

ELLICOTT CREEK FLOOD MITIGATION

Williamsville, NY



Draft Report

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Prepared for



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Prepared by



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LIST OF ABBREVIATIONS

%	Percent
1D/2D	one-dimensional/ two-dimensional
7-day low flow	lowest annual seven-day average flow
AACE	Association for the Advancement of Cost Engineering
ACE	annual chance exceedance
cfs	cubic feet per second
DEM	digital elevation model
Gomez and Sullivan	Gomez and Sullivan Engineers, D.P.C
HEC-RAS	Hydrologic Engineering Center River Analysis System
LiDAR	Light Detection and Ranging
Mill	Williamsville Water Mill
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
ROM	rough order of magnitude
RPPAP	Record Plans Public Access Portal
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
Village	Village of Williamsville

1 Background

Several residential areas within the Village of Williamsville (Village) are within the 1% annual chance flood hazard area and are known to experience flooding of the streets, residential properties, and some residences. The Resilient NY program used advanced modeling techniques and field assessments to identify priority projects for flood mitigation along Ellicott Creek in Erie County, New York. The report¹, commissioned by the New York State Department of Environmental Conservation (NYSDEC), provided alternatives at a conceptual level for local municipalities to make their community more resilient to future floods. Alternatives considered during the Resilient NY study included the construction of a series of flood benches in the Village between Island Park and Wehrle Drive to evaluate the potential for reduced flooding impacts. The Village is interested in evaluating additional conceptual design alternatives that were not presented in the Resilient NY report, particularly those that consider modifications to the Williamsville Dam located on Ellicott Creek within the Village of Williamsville.

Originally, Ellicott Creek only consisted of the west channel around Island Park with Klein Dam located just downstream of the Mill Intake to ensure water levels were high enough for mill operation, as depicted in [Figure 1.0-1](#) and Figure 1.0-2. The east channel was created to reduce water levels during high flow events with Williamsville Dam constructed to provide flow in the west channel during low and normal flows and satisfy the Williamsville Water Mill (the Mill) riparian rights upheld by the New York State Supreme Court on April 2, 1946. This court order only allows a flow of up to 267,000 gallons per day, which is approximately 0.4 cubic feet per second (cfs), in the east channel when flood conditions are not present. Williamsville Dam is regulated by the NYSDEC (Dam ID #: 017-0887) and is currently classified as a Low Hazard, Class A, structure per the NYSDEC Dam Inventory. Five manually operated flood gates, each holding up to three stop logs, control discharge at Williamsville Dam. The stop logs were originally intended to only be removed to pass flood flows (e.g., when at least one inch of rain falls). However, rushing flows can prevent the successful removal of all the stop logs. Additionally, the Village has at times removed stop logs in the fall and replaced them in the spring due to issues with stop log removal during the winter (e.g., frozen in place) which exacerbated flooding. The change in stop log operations over the years has led to objections from the Mill regarding the riparian rights granted to them. Research suggests that Mill operations continued with occasional demonstrations through 2003², but have ceased since. Several other residents around and upstream of Island Park have also expressed to the Village that Williamsville Dam operations impact their riparian rights along Ellicott Creek. Further exacerbating the riparian rights issue is that fact that, based on aerial imagery, Klein Dam was removed sometime between 2011 and 2014.

1.1 Study Objectives

The primary purpose of this study is to use the results of hydraulic modeling of Ellicott Creek to assess the impacts from potential modifications to Williamsville Dam relative to flooding and riparian rights concerns, while considering the cost, operations, and maintenance of any potential modification. Additionally, the study will discuss the flow conditions which are likely contributing to channel erosion, particularly with respect to the stone walls located along Ellicott Creek between Williamsville Dam and Glen Avenue.

