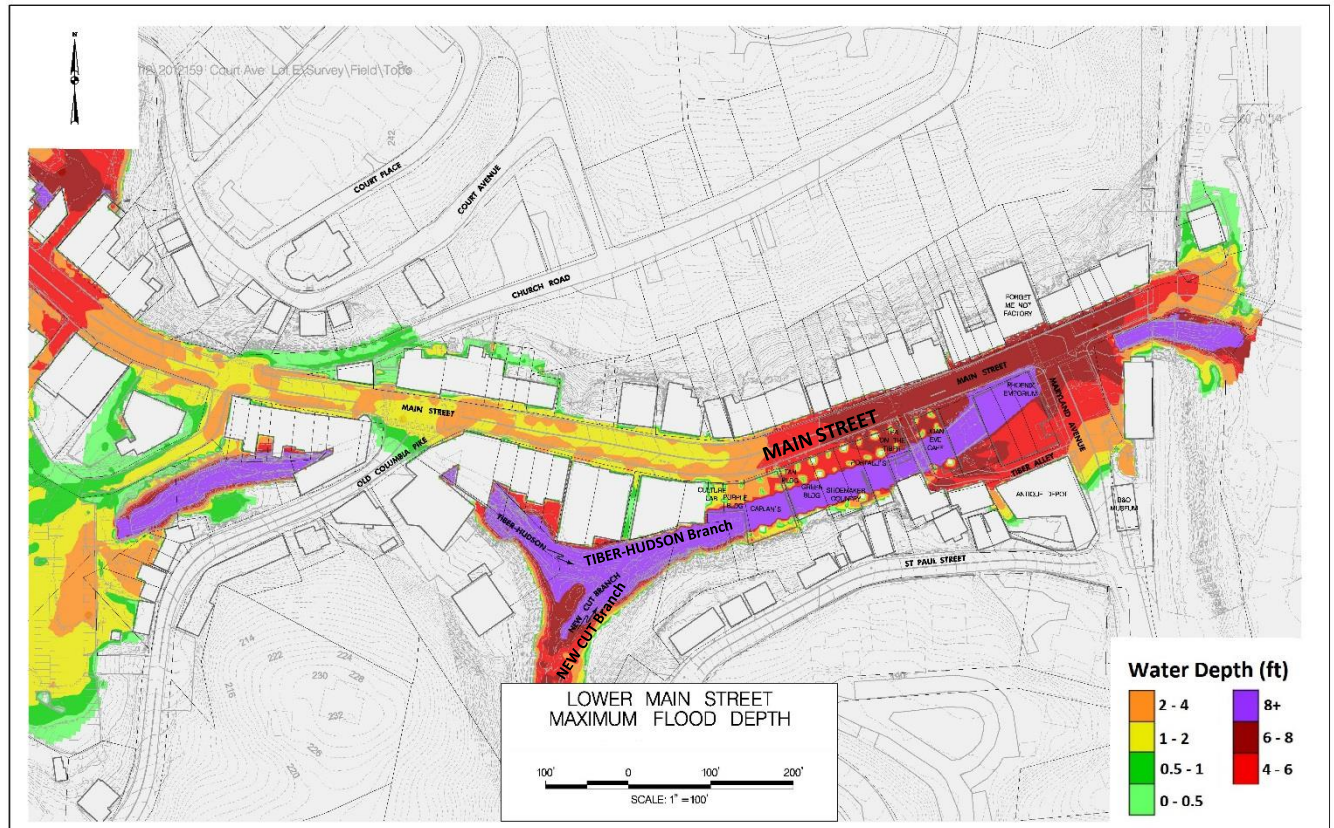


Diagram 2

This model preserves the building structures, while opening up the first floor for water to flow more naturally from Main Street into the stream channel. As shown above, while the model does show a decrease in the amount of water on Main Street, the potential for debris catching on the supports of the buildings and pushing additional floodwater into Main Street is very high and does not adequately reduce the risks that currently exist. Water in the Tiber-Hudson Branch and the New Cut Branch remains over 8 feet, while the water depth along lower Main Street ranges from 4 to 8 feet.

3. Model of Culvert in Lower Main Street

Consideration was also given to the potential of keeping the existing buildings and building a culvert down the middle of Lower Main Street. There were significant concerns associated with constructing such an infrastructure improvement, and even so, the result provides limited reductions in floodwaters on Main Street, as seen below:

