VILLAGE OF PELHAM MANOR
WESTCHESTER COUNTY, NEW YORK

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PELHAM MANOR, NY 10803-3298

VILLAGE ADMINISTRATION 914-738-8820

TO: Whom It May Concern

FROM: Lindsey M. Luft, Village Manager

DATE: June 5, 2023

SUBJECT: Village-Wide Drainage Infrastructure Assessment

The Village of Pelham Manor remains committed to stormwater management and mitigation, to further support our efforts we embarked on a comprehensive study of our entire stormwater system. The Village-Wide Drainage Infrastructure Assessment (assessment) is now complete and will serve as one of our key tools to guide future investments.

As the scope of work for the assessment was being conducted, interim mitigation measures were taken concurrently. Some examples of these measures are catch basins enhancements, replacing sections of compromised pipe, jet cleaning the entire system and continuously advocating with our neighboring partner agencies. These measures build upon a long-standing history of stormwater infrastructure investments.

Our standard storm system maintenance includes: thorough annual catch basin cleaning, as well as additional cleaning in advance of predicted storms, monthly street sweeping to remove debris before it enters the storm system, and repairing catch basins as needed.

The entire assessment with all appendices is voluminous. The following document is the narrative. Residents are welcome to view the entire assessment by making an appointment at Village Hall. Please call 914-738-8820 if you would like to schedule a time.

At the June 12, 2023 Board of Trustees meeting, the engineers who conducted the report will be presenting their findings. Questions may be submitted in advance to villagemanager@pelhammanor.org or via comment card at the Board of Trustees meeting, which will be answered by the Village Manager subsequent to the meeting.

AI Engineers

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Village-Wide Drainage Infrastructure Assessment

Village of Pelham Manor

Westchester County, New York

May 2023

Prepared by:

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1. Study Scope & Summary

AI Engineers, Inc., Dolph Rotfeld Engineering Division (AIE/DRE) has been engaged by the Village to perform a comprehensive drainage assessment of the entire Village to determine the capacity of the current drainage infrastructure system and to recommend potential improvement projects at key locations. The goal is to mitigate to the best extent practicable flooding events that are known to occur. The study includes a comprehensive overall mapping of the drainage system, noting pipe sizes, slopes and materials, drainage structures and contributing watershed areas. This mapping will assist in formulating an overall plan of maintenance and investigation of the system Village wide and facilitates development a computer model of the drainage system to aid in this assessment. The model is key in analyzing and assessing capacity improvements to the Village system to identify future capacity improvement projects.

Study overview:

A. Review of existing information such as the Westchester County Hazard Mitigation Plan with regard to recurring flood hazard areas and identified projects listed for the Village. See Appendix A, "Overall Map w/ Target Areas" depicting locations identified by the Village as known flood prone areas.

B. Review NFIP Flood Insurance Rate Maps to identify and assess areas of Special Flood Hazard. See Appendix A profiles.

C. Procure Village-wide aerial photography mapping to be used as a base map.

D. Review existing historic drainage mapping throughout the Village as well as GIS storm drainage mapping that was completed under the NYSDEC MS4 program, to create a master drainage system map. Delineate existing watershed areas Village-wide as well as flood hazard areas.

E. Utilize the drainage system mapping to prepare a plan for Closed Circuit TV (CCTV) inspection to clean, identify and confirm storm drainage piping sizes and conditions Village wide and update the system map accordingly.

F. Provide land surveying services to obtain invert elevations for the drainage system network.

G. Hydrologic analysis performed to model the various watershed areas Village wide. The analysis will utilize **HydroCad®**, a TR-20 (United States Department of Agriculture Natural Resource Conservation Service Technical Release 20) based computer model. Current rainfall **extreme precipitation data** such as Northeast Regional Climate Center or NOAA Atlas 14 precipitation data and the most recent FEMA Flood Insurance Rate Maps will be

utilized. The study analyzes and models existing conditions and will include various storm events and intensities as needed to evaluate current system capacity and identify future improvements.