¹ https://extapps.dec.ny.gov/docs/water_pdf/ellicottcreekfinal.pdf

² <https://buffaloah.com/a/WILL/mill/mill.html>

Figure 1.0-1: Overview

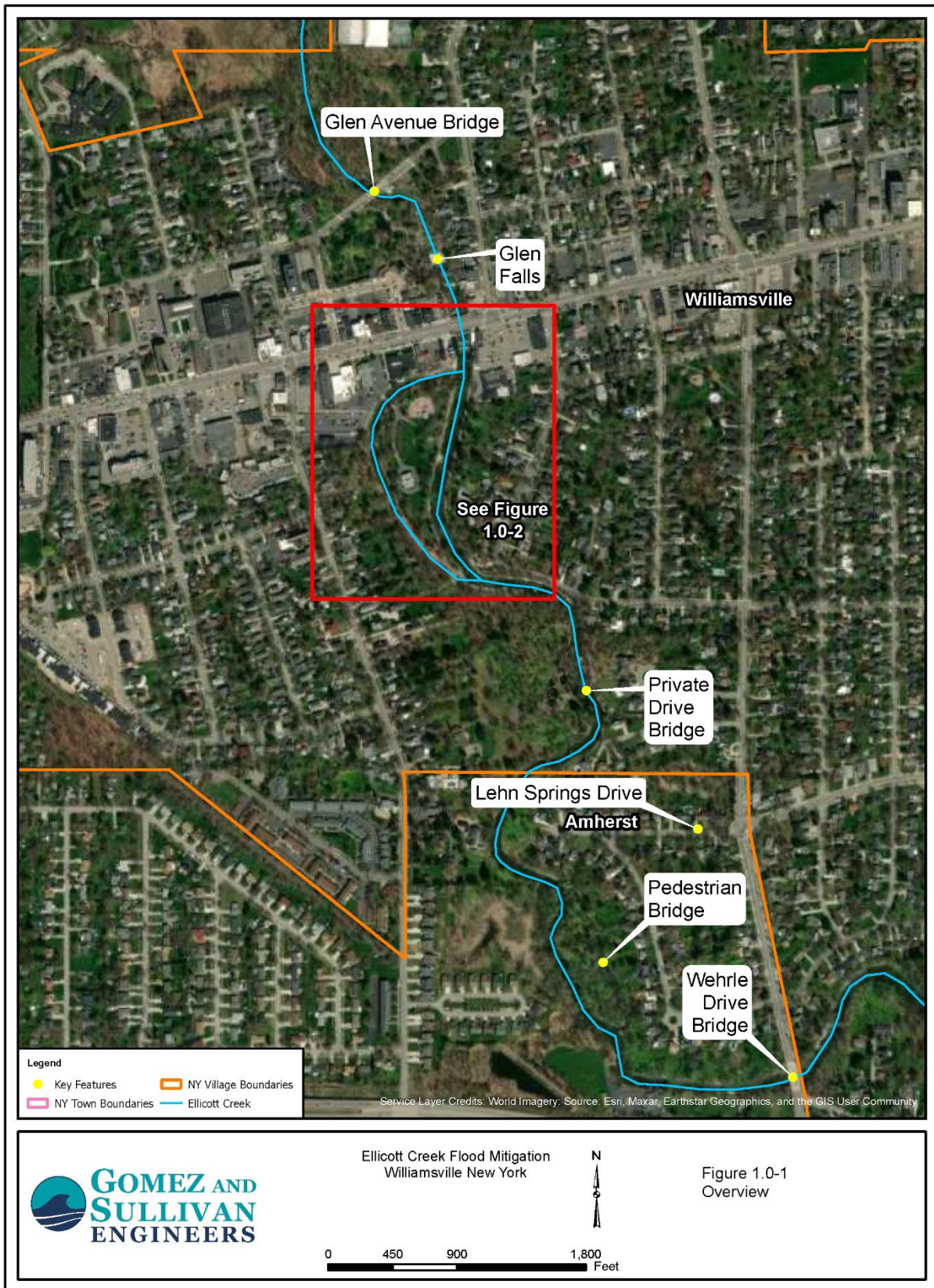
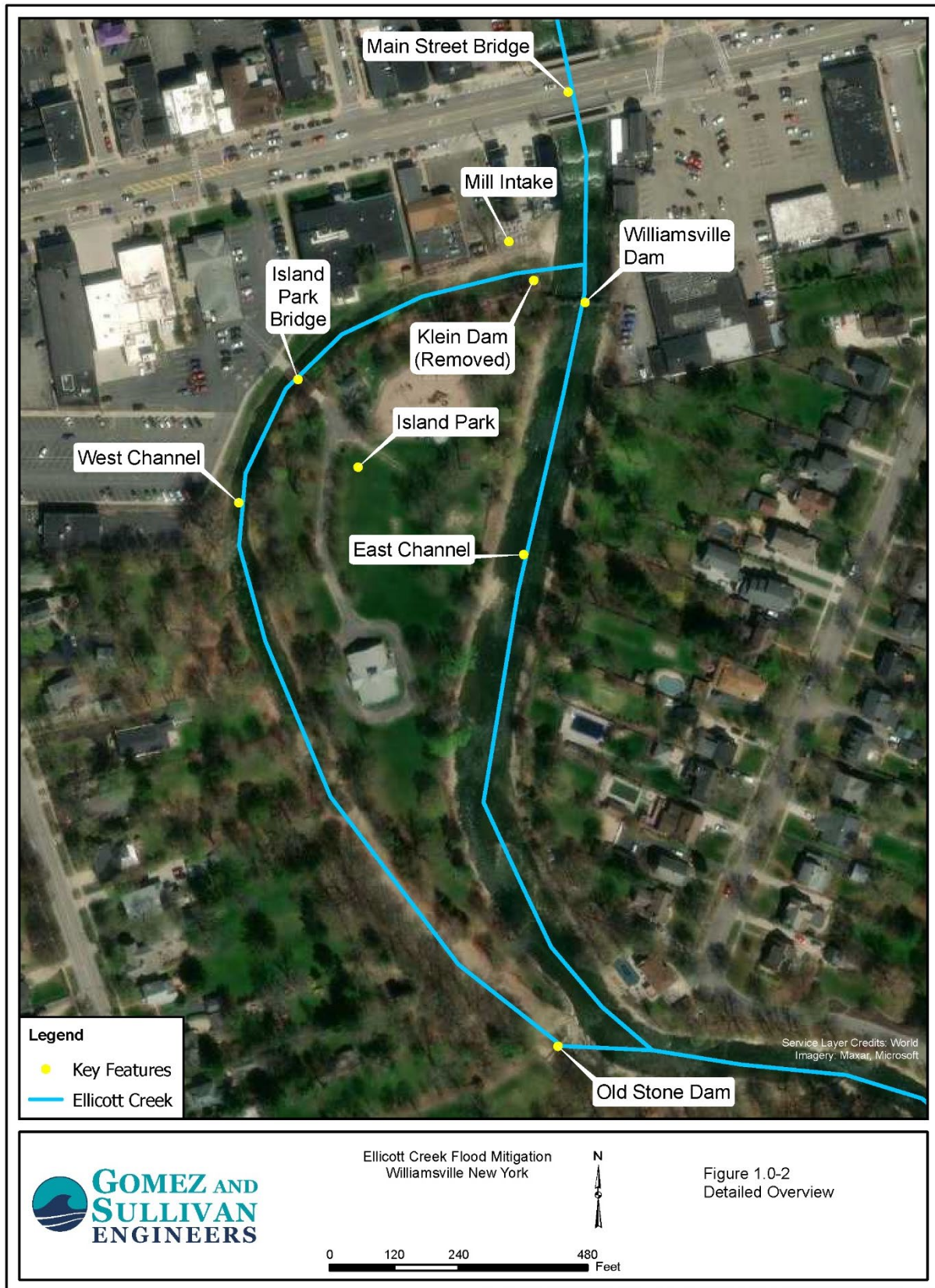