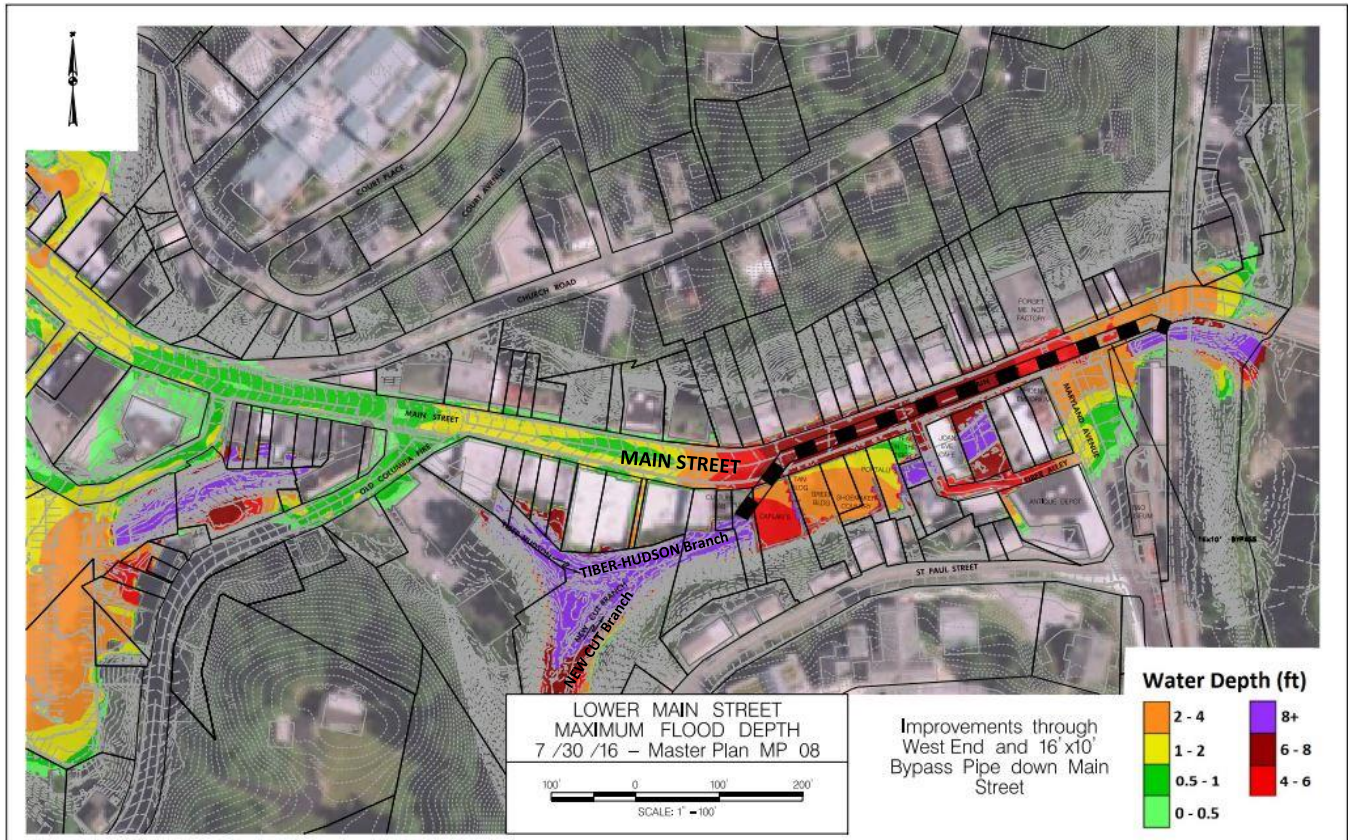


Diagram 3

As this model shows, water depths in the Tiber-Hudson Branch and the New Cut Branch still exceed 8 feet, and the majority of water on lower Main Street remains at 6 to 8 feet.

4. Model with No Structures Over the River

Another scenario the County explored was keeping the fronts of the structures facing Main Street in place in order to preserve the existing viewshed (the existing view from the street). The results of this iteration of modeling shown in Diagram 4 below demonstrate limited reductions in the water on Main Street.

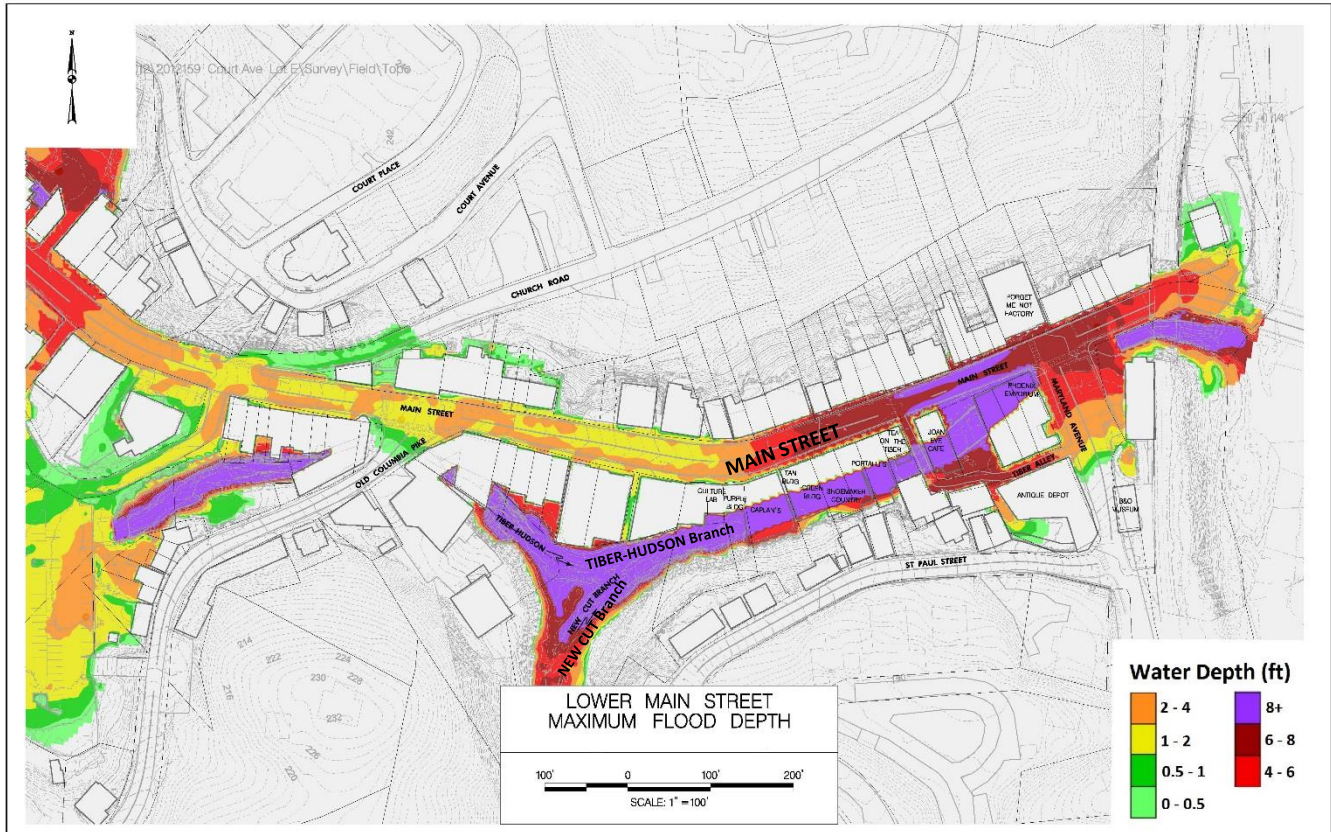


Diagram 4

As shown in this model, the water level in the Tiber-Hudson Branch and the New Cut Branch remains over 8 feet, and the majority of water on lower Main Street ranges from 4 to over 8 feet. Again, the life safety risks remain with these water depths.

5. Expanded Stream Channel Model

The model in Diagram 5 below demonstrates the effect of an expanded stream channel in the area on lower Main Street between the Caplan's Building and Maryland Avenue with the buildings having been removed.