H. Hydraulic analysis of the drainage system performed at key locations to estimate existing capacity of the main trunk lines serving the Village. The analysis utilizes **EPA's Storm Water Management Model (SWMM)** computer software to model the existing system as well as superimposing proposed improvements. The hydraulic model depicts hydraulic gradient and predicts areas of pipe system surcharging for various storm events modelled. Surcharging of the model indicates flooding potential and focuses improvements on those areas. Various potential design options and improvements can be simulated to determine and make recommendations for proposed capacity improvements and facilitate future planning. This model also considers the effects of the 100 year floodplains within the Village at key outfalls.

2. Investigation

Under this phase of the study, the following tasks were completed to ascertain the existing condition of the system:

- Aerial Mapping performed Village–wide.
- CCTV Inspection and cleaning of all drainage infrastructure piping, catch basins and manholes Village-wide (58,000 LF of pipe)
- Survey of all existing drainage structures throughout the Village (525 MH's/CB's)
- Development a comprehensive existing conditions map of the system. (see App. B)
- Profile "key" drainage pipe main runs for analysis and assessment, particularly targeting specific areas identified by the Village. The "target" areas are known to experience stormwater flooding issues and are located on the attached map (see App. A)
- Note that CCTV findings were utilized throughout this process to help facilitate interim measures for infrastructure improvements to improve capture of stormwater into the system.

3. Hydrology

- Utilized current rainfall **extreme precipitation data (see App. H)**
- 5 primary watersheds identified and associated outfalls mapped (see App. A).
- Each watershed further divided into sub-watershed areas for each of the targeted flood prone locations. Areas of **Watersheds 1, 3 and 5** directly tributary to the main storm drain pipe runs were modelled to predict peak rates of stormwater runoff.
- Models developed in HydroCAD software – peak runoff rates calculated for various storm events, including the 90% rainfall, 1 year, 10 year and 100 year storms also including the measured rain event data from 4/28/2023 (See App. G)
- Rainfall depths respectively are 1.5", 2.85", 5.09" and 8.96" , 24 hour duration event. (See App. H)

4. Hydraulics

- Utilizes SWMM computer software to model drainage infrastructure piping and determine capacity of the system.
- FEMA flood elevations at the Hutchinson River outfalls were considered.
- High tide elevations at outfalls were considered.
- SWMM pipe profiles generated and modelled with input from the Hydrology analysis for various storm events,
- Both existing and various proposed conditions with potential improvements were modelled. (See App. E & F)

5. Existing Conditions Findings

A. Watershed #1

Watershed #1 is the area roughly bound by Colonial Ave. to the north, Esplanade and Boston Post Road to the south, Manor Ridge Road and extending past the Village line to the east, and the Hutchinson River to the west. This area discharges through a 48" diameter reinforced concrete pipe through Glover Field to an outfall on the bank of the Hutchinson River. The main trunk line consists of varying pipe

sizes from 48" in diameter to 18" diameter mainly running along Iden Avenue, Wolfs Lane, Reed Avenue, Highbrook Avenue, and Witherbee Avenue.

The following conditions currently exist with regard to current system capacity:

- Existing SWMM profiles (See App. E) demonstrate sufficient pipe capacity for 90% storm event, 1.5".
- The SWMM profiles begin to show manhole surcharging within the system during the 1 year storm event (2.85") in the vicinity of Wolfs Ln., Witherbee Ave., Highbrook Ave. and Pelham Manor Rd.. This would indicate that full capacity of the piping has been reached and there is likely flooding within the roadway under these conditions.
- The 10-year (5.09") and 100-year (8.96") storm events further indicate surcharging of the system suggesting flooding at more areas along this pipe run.
- The SWMM model agrees with anecdotal evidence , showing that study target areas experience surcharging during the modelled storm events noted, primarily along Highbrook Ave., and Pelhamdale Ave..
- The SWMM model also accounts for high tide elevation during 90% and 1-year storms and also incorporates FEMA flood elevations at 10-year and higher. This further introduces a submerged outlet condition (known as "tailwater") at the pipe discharge point.