Figure 1.0-2: Detailed Overview



2 Model Development

The data collection, hydrologic analysis, and hydraulic modeling necessary to analyze the existing and potential alternative conditions are described in the following sections.

2.1 Data Collection

The Village provided a variety of information relevant to the study, including elevation information, gate operating procedures, and sketches of the Park Island Bridge. Drawings of the Route 5/Main Street Bridge were obtained from the New York State Department of Transportation (NYSDOT) Record Plans Public Access Portal (RPPAP). A digital elevation model (DEM) with a 1-meter horizontal resolution derived from a 2019 Light Detection and Ranging (LiDAR) data collection was obtained from the United States Geological Survey (USGS) National Map Viewer. A letter was received by Gomez and Sullivan from residents of Lehn Springs Drive pertaining to Ellicott Creek riparian rights and potential modifications to Williamsville Dam. Additionally, Gomez and Sullivan performed field reconnaissance which included obtaining channel bottom elevations at select locations within the study extents, as well as limited structure dimensions and elevations at Williamsville Dam, Island Park Bridge, Glen Avenue Bridge, and retaining walls along the creek.

2.2 Hydrologic Analysis

The Resilient NY program analyzes current and future projected future flows for the 10%, 2%, 1%, and 0.2% annual chance exceedance (ACE) events, often referred to as the 10-year, 50-year, 100-year, and 500-year recurrence interval events, respectively, as well as the bankfull streamflow. The few years of additional flow data from the USGS gage on Ellicott Creek below Williamsville, NY (USGS Gage 04218518) available since the Resilient NY study was performed, does not significantly change the peak frequency flow estimates for current flows from those computed as part of that study. Similarly, the recommendations regarding future flow estimates provided in the New York State Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act (August 2020) have not changed from the draft 2018 guidance used in the Resilient NY study. Therefore, this study utilized the bankfull and ACE flow estimates presented in [Table 2.2-1](#), which are the same as those utilized during the Resilient NY program analysis of Ellicott Creek at the downstream study extents.

As a Class A (Low Hazard) structure, Williamsville Dam has a Spillway Design Flood (SDF) equal to the 1% ACE event. No additional regulatory flows were identified as necessary for this study. However, information from the USGS Gage 04218518 was analyzed to develop an annual median flow and the lowest annual seven-day average flow (7-day low flow). Daily average flows from 10/1/1973 through 9/30/2024 were used to compute the median annual flow, as well as the lowest seven-day average flow, for each of the 52 water years (1973-2024) for which data was available. [Figure 2.2-1](#) and [Figure 2.2-2](#) both show an upward linear trend over the 52 water years (1973-2024) of data from USGS Gage 04218518. Therefore, a median annual flow of 97 cfs and a 7-day low flow of 27 cfs were selected for this study based on linear regression analyses of the data projected to water year 2025.

2.3 Hydraulic Modeling

The hydraulic model from the Resilient NY analysis was used as the basis of the hydraulic model for this study; that model was developed using Version 5.0.7 of the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center River Analysis System (HEC-RAS) computer software and reported elevations in the North American Vertical Datum of 1988 (NAVD88). However, this study made several modifications to the Resilient NY hydraulic model and updated the model to HEC-RAS Version 6.6. When

the Resilient NY program analyzed flooding along Ellicott Creek, the model extended through multiple communities. Only the portion of the Resilient NY model within the extents of the Village were included in this study. Additionally, water levels and velocities along Ellicott Creek were analyzed using combined one-dimensional/ two-dimensional (1D/2D) unsteady flow analysis methods for this study, as opposed to the 1D steady flow analysis methods utilized for Resilient NY. This study utilized 2D analysis methods in the vicinity of Island Park to better evaluate flow patterns in the east and west channels around Island Park, as shown in [Figure 2.3-1](#). The overbank elevations for all cross sections within the study extents were updated based on the DEM derived from the 2019 LiDAR data collection. Additional modifications were made based on the field reconnaissance and other information described in [Section 2.1](#). Finally, an inline structure was placed at the top of Glen Falls, to better represent the hydraulic control at that location and improve model stability when evaluating unsteady flow computations.