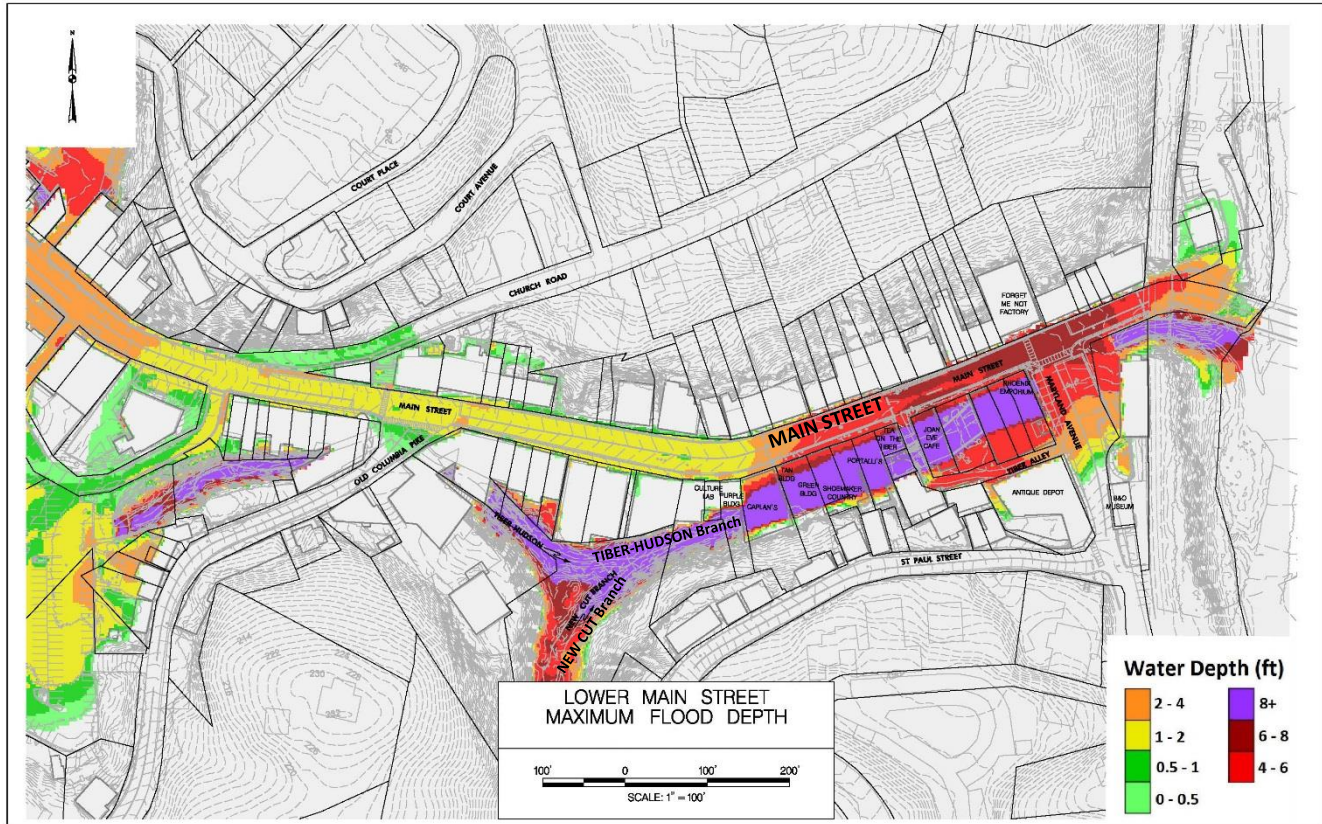


Diagram 5

This model shows a significant reduction in the floodwaters compared to existing conditions, and demonstrates the most improvements in water depth, water velocity and the risk to life safety. With the expanded stream channel and the removal of buildings along lower Main Street, the water velocity is approximately 4.5 feet per second – a significant reduction from the conditions that existed during the July 30, 2016 flood with water velocity around 11.1 feet per second.

Expanding the stream channels and floodplain in strategic locations is a central and necessary component of this model. This will require the acquisition of several properties and the demolition, or relocation of several buildings that constrain the stream channel and have significant life safety risks for occupants. Key locations include critical chokepoints in the West End, as well as the area just east of the confluence of the New Cut Branch with the Tiber-Hudson Branches on the lower end of Main Street down to the Patapsco River.

D. Recommendations

As the models demonstrate, the acquisition and relocation/demolition of 10 buildings that currently constrict the stream channel will provide the most immediate and impactful benefit in reducing the life safety risk on Lower Main Street. Significant improvements to realize this vision can be taken within a year. The Ellicott City Master Plan will provide guidance on how the floodplain in this area can be terraced so that it can be transformed into a community open space that can be used for public enjoyment. **This space can be one of beautiful functional design with numerous amenities for the community to enjoy while serving as life safety protection.** The community will be engaged to help design this new open space.

In addition, the opportunity to strategically expand the floodplain further west will also be pursued. This will include the acquisition and demolition of approximately seven residential structures in the West End, which also achieve a similar immediate benefit to the community.

Collectively, the expansion of the floodplain in these strategic areas would result in the loss of less than 5 percent of the structures in the Historic District. **The County will make every effort to preserve the key historical elements of these structures so that they may be re-used in the Historic District to safeguard their legacy for the years to come.**

E. Infrastructure Improvements

The strategy to expand the floodplain will be combined with the execution of several floodwater retention facilities that have been in process, as well as several conveyance improvements. These include:

- Hudson 7 Retention Facility (identified in H and H Analysis): 13 acre-ft of storage in the US 29/40 Interchange
- Quaker Mill Retention Facility: 10 acre-ft of storage along Rogers Avenue
- 8600 Main Street Culvert Expansion (identified in the H and H Analysis): Significantly increasing the capacity of the culvert.

In addition to these projects, the County is continuing to evaluate the potential to construct the retention facilities described as T1 and NC3 in the H and H Analysis.

These projects will now be coupled with two new elements to drastically improve conveyance of water through the town.

The first is the expansion of the channel that runs under Parking Lot E to Parking Lot D. This idea was explored through the Master Plan concepts, and it will tie into the expansion of the Ellicott Mills Drive culvert as that is rebuilt. This will require the relocation or removal of two additional structures.

The other project will be the addition of culverts under Maryland Avenue that will connect the Tiber-Hudson with the Patapsco River further downstream. The constriction at the B & O Railroad Bridge proves to be a continuing challenge, so the addition of an outlet further downstream will reduce the backwatering caused at that constriction. The County will need to work with its partners at CSX to perform this work, and the goal is to construct at least two 10' diameter culverts as shown in the Appendix.

F. Community Outreach

The County has been working continuously with its partners in the community to expand stormwater management on residential and commercial properties, not only in the Tiber-Hudson Watershed, but across the entire County. In the Watershed, we have been supportive of the efforts of Howard EcoWorks and its SoakItUp campaign. The Office of Community Sustainability has also been working to continue to increase the number of bio-retention facilities, rain barrels, and other projects in this watershed and throughout the county. They have also been working to improve the capacity of our existing stormwater management ponds. With the utilization of new technology such as Opti, the County is improving the retention capacity of the existing stormwater management ponds, and will continue to look for areas to improve in the watershed. The County will continue to support these efforts and encourage property owners to do what they can to manage their stormwater as well.

As part of this new approach, Howard EcoWorks has been working with Baltimore Gas and Electric to immediately include better natural vegetative management within its Right of Way. This practice is another effort worth exploring to more immediately reduce the amount of stormwater reaching the town. Every bit helps, and the County will continue to be supportive and encourage these practices.

The Flood Work Group, established by County Executive Allan Kittleman and Councilmember Jon Weinstein in the spring of 2015, has also been a critical component in the County's flood mitigation efforts. The workgroup's participation in the recovery efforts and their recommendations have been utilized to improve the County's response, while also serving as a direct conduit to the community. Their assistance has been invaluable and the County will continue to work with the members of this group in the implementation of this plan.