Investigation results and findings:

- CCTV inspection revealed a pipe interference within the drain manhole just west of the Hutchinson River Parkway and within the fringe of Glover Field. A 20" diameter sanitary sewer main passes directly through the drain manhole creating a blockage in the flow path. This condition has been incorporated in the SWMM model to evaluate the capacity with and without this blockage.

- Limitations due to the pipe interference and high water within the pipe under Glover Field made it impossible to sufficiently inspect the piping west of the sewer interference. However, record drawings of Glover Field and a previous CCTV inspection reveal that the piping is 48" in diameter and that at least one neoprene check valve has been installed by the Pelham Public School District to prevent backwater into the field. This should be verified when access to the drain manholes in Glover field can be accommodated.

- Piping along Highbrook Ave., between Pelhamdale Ave. and Witherbee Ave. is mainly vitrified clay pipe. The condition appears to be poor and the piping undersized. The pipe in the vicinity of Highbrook and Pelhamdale is also back-pitched; which reduces capacity. In addition, sharp, 90 degree turns in the flow path at Pelhamdale/Highbrook and Highbrook/Witherbee also impact capacity.

- The remaining piping east of Highbrook Ave. along Witherbee Ave. is also vitrified clay pipe, in poor condition and undersized.

B. Watershed #3

Watershed #3 consists of the area west of I-95 and runs along the southern Village municipal line that drains toward the City of New York to Pelham Bay Park. This area is generally bound by Peace St. to the west, Boston Post Road, Edgewood Ave. and Prospect Ave. to the north and I-95 to the east and south. The key target flood area was identified as Monroe St. between Clay Ave. and I-95. The main trunk line consists of varying pipe sizes from 18" in diameter to 36" diameter primarily running along

Highland Ave, Oak Ln., Hunter Ave., Monroe Ave. and under I-95 through dual 36" diameter pipes to an open channel in Pelham Bay Park. Pipe was found to consist mainly of vitrified clay pipe varying from poor to good condition.

The following conditions currently exist with regard to current system capacity:

- Existing SWMM profiles (See App. E) demonstrate sufficient pipe capacity for the 90% storm event, 1.5".
- The SWMM profiles begin to show surcharging of manholes within the system during the 1-year storm event (2.85") consistent with the target area. SWMM profiles indicate full pipe capacity reached through the system beginning near Highland Ave. during this storm event. These results indicate that full capacity of the piping has been reached and there is likely flooding within the roadway under these conditions.
- The 10-year (5.09") and 100-year (8.96") storm events further indicate increased manhole surcharging of the system with full surcharge at various points along the pipe run.
- The SWMM profiles indicate that additional capacity does exist in the dual 36" pipes crossing under I-95 in the 1-year and 10-year storm events.
- The SWMM model agrees with anecdotal evidence, showing study target areas experience surcharging during the modelled storm events noted primarily in the areas near Monroe Ave.

Investigation results and findings:

- CCTV inspection revealed pipe to be varying in condition , but mainly constructed of vitrified clay and as evidenced by the SWMM modelling, undersized for larger storm events with pipe capacity reached in the 1-year storm.
- Functionality of the system is dependent on the maintenance and existing capacity of the piping crossing under I-95 and the receiving open channel within Pelham Bay Park. The dual 36" capacity culverts were shown to have capacity to pass peak flows from the 1-year and 10-year storms under ideal conditions. However the receiving channel in Pelham Bay Park is extremely flat in pitch and holds water that acts as tailwater to the system, limiting capacity. There is a second set of dual pipes passing under a bridal path in the park a short distance downstream from the outfall, and set slightly higher, further cause for sediments and debris build up in the flow path that requires constant maintenance by NYSDOT and the City of New York.

- Two additional pipe crossings under I-95 do exist along Grant Ave. just east of the dual 36" pipes. However these are 18" in diameter and have limited excess capacity to be considered for meaningful diversion of flows. In fact, an existing trench drain already exists at the intersection of Monroe Ave. and Grant Ave. to direct surface water to one of these outfalls during flooding conditions with minimal impact in higher intensity storm events.