This study entered all flow at the upstream end of the study extents, as the Resilient NY study generally only added a relatively small percent of additional flow between the second most upstream XS and the downstream study extents. The flow inputs were entered as a steady flow throughout the simulation. This study assumed that under existing conditions the stop logs at Williamsville Dam are in place under the median and 7-day low flows and removed under all higher flows analyzed. This stop log assumption is based on 1) the Village indicating that the stop logs are to be pulled when more than one-inch of rain falls, 2) a 24-hour duration precipitation depth of 1.93 inches at the site has a one-year recurrence interval according to the National Oceanic and Atmospheric Administration (NOAA) Precipitation Data Frequency Server (<https://hdsc.nws.noaa.gov/pfds/index.html>), and 3) a bankfull flow is generally considered to have a recurrence interval between one and two years.

Default Computation Options and Tolerances were generally maintained when evaluating unsteady flow computations for this study. However, the 2D equation set was changed from Diffusion Wave to the Shallow Water Equation Eulerian-Lagrangian Method to include momentum terms in the computations. A 2D initial conditions time of one hour and 4000 1D warmup time steps were included to allow for a stable model at the beginning of the simulation. Similarly, up to 20 iterations between the 1D and 2D model components, as well as use of the default Local Partial Inertia Mixed Flow Regime parameters, were allowed to increase model stability. Simulations were completed using a one second computational time step and were run until flows and water levels stabilized throughout the study extents.

Table 2.2-1: Bankfull and ACE Flows

Current					Future Projected			
Bankfull	10%	2%	1%	0.2%	10%	2%	1%	0.2%
1,520	3,630	5,580	6,470	8,620	3,993	6,138	7,117	9,482