The County recognizes the keen community interest in staying abreast of plans and projects focused on flood mitigation in the Tiber Watershed. To that end, we will continue to be transparent on all aspects of our work. **The flood recovery website (ECfloodrecovery.org) will continue to be our primary conduit for information. This site will be kept up to date with all upcoming meetings, project status and related community activities.**

G. Overall Plan

This multi-faceted strategy is tailored to adapt to the urgent nature of the threat we now face. It provides the most benefit to the community in the shortest duration. The overall cost of the proposed flood mitigation described in this plan is approximately \$40 to \$50 million, close to half of the estimate for all the projects identified in the Hydrologic and Hydraulic Analysis. With financial and technical assistance from our State and Federal partners, the County believes this plan could be implemented in a five-year timeframe. **The most immediate life safety threat in Lower Main could be addressed within a year.**

The models below demonstrate the tremendous benefit that would be realized from this multi-faceted approach. The first model run in Diagram 6 shows the impact of the July 30, 2016 storm on the town during current conditions:

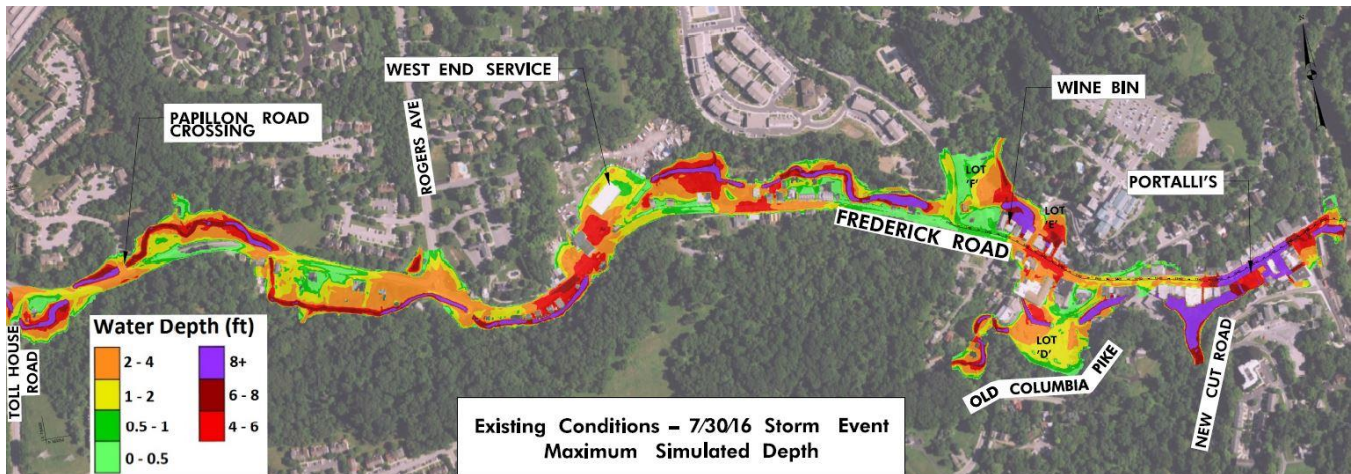


Diagram 6

The model run below in Diagram 7 shows the impact of the same July 30, 2016 storm with the recommended mitigation improvements described in this plan in place:

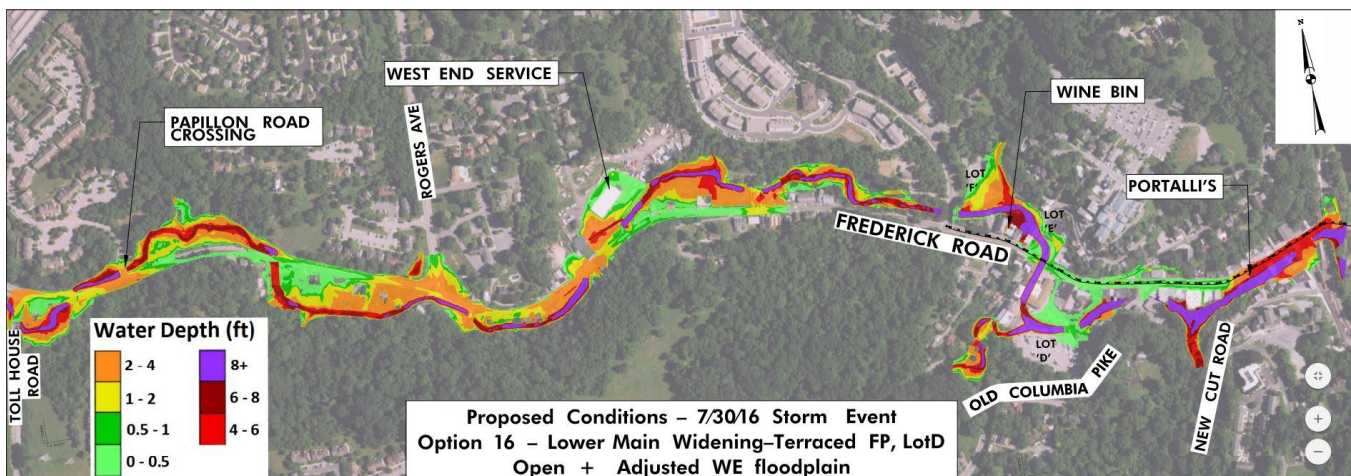


Diagram 7

These model runs show unequivocally that there is a significant decrease in roadway flooding with the expanded stream channels and infrastructure improvements. In addition, the velocity of the water on the road has also decreased dramatically. For instance, in the lower end of Main Street, the water was travelling at approximately **11.1 feet per second** in the street during the July 30, 2016 storm, but that will now be closer to **4.5 feet per second** after the identified improvements are made. **Reducing the velocity of the water by 60 percent** will significantly decrease the destructive force the water has had on the structures. Even so, property owners will continue to be strongly encouraged to floodproof their buildings.

IV. Next Steps for the Master Plan

This flood mitigation plan is meant to serve as a short-term strategy to direct County efforts in reducing the immediate life safety risk in Ellicott City. With the assistance of our State and Federal partners, this plan could be accomplished in a 5-year timeframe. This flood mitigation plan will be incorporated into the [Ellicott City Watershed Master Plan](#) (Master Plan).

The County launched the Ellicott City Master Plan as the Hydrologic and Hydraulic (H&H) analysis was completed. The Master Plan incorporated the results of the H&H analysis, integrating these with economic, historic, community design and environmental considerations. The master plan process has been crafted to define a comprehensive community-driven vision for rebuilding a stronger and more resilient Ellicott City. The plan was developed with a high level of engagement, being based on the 2016 flood recovery meetings and a series of public workshops and outreach. The master planning process resulted in a new vision and a series of strategies for the Main Street core area, the West End and the larger watershed.

The Master Planning process is to be restarted this September 2018. It is important to note that this 5-year plan is meant to solely address the flood mitigation, while the Master Plan will provide more holistic recommendations in the Tiber-Hudson Watershed to address transportation, community and economic development.

V. Summary

The transformative vision outlined in this document will ensure Ellicott City immediately becomes more resilient to future flooding. Since its inception, Ellicott City was built to control the water. As we adapt to changing weather patterns, we must embrace the natural environment that surrounds our community and coexist with it. These are the actionable steps that must be taken to preserve Ellicott City so that future generations will have the opportunity to enjoy all that it has to offer.