C. Watershed #5

Watershed #5 consists of the areas surrounding I-95 along the eastern Village municipal line that drain toward the City of New Rochelle, roughly encompassing the areas around Esplanade Ave. and Pelhamdale Ave. west of I-95 and the areas surrounding Mount Tom Road and Pelhamdale Ave. east of I-95. Each area ultimately discharges to the City of New Rochelle and the open channel flowing through the Pelham Country Club. The key target flood area was identified as Mount Tom and Bolton Road in the vicinity of Pelhamdale Ave. The main trunk line consists of varying pipe sizes from 12" in diameter to 20" diameter primarily running along Roosevelt Ave. and Mount Tom Road, into the City of New Rochelle system which discharges into an open channel at the intersection of Hillcrest Dr. Pipe was found to consist mainly of vitrified clay pipe in poor to good condition.

The following conditions currently exist with regard to current system capacity:

- Existing SWMM profiles (See App. E) demonstrate sufficient pipe capacity for 90% storm event, 1.5", however pipe capacity is reached in the vicinity of an apparent back pitched section near Rockledge Road at MH177.

- The SWMM profiles begin to show surcharging of manholes within the system during the 1 year storm event (2.85") along Mount Tom Road between Pelhamdale Ave. and Rockledge Road. SWMM profiles indicate full pipe capacity reached through the entire system during this storm event. Additional surcharging is also indicated along Roosevelt Ave. where there is a low point in topography. These results indicate that full capacity of the piping has been reached and there is likely flooding within the roadway under these conditions.

- The 10-year (5.09") and 100-year (8.96") storm events further indicate increased manhole surcharging of the system however full surcharge is continued to be concentrated near the areas described previously.

- The SWMM model agrees with anecdotal evidence, showing study target areas experience surcharging during the modelled storm events noted primarily in the areas near Mount Tom Road, Pelhamdale Ave. and Bolton Road.

Investigation results and findings:

- CCTV inspection revealed pipe to be varying in condition , but mainly constructed of vitrified clay and as evidenced by the SWMM modelling, undersized for larger storm events with pipe capacity reached in the 1-year storm.

- Survey of the pipe inverts revealed a 2' back-pitched pipe section at MH 177, in mount Tom Road near Rockledge Ave.

- Functionality of the system is dependent on the maintenance of the piping and outfall within the City of New Rochelle and the open channel at the Pelham Country Club. For this analysis AIE/DRE assumed pipe sizes and condition through the remaining 800 linear feet running through New Rochelle which will need to be verified.

- The discharge point at the open channel in New Rochelle will need periodic maintenance, including the underground culvert section as well as the open channel at the Country Club, to maintain full pipe capacity. It is noted that this outfall also combines with flows from northern sections of the Pelham Country Club near Hillcrest Dr., this could possibly create a tailwater effect at the outfall that could effect pipe capacity as well.

6. Potential Improvements

The Village has continuously carried out stormwater mitigation efforts, such as replacing sections of compromised pipe, rehabilitating collapsed catch basins, making improvements to storm drains, as is proper standard operating procedures for a stormwater collection system. These efforts should be continued and can be further aided by the information in this study. In addition to these operational measures, there are a few projects that may show improvement to the system. It is important to keep in mind that every stormwater piping network will have a capacity. It would not be a realistic or practical goal to increase capacity to protect against every possible storm event.