Figure 2.2-1: USGS Gage 04218518 Annual Median Flows

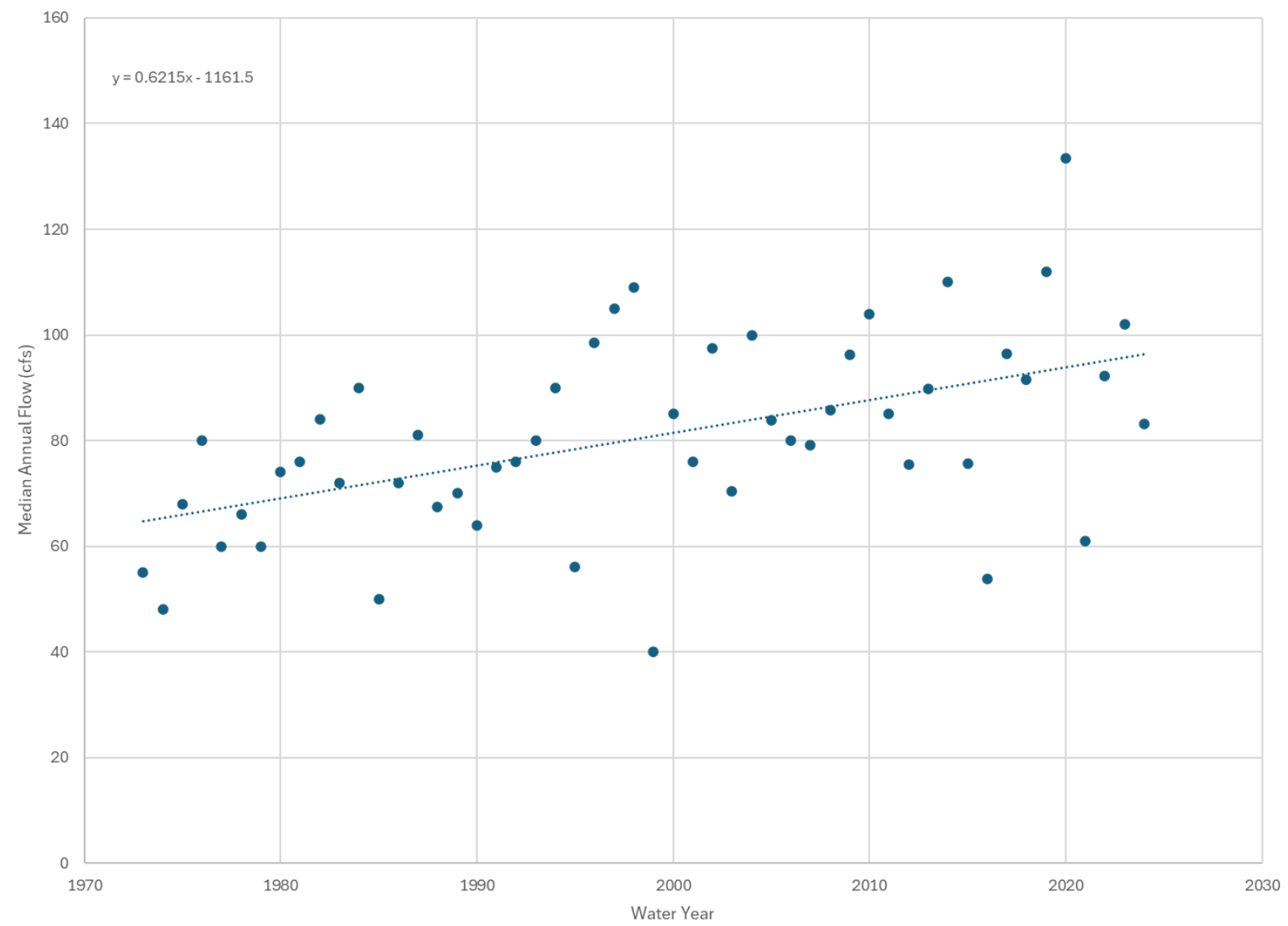


Figure 2.2-2: USGS Gage 04218518 Lowest Seven-Day Average Flows

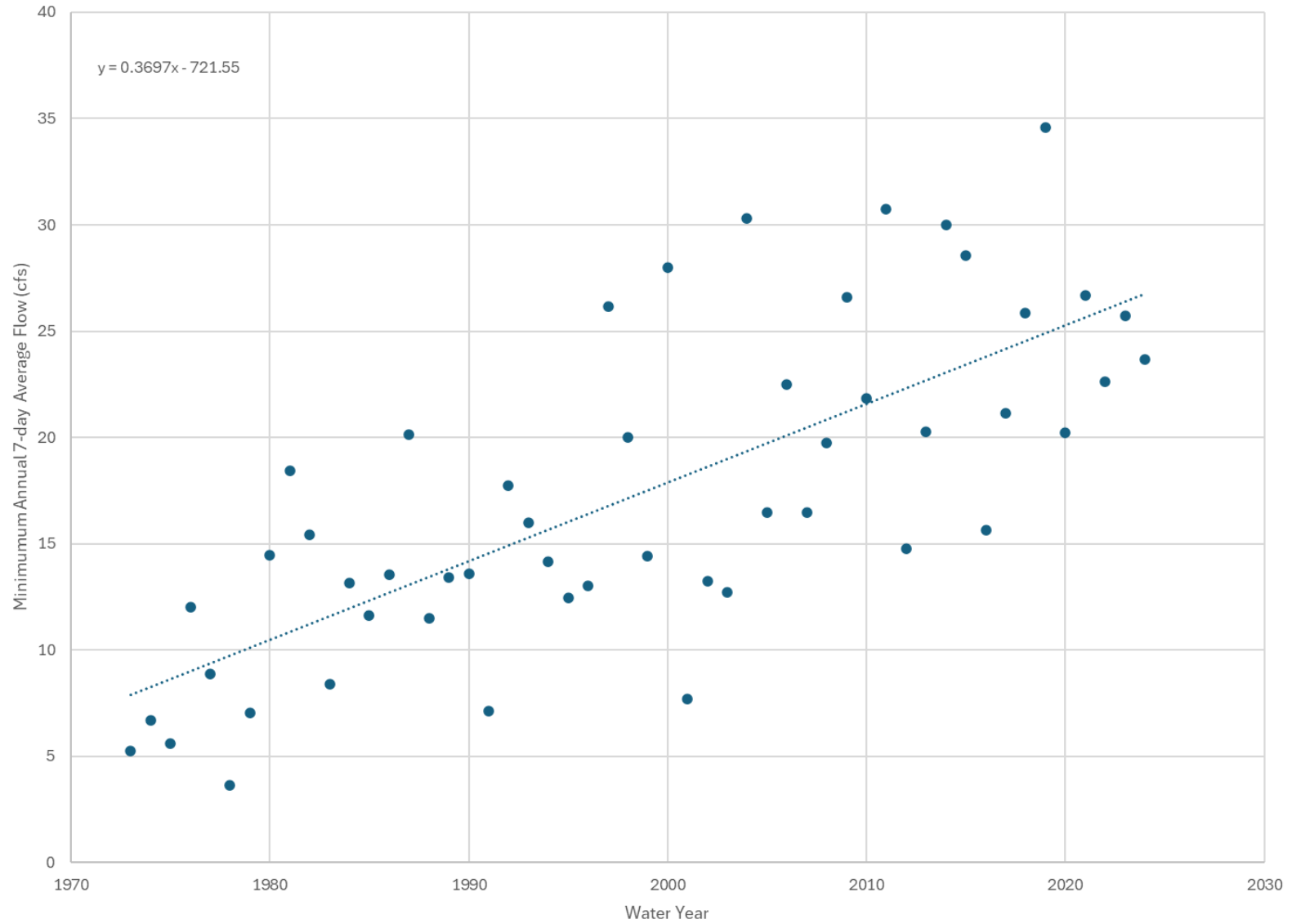
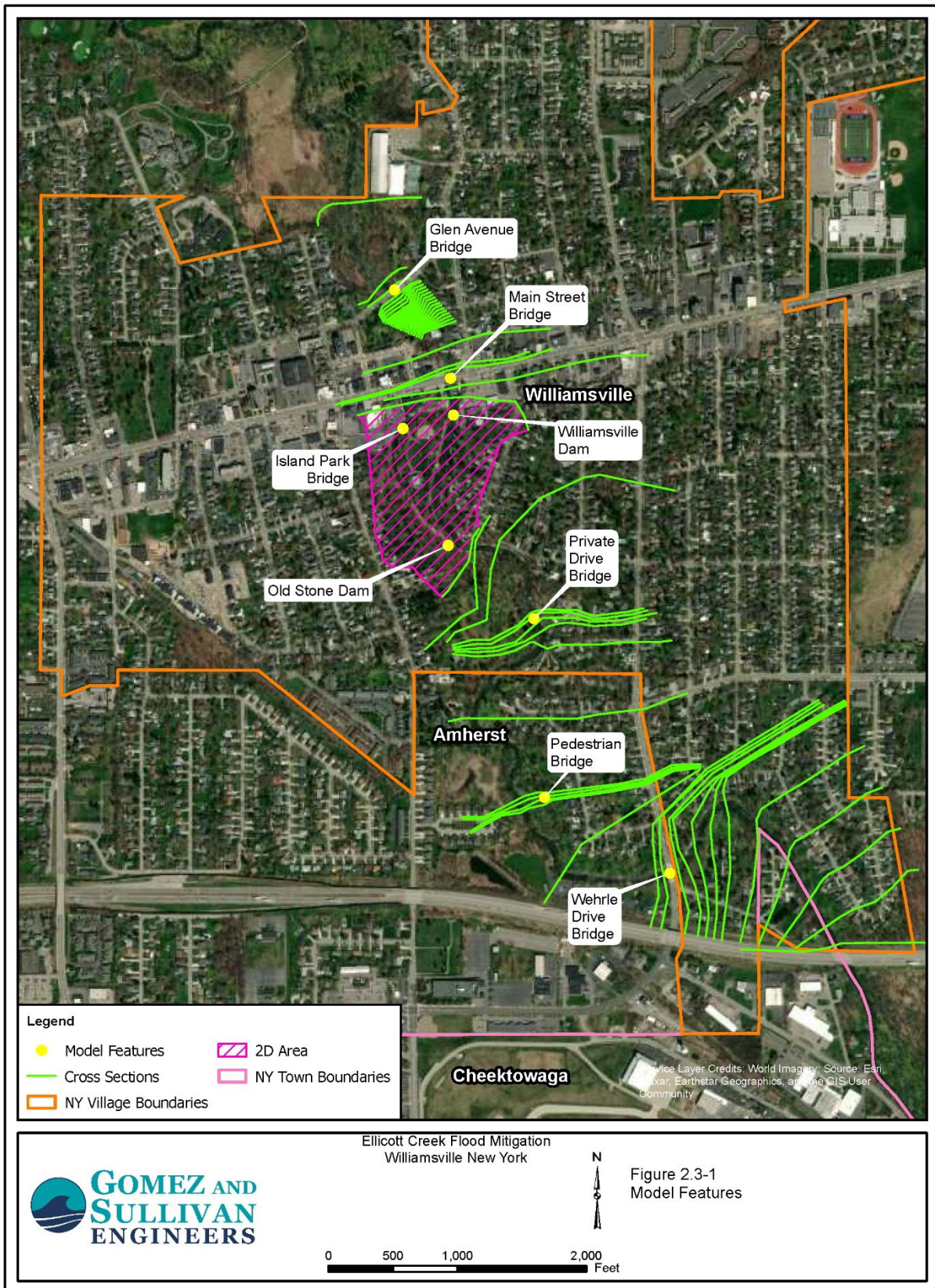