This bold five-year strategy to mitigate flooding in Ellicott City, includes a core component that would address the most immediate life safety threat on the town's lower Main Street within one year. The strategy includes the acquisition and removal of 10 buildings on the south side of Main Street within the next year and the creation of a public open space with a wider, deeper river channel in their place. The community will be engaged through the Master Plan process to provide input into the design and use of this new open space. Community input will also be important to identify key historic features that can be preserved and re-used when the buildings are removed to widen the channel.

In addition to community input, the Master Plan itself and specifically any proposed removal of structures within the Historic District require the Historic Preservation Commission (HPC) to review. A Certificate of Approval will need to be obtained from the HPC before the County can proceed with these plans. Projects that have any federal/state permitting or funding must include a Section 106 Review where the County will identify and determine the impact and any adverse effects of the historic resources within the identified area. The County will work with state agencies such as Maryland Historic Trust in this review process.

As part of this five-year strategy, at least two additional culverts, each 10 feet in diameter, will be installed beneath Maryland Avenue to carry water from the Tiber-Hudson branches further downstream in the Patapsco River. The Hudson branch channel under Main Street near Court Avenue will be widened to

eliminate a significant pinch point that causes the water to rush out onto upper Main Street during heavy rainfalls.

The most experienced forecasters have told the County that storms capable of producing devastating flash floods are becoming more likely in the entire mid-Atlantic region. The County must adapt to this likelihood, with the protection of life safety driving the changes necessary.

The strategy to expand the stream channels will be combined with the construction of three upstream floodwater retention facilities and conveyance improvements:

- A 13-acre-foot retention pond in the US 29/40 interchange.
- A 10-acre-foot retention pond along Rogers Avenue.
- Significant expansion of the culvert in the 8600 block of Main Street to increase capacity.

It is important to note, even with these improvements, storms like the ones experienced in 2016 and 2018 could still cause some flooding, and this strategy will substantially reduce the height of the floodwaters. Perhaps more importantly, it will decrease the velocity of the water and its destructive force by 60 percent, improving the current risks faced to life safety and property damage. This will make a substantial difference for residents, business and property owners, and visitors to our community.

The County is also planning to acquire and remove approximately seven residential properties in the town's West End between Ellicott Mills Drive and Rogers Avenue to achieve a similar benefit for that part of the community. The number of structures that are planned for acquisition and removal comprise just 5 percent of the entire Historic District. The Howard County Economic Development Authority will continue to assist those impacted businesses find alternate locations.

In the Valley Mede community north of U.S. Route 40 in Ellicott City, the County is engaged in ongoing discussions with several residents who have been most impacted by recent flooding. The County is evaluating the purchase of these homes as well, in addition to stormwater improvements.

The recommended five-year plan is estimated to cost about \$40 to \$50 million. The County is seeking financial and technical assistance from the state and federal governments to implement the recommended plan and provide the most immediate impact in addressing the significant life safety threat in Ellicott City.