A. Watershed #1

AIE/DRE has analyzed and prioritized various practical improvements that could be made to the existing storm piping, these were modelled utilizing SWMM software; and are as follows:

I. Further investigate and explore options for the removal of the sanitary sewer interference at Glover Field. *The SWMM models demonstrate that this obstruction causes a hydraulic jump and surcharging of the system in the Wolfs Lane area*. In order to remove this interference, either the drain line or the sanitary sewer line would need to be relocated. This would require additional survey and mapping of the existing sewer and storm drain to evaluate if this is practically feasible. Another

option may be to design a larger chamber at the interference/crossing that would effectively minimize the negative hydraulic effects of the interference, thus leaving the piping at it's current alignment. Currently ownership and access rights are unclear in this location and should be investigated. Access to the drain manholes is under the turf field and would require coordination with the Pelham Public School District for inspection, this should be the next step along with verifying the 48" pipe sizing in this location. The sanitary sewer main conveys sewage from not only the Village of Pelham Manor but also the Village of Pelham and the City of New Rochelle, connecting across the Hutchinson River to the Pump Station owned by the Westchester County Department of Environmental Facilities located behind the "Ice Hutch" in Mount Vernon, so any remediation could involve multiple municipalities. *Estimated Cost: T.B.D.*

II. Removal and replacement ofexisting pipe from Pelhamdale Ave. to Witherbee Ave. This section contains back-pitched pipe and sharp turns, it can be replaced with 48" diameter high density polyethylene (HDPE) smooth wall pipe and additional manhole structures to allow for more gradual flow direction changes. This will improve hydraulics by providing a smoother interior surface in the pipe with upsizing in some sections, additional structures will allow for 45º changes in direction instead of 90º to reduce turbulence. This project would increase capacity in the system, eliminating surcharging of the system in this area up to the 1 year storm event. The piping connections from Pelhamdale Ave. should also be further analyzed as part of any new design for Highbrook to further make improvements in this area. Work here should be coupled with downstream improvements (ie. sanitary sewer interference) unless further study ensures no deleterious effects downstream. *Estimated Cost: $1.2M**

III. Replacement of deteriorated 18" vitrified clay pipe upstream of Highbrook/Witherbee with HDPE 24" diameter pipe for increased capacity and improved hydraulics. This can be considered in yearly capital improvement planning for upcoming projects and **completed in phases**. This must be completed prior to any added storm drain piping in this area such as adding storm drains to Wynnewood Road which has been discussed. *Estimated Cost: $2.0M **

B. Watershed #3

AIE/DRE has analyzed and prioritized various practical improvements that could be made to the existing storm piping and receiving channel, these were modelled utilizing SWMM software and are as follows:

I. Clean and dredge the open channel in Pelham Bay Park. Additional survey should be performed to determine if there is opportunity to increase the capacity of this channel within the park (cleaning/dredging). This would require cooperation and partnering with the City of New York Parks Department. *Estimated Cost: T.B.D.*

II. Replace and lower the dual culverts at the Bridal Path within Pelham Bay Park with a larger single unit box culvert. This would help to minimize the tailwater experienced by the dual pipes passing under I-95 by decreasing the probability of blockage and sediment buildup/need for maintenance and allowing for a consistent positive slope in the channel. *Estimated Cost: $75K**

III. Remove and replace the 30" drain line in Monroe Ave. up to Hunter Ave. with a 48" diameter pipe or equivalent pipe. This would achieve up to 10-year storm event capacity with tailwater effects corrected at Pelham Bay Park. *Estimated Cost: $1.0M**

IV. Replacement and upsizing of existing undersized vitrified clay pipe upstream of Hunter Ave. with HDPE pipe for increased capacity and improved hydraulics. This should be considered in yearly capital improvement planning for upcoming projects and completed in phases once additional capacity (48" pipe) is completed in the downstream areas. *Estimated Cost: $1.5M**

C. Watershed #5

AIE/DRE analyzed various practical improvements that could be made to the existing storm piping, these were modelled utilizing SWMM software and are as follows:

I. Removal and replacement of existing pipe within Mount Tom Road from the location of the back pitched section (MH177) to the outfall located in New Rochelle. The pipe can be replaced with 48" diameter high density polyethylene (HDPE) smooth wall pipe and new manhole structures to allow for a consistent pipe slope to the outfall. This will improve hydraulics and capacity by providing a larger, smooth interior wall pipe. This project would increase capacity in the system, eliminating surcharging of the system in this area up to the 10-year storm event. Coordination with the City of New Rochelle would of course be required to continue this effort to the outfall. Additional information from the City should be procured once they have completed their own stormwater/flood study which is currently underway. The connection of the new piping at the culvert outfall near Hillcrest Dr. will need further investigation to design an appropriate connection. *Estimated Cost (including New Rochelle's share of piping): $1.2M**