Figure 2.3-1: Model Features



3 Alternatives

The Village is interested in evaluating how alternatives may, in no particular order, 1) reduce operational responsibilities at Williamsville Dam, 2) reduce flooding upstream of Williamsville Dam, and 3) address riparian rights issues. The selection of alternatives considered various combinations of modifications in both the east channel and west channel, as presented in [Table 3.0-1](#). The Village selected two alternatives for an initial analysis. The first alternative analyzed the installation of automated crest gates at the existing Williamsville Dam. This alternative would allow Williamsville Dam to operate as originally intended with less operational responsibility for the Village. The second alternative analyzed a combination of constructing a new fixed crest weir in the east channel with excavation of the west channel to evaluate whether operation and maintenance costs could be decreased while reducing flooding and providing flow to the west channel. Based on preliminary results of these two alternatives, the Village selected a third alternative for analysis, which builds upon Alternative 2 to evaluate how the addition of flood benches may enhance the flood reduction capabilities of Alternative 2. The following sections provide a more in-depth description of each alternative analyzed during this study including a rough order of magnitude (ROM) cost for final design and construction.

The ROM costs were based on online construction cost data catalogs including R.S. Means and internal information maintained by Gomez and Sullivan and were developed in accordance with Association for the Advancement of Cost Engineering (AACE) standards for Class V cost estimates. Competitive bidding environments, tariffs, and unknown field conditions may contribute to variances in costs. As such, a 40% contingency was applied to the ROM costs at this time, which is within the 30-100% contingency range recommended by AACE for Class V estimates.

3.1 Alternative 1 – Automated Crest Gates

This alternative considers replacing Williamsville Dam's existing flood gates with an automated crest gate system, as depicted in [Figure 3.1-1](#). There are different types of crest gates available, but the image to the right depicts an example where one set of crest gates is raised, while the other set is partially lowered to allow flow. Placing the automated crest gate system within the existing Williamsville Dam structure allows for use of the existing sill and abutments. The crest gates would be approximately 7.5 feet high when in the raised position to divert all flow down the west channel under the median



Photo Credit: Obermeyer Hydro, Inc.

annual flow condition and address potential riparian rights claims. Use of an automated gate system reduces the operational responsibilities of the Village compared to the existing Williamsville Dam, as a water level sensor located just upstream of Williamsville Dam would be used to automatically adjust the gates and maintain the desired water level, with the gates being fully lowered during high flow events. However, the Village would still have to maintain the sensor, mechanical, and structural systems associated with the crest gate. The ROM cost is estimated to be \$1.2 million based on recent experience with similar construction activities, assuming Island Park can be used for laydown and staging during construction and that access to Williamsville Dam is available from either side.