Appendix: Detailed Modeling of the Recommended Improvements

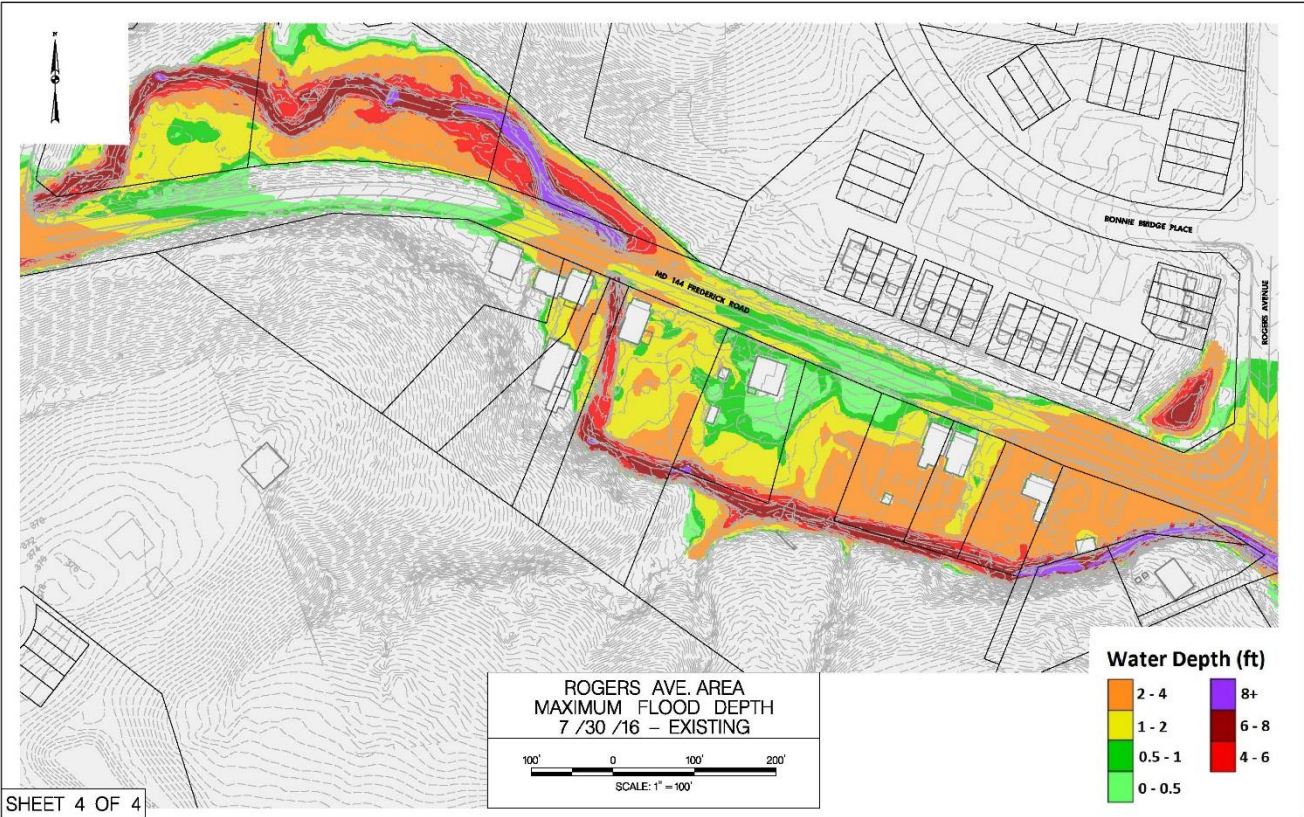


Diagram 8

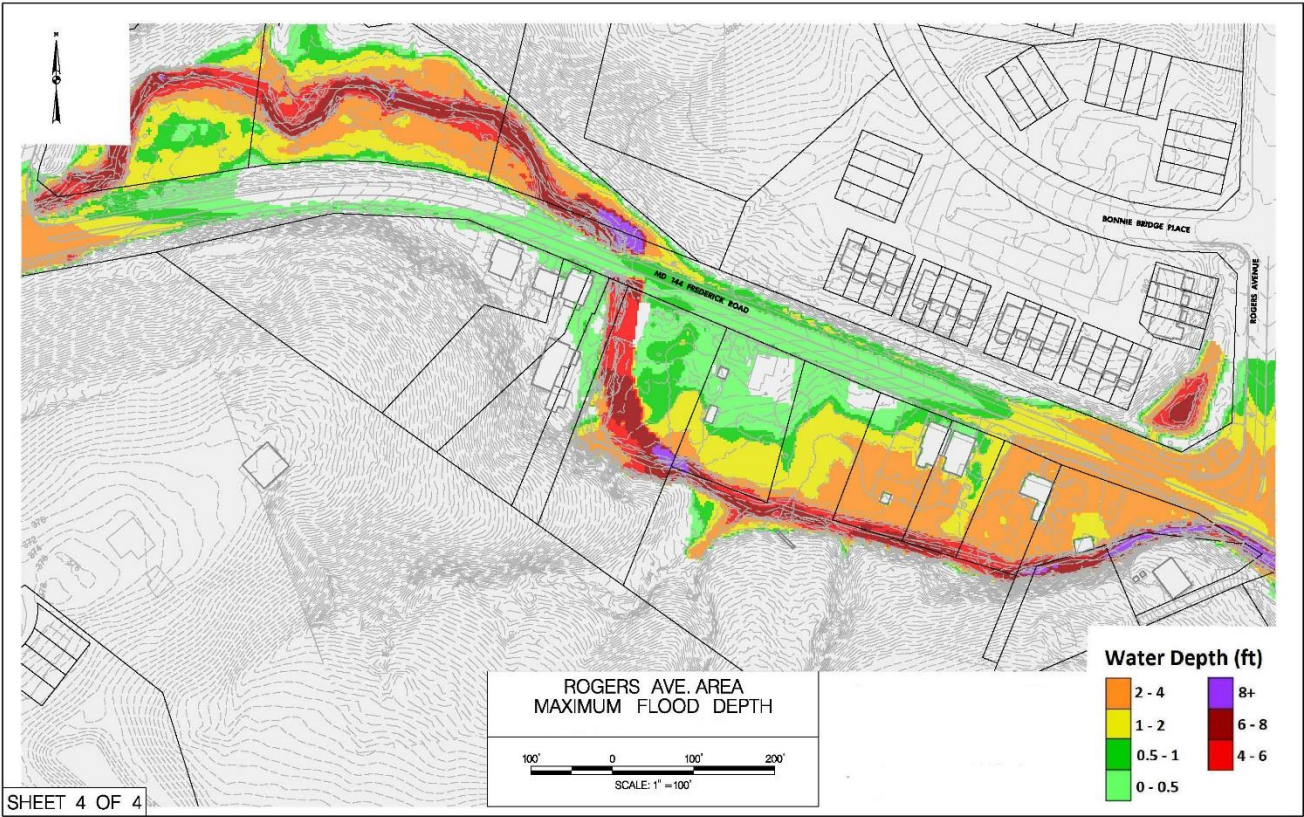