II. Replacement and upsizing of existing undersized vitrified clay pipe upstream of MH177 with HDPE pipe for increased capacity and improved hydraulics. This should be considered in yearly capital improvement planning for upcoming projects and completed in phases once additional capacity (48" pipe) is completed in the downstream areas. *Estimated Cost: $1.0M**

***All estimated costs are opinions of construction costs for budget purposes only and do not consider relocation of other utilities as may be necessitated if identified during engineering design or that could not be otherwise anticipated under the scope of this report. A more detailed cost estimate can be provided once preliminary design is authorized by the Village.**

7. April 28, 2023 Storm

As a check to the system modelling performed under this report, AIE/DRE has obtained actual rainfall data from the April 28, 2023 recent storm event from the Village rain gauge to input into our hydrology and hydraulic models for analysis. The precipitation event that occurred Friday, April 28 through Sunday, April 30, 2023, totaled approximately 4.99 inches of rainfall. However, this rainfall was effectively (2) separate precipitation events:

Storm 1: According to the data received from the Village of Pelham Manor rain gauge, precipitation generally started Friday April 28, 2023, at approximately 7:30 PM and ended Saturday April 29, 2023, at 7:30 PM: essentially a 24-hour storm event with a total rainfall volume of 2.67 inches.

The rain gauge did not record another storm event until about 16 hours (+/-) after the first storm was complete.

Storm 2: According to the Village of Pelham Manor rain gauge data, precipitation generally started Sunday April 30, 2023, at approximately 12:00 noon, and ended Sunday April 30, 2023, just before midnight: essentially a 12-hour storm event with a rainfall volume of 2.25 inches.

The first storm appears to have been just below a 1-year frequency, 24-hour duration storm, and effectively acted to create saturated ground conditions. In highly impervious watersheds, ground saturation is less of a runoff factor than in more pervious, single family residential areas. Consequently, when the second storm event began 16 hours later, most of the rainfall was translated directly to runoff in the residential areas of the Village. The volume of rainfall of this second storm (2.25 inches, just below a 1-year frequency, 12-hour duration storm event) – although not quite equal to volume of the first storm (2.67 inches) - occurred in about half the time, and onto saturated ground conditions. As such, the resulting runoff volume of the second storm had the effect of a much larger rainfall event. The resulting flooding likely approached what would be experienced during a 5-year frequency, 24-hour duration storm event. This data was also input into our SWMM models and consequently, surcharging was predicted in the vicinity of the target areas previously identified. SWMM profiles can be found in Appendix G.

8. Green Infrastructure Considerations

It should be noted that the Village and NYSDEC already require infiltration practices as standard for any new impervious surfaces related to new development or construction.

Green infrastructure techniques, while beneficial in certain contexts, have limitations when it comes to minimizing flooding events. These practices are mainly intended to improve water quality for the 90%

rainfall event (1.5") and not necessarily intended to provide flood storage. The scale and intensity of flooding events the Village experiences will surpass the capacity of green infrastructure to provide significant relief. Severe or intense storms and hurricanes that can cause massive inundation will overwhelm the capacity of green infrastructure elements such as green roofs, permeable pavements, and rain gardens. While these features can help manage smaller-scale rain events and reduce stormwater runoff, they are not designed to handle the large volumes of water that accompany major storm events. Most of these practices rely on infiltration and re-charge of water into the ground, as we saw in the above example of the April 28th storm, ground saturation was a key factor.