3.2 Alternative 2 – Fixed Crest Weir

This alternative considers removing Williamsville Dam, constructing a new weir in the east channel just downstream of where the east and west channels split, and excavating the west channel, as depicted in [Figure 3.2-1](#). Placing the new weir upstream of the existing Williamsville Dam and excavation of the west channel allows for a lower weir height, which reduces the potential flooding impact during high flow events, while still providing flow in the west channel during low flow conditions. In order to minimize the potential impact to upstream flooding, the maximum height of the weir is 0.5 feet, and the west channel is excavated to have the same bottom elevation as the east channel where these channels split. This will require greater than three feet of excavation in some areas with excavation extending throughout most of the west channel for a total excavation volume of nearly 2,900 cubic yards. Use of a fixed crest weir reduces the operational and maintenance responsibilities of the Village compared to the existing Williamsville Dam. The ROM cost is estimated to be \$0.7 million based on recent experience with similar construction activities, assuming Island Park can be used for laydown and staging during construction and that access to Williamsville Dam is available from either side. Further, it is assumed the west channel excavation can be accomplished with an excavator (e.g., without rock drilling or blasting) and that no environmental contaminants are in the material removed. Further, it is assumed that west channel excavation will be completed during low flow conditions, such that cofferdams will not be needed to keep water out of the west channel.

3.3 Alternative 3 – Fixed Crest Weir and Flood Bench

This alternative includes all activities discussed under Alternative 2 while also creating a flood bench in the right overbank along the East Channel, as depicted in [Figure 3.3-1](#), to provide additional area to store and pass flood flows. This strip of land, owned by the Village, would be lowered by approximately 4.1 feet for a width of 40 feet and length of 725 feet, removing approximately 4,400 cubic yards of material. The location of this flood bench was selected because it represents land already owned by the Village which is not currently utilized for other purposes. The ROM cost is estimated to be \$1.3 million based on recent experience with similar construction activities, assuming the west channel and flood bench excavation can be accomplished with an excavator (e.g., without rock drilling or blasting) and that no environmental contaminants are in the material removed. Further, it is assumed that west channel excavation will be completed during low flow conditions, such that cofferdams will not be needed to keep water out of the west channel.

Table 3.0-1: Channel Modifications Considered

Channel	Modification	Potential Benefits	Potential Drawbacks
East	Remove Williamsville Dam	- Likely reduced operational and maintenance costs - Potential slight reduction in upstream flooding	- Likely will not address riparian rights at the Mill or other potential riparian rights in the west channel - Likely will not address potential riparian rights upstream of Island Park
	Build Fixed Crest Weir	- May address riparian rights at the Mill or other potential riparian rights in the west channel - Likely reduced operations and maintenance costs - Potential slight reduction in upstream flooding depending on height of weir and if any west channel modifications are included - May address potential riparian rights upstream of Island Park (depending on weir height)	- Likely will not allow Mill operations to resume due to removal of Klein Dam - May increase upstream flooding depending on height of weir and if any west channel modifications are included - May not address potential riparian rights upstream of Island Park (depending on weir height)
	Install Automated Crest Gates	- Likely reduced operational costs - May address riparian rights at the Mill or other potential riparian rights in the west channel and upstream of Island Park - Potential slight reduction in upstream flooding	- Likely will not allow Mill operations to resume due to removal of Klein Dam - May increase maintenance costs
West	Remove Old Stone Dam and potentially Excavate Channel	- May address riparian rights at the Mill or other potential riparian rights in the west channel - Potential slight reduction in upstream flooding	- Likely will not allow Mill operations to resume due to removal of Klein Dam - Likely will not address potential riparian rights upstream of Island Park