Diagram 9

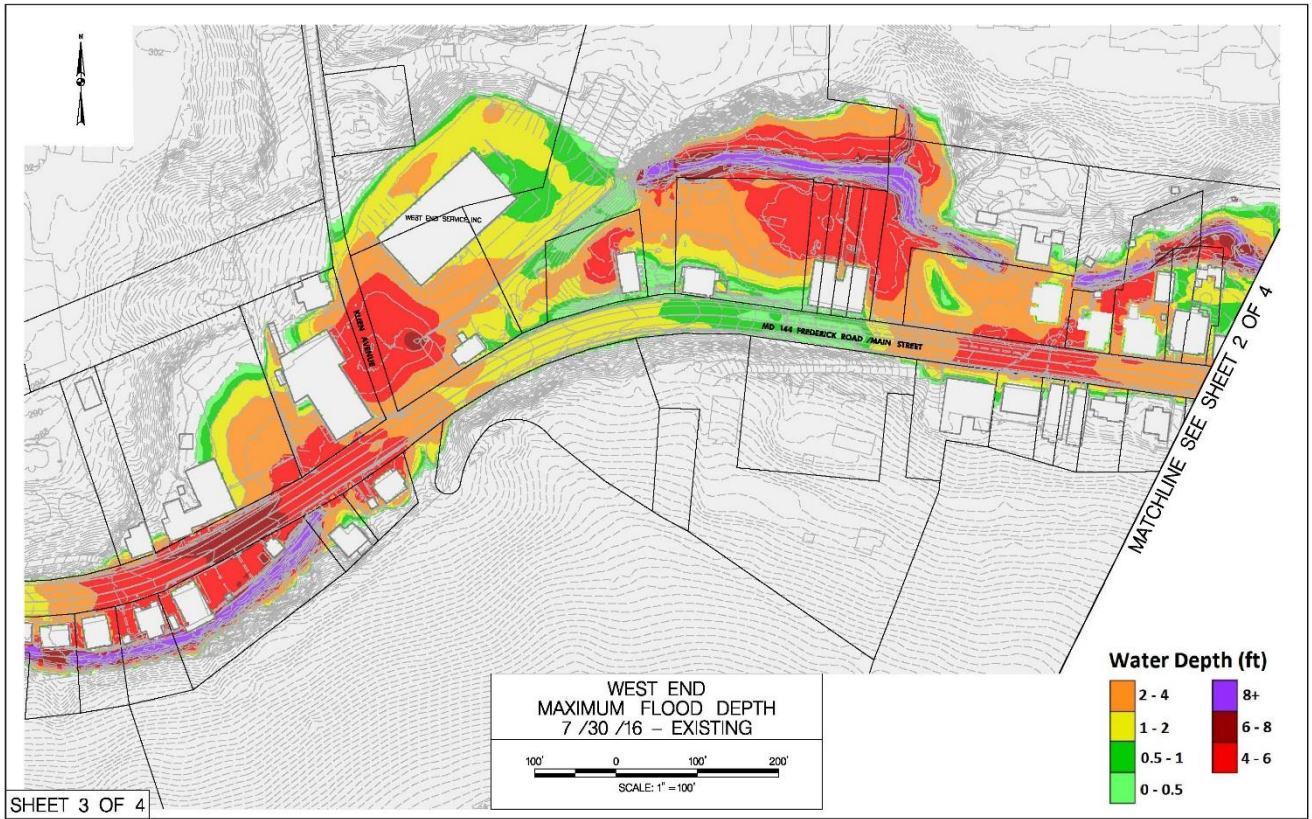


Diagram 10

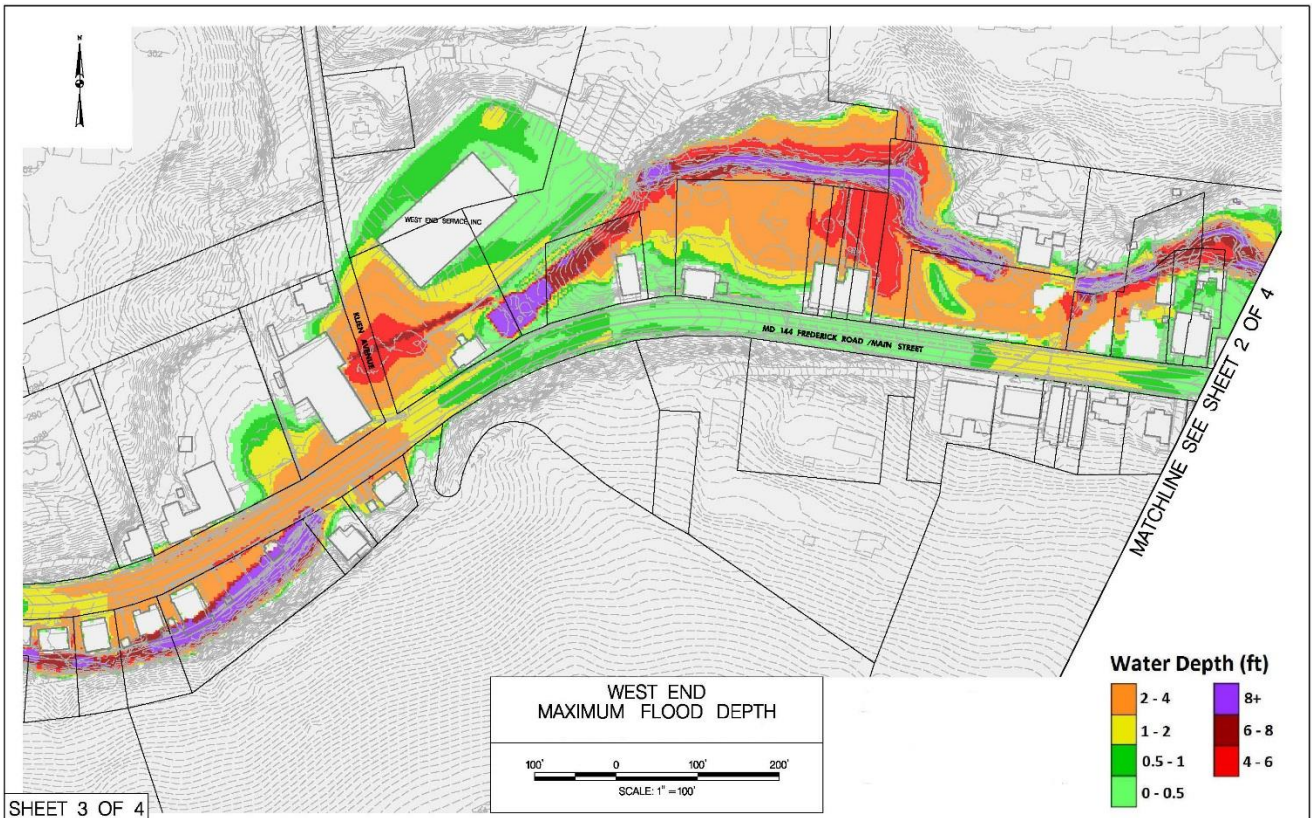


Diagram 11