Another factor to consider is limited availability of space in densely populated urban areas such as the Village of Pelham Manor. This poses a challenge for implementing green infrastructure on a scale that would have a substantial impact on flood mitigation. While retrofitting existing buildings with green roofs or installing permeable pavements in certain areas can provide localized benefits, the overall impact Village-wide on flooding will be limited. To effectively minimize flooding events, larger-scale engineering solutions such as increased storm culvert capacity is necessary.

One possible location to incorporate green infrastructure practices might be along the Esplanade grassed areas. Possibly a bio-retention basin or rain garden could help filter water from the roadway in this location. However as noted, this would not be capable of mitigating any larger scale intense storm events as we are targeting here.

9. Backwater Valves

It is noted that the Pelham Public School District has indicated that at least one neoprene backwater in-line valve has been installed within the 48" pipe discharging to the Hutchinson River at Glover Field. The use of this type of backwater valve at outfalls can prevent flood waters from entering and filling the system during high tide events. However once flow is established in the pipe and a pressure differential is realized, the valve will open to release the flow. This valve therefore will have minimal hydraulic benefit to the system during normal storm events. Once the valve opens the system will be exposed to any "tailwater" effects of high tide or flood elevations at the Hutchinson River. Therefore, the benefits are realized more during dry events such as typical high tides. These valves do require maintenance and monitoring to be kept clear or a blockage could occur; we encourage the Village to work with the School District to verify the location of the valves and monitor their functionality and maintenance at regularly scheduled intervals.

Conclusions and Recommendations

A. Watershed #1

AIE/DRE recommends prioritizing projects as follows. Project I should be pursued and further investigated initially. Removal of the sanitary sewer interference would produce significant increases to capacity up to the 1-year storm event. This will require working closely with the Pelham Public School District to determine access, ownership and feasibility of potential solutions. If downstream effects are confirmed to be de minimis, project II could be pursued concurrently. As noted previously Project III can be considered in yearly capital improvement planning and completed in phases after Projects I and II are completed. These improvements should be completed prior to any added storm drain piping in this area that has been previously contemplated ie: Wynnewood Road or other cross streets to Witherbee Ave.

B. Watershed #3

AIE/DRE recommends prioritizing projects as follows. Partner with the City of New York to further investigate the possibility of improving capacity in the open channel in Pelham Bay Park, including replacement of the dual culverts under the Bridal Path. This will ensure maximum capacity and functionality of the dual culverts under I-95. Once that is accomplished , upstream improvements can be pursued, replacement of the main pipe within Monroe Ave. with a 48" diameter or equivalent pipe will increase capacity significantly. Further improvements to replace and increase pipe sizes, upstream of Hunter Ave. to Highland Ave. may be considered once the lower area pipe improvements are accomplished. These might be considered in yearly capital improvement planning and completed in phases.

C. Watershed #5

AIE/DRE recommends prioritizing projects as follows. Partner with the City of New Rochelle to further investigate the possibility of replacing the pipe on Mount Tom Road, Project I, with a 48" HDPE pipe. As noted the City is currently conducting it's own flood study and may have some shared interest in making improvements at this location. Once downstream capacity is increased, the Village should plan on replacing pipe segments upstream from Mount Tom Road including Pelhamdale Ave. and Bolton Road. These further improvements might be considered in yearly capital improvement planning and completed in phases.

AIE/DRE is available to further analyze any combination of the improvements suggested to ascertain specific benefits during various conditions or storm events if requested. The many combinations of improvements and storm or tide conditions make it impractical to cover all circumstances in this report. The data and model that has now been compiled can be used to further analyze any specific circumstance or location in the Village with regard to predicting effectiveness of potential storm drainage improvements, including rerouting or more invasive approaches such as diversion of flows to other discharge points that may have been beyond the scope of this report.

Appendix A
Overall Map with Target Areas

Appendix B

Watershed 1 Mapping & Profiles

Appendix C

Watershed 3 Mapping & Profiles

Appendix D

Watershed 5 Mapping & Profiles

Appendix E

SWMM Profiles
Existing

Appendix F

SWMM Profiles
Proposed

Appendix G

April 28, 2023 Storm Event

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