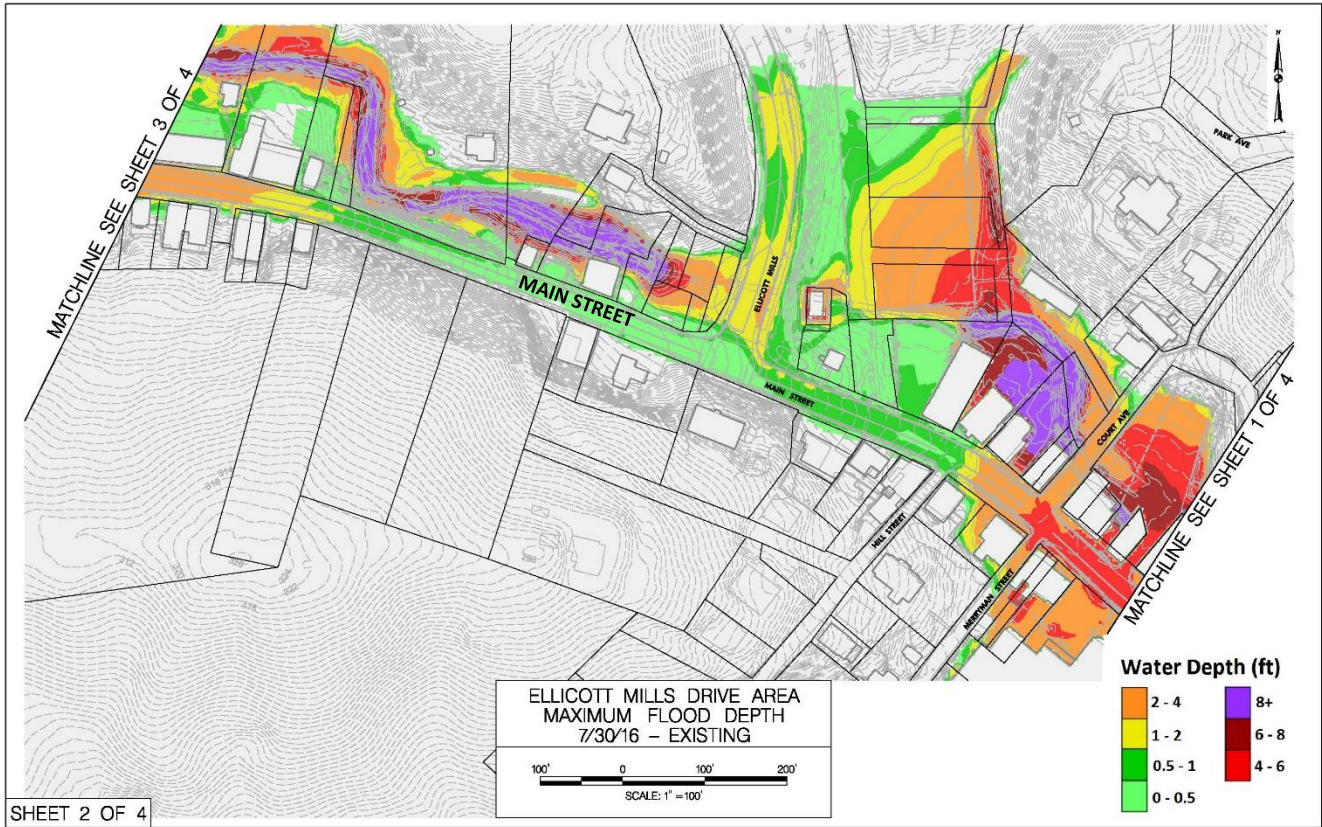


Diagram 12

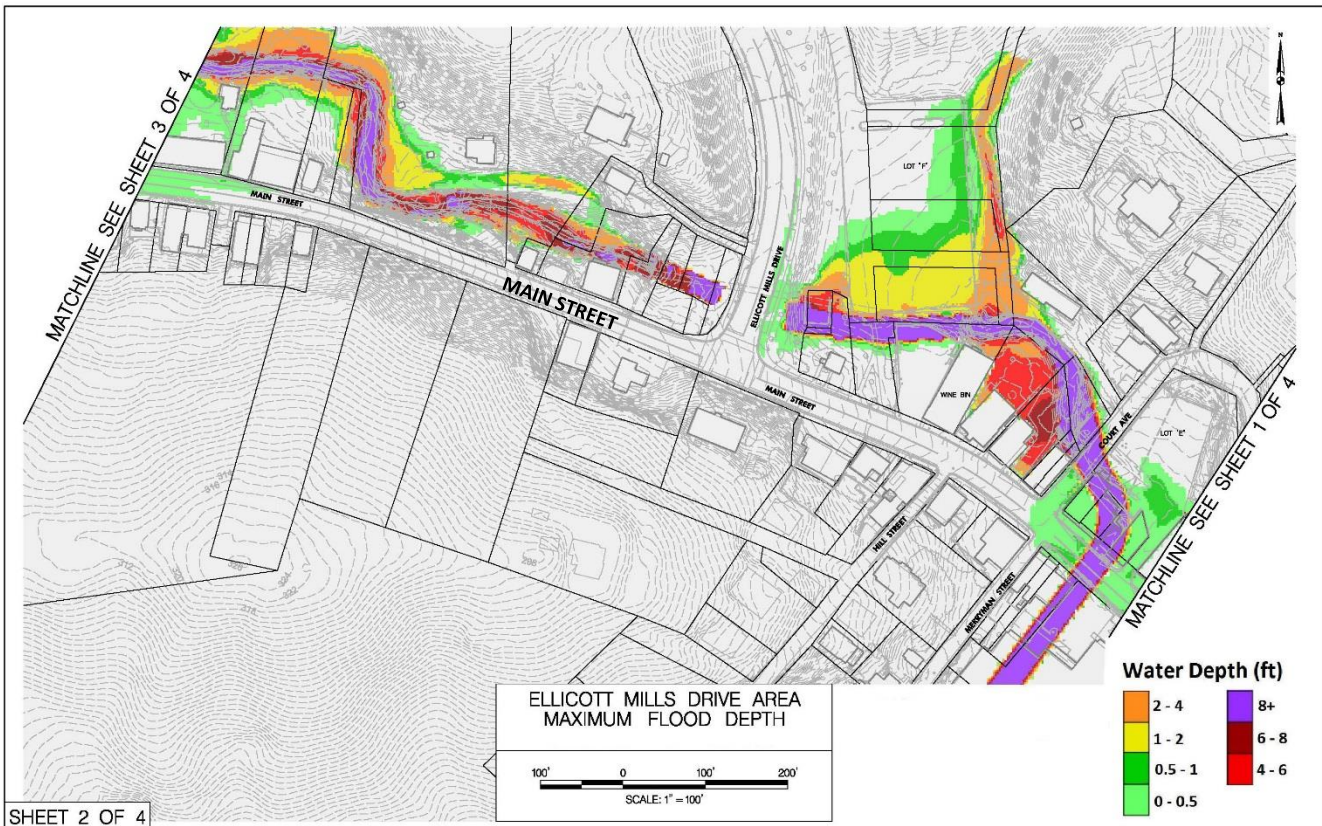


Diagram 13

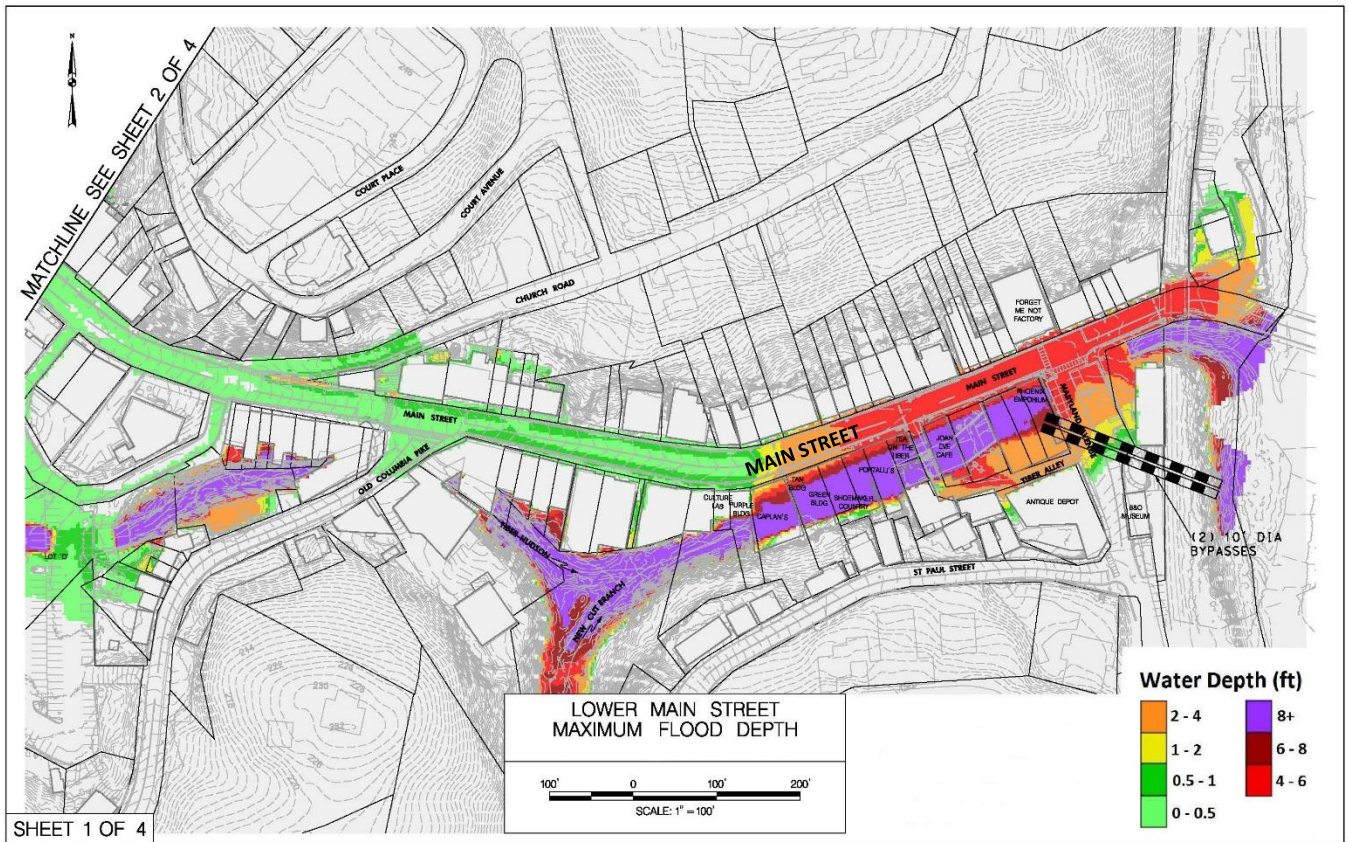


Diagram 14