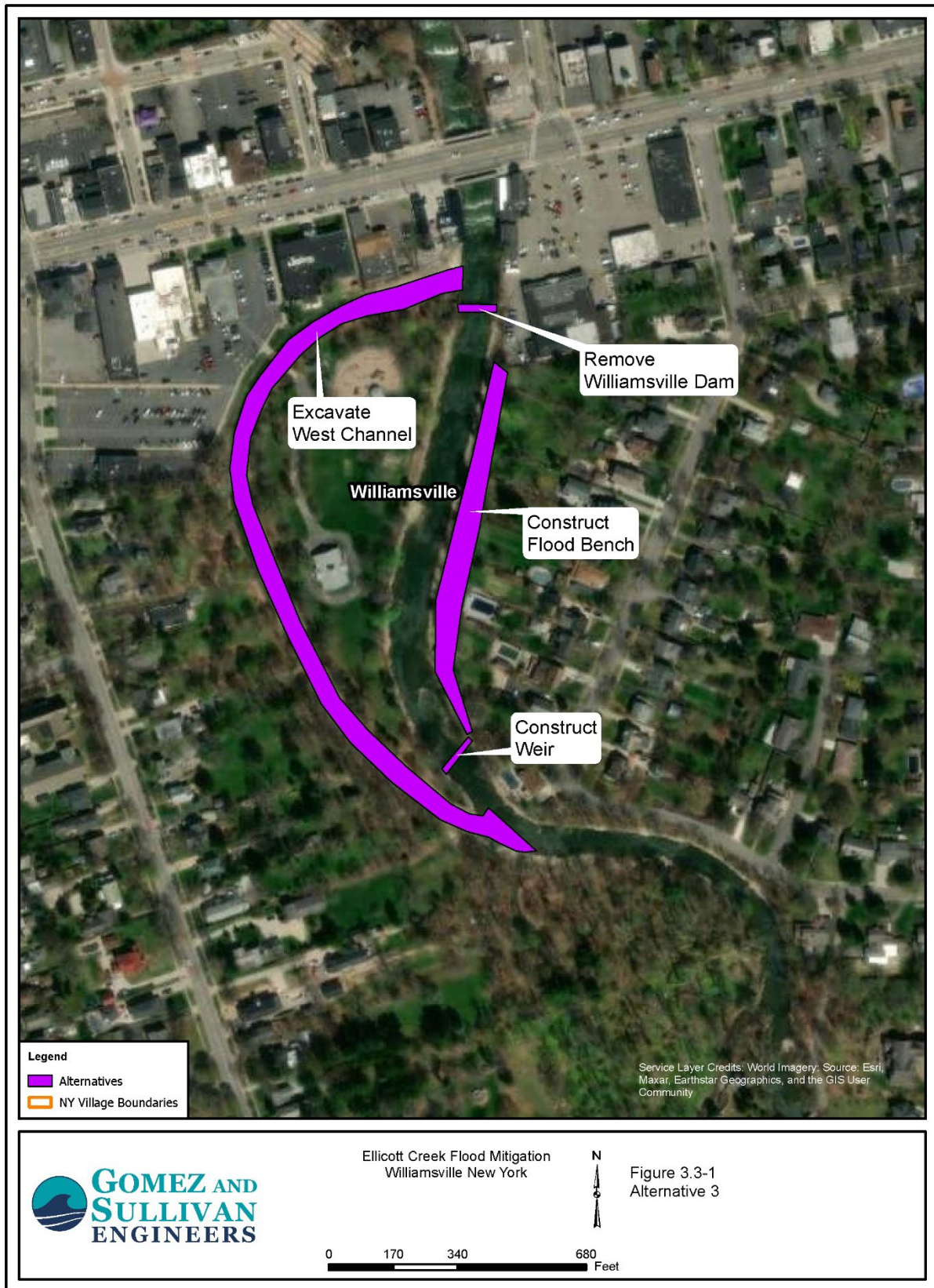
Figure 3.1-1: Alternative 1



Figure 3.2-1: Alternative 2



Figure 3.3-1: Alternative 3



4 Results

The existing conditions and alternatives were simulated in the model under the 7-day low, median, bankfull, and ACE flows discussed in [Section 2.2](#). Results just upstream of Island Park are presented in [Table 4.0-1](#) for each simulation. The following sections further discuss the results of these simulations.

4.1 Existing Conditions

The results show that there is no flow in the east channel under both the 7-day low and median flow scenarios, consistent with requirements of the New York State Supreme Court order. Water levels in the west channel near the Mill Intake are up to approximately 1.3 feet deep and 3.7 feet below the sill of the Mill Intake under the median flow due to the removal of Klein Dam. [Figure 4.1-1](#) provides an overview of the anticipated flood extents for the Current 1% ACE flow scenario. Channel velocities downstream of Williamsville Dam are generally less than six feet per second under the median annual flow. However, under the bankfull flow and higher flows, the velocities are generally between 10 and 15 feet per second, with velocities around 20 feet per second just upstream of the Glen Avenue Bridge under some flows. The high velocity flow in these areas has caused damage to the banks and stone walls along Ellicott Creek between Williamsville Dam and Glen Avenue. Placement of in-channel features to slow down or redirect flow from the banks would likely increase flood elevations. As such, repair and maintenance of the existing walls, putting a smooth concrete facing on the existing walls, or replacing the existing walls with a new concrete wall may be the only feasible options. A concrete facing or new concrete wall may be more robust than repair of the existing walls as there is a lower likelihood of significant portions of the concrete wall being plucked out compared to a stone wall. A ROM cost for wall repair options was not completed due to insufficient information (e.g., ownership of the walls and surrounding land, foundation depth and construction methods of the existing walls).

4.2 Alternative 1 – Automated Crest Gates

The results show that there is no flow in the east channel under both the 7-day low and median flow scenarios, consistent with requirements of the New York State Supreme Court order. Water levels in the west channel near the Mill Intake are up to approximately 1.3 feet deep and 3.7 feet below the sill of the Mill Intake under the median flow due to the removal of Klein Dam. Further, [Table 4.0-1](#) shows that this alternative has the potential to slightly reduce water levels under flood flow conditions due to the removal of the piers separating each stop log bay, but the reduction has virtually the same inundation extents under the 1% ACE event as shown in [Figure 4.1-1](#) for existing conditions. However, the reduction in water levels would be even greater during those events in which the Village is not currently able to remove all stop logs. Additionally, this alternative may reduce the likelihood of debris jams at Williamsville Dam due to removal of the piers separating each stop log bay. Finally, this alternative is generally not expected to have a significant impact on erosion, as it produces water levels and velocities similar to existing conditions.

4.3 Alternative 2 – Fixed Crest Weir

The results show that the flow in the west channel is approximately 5 cfs (i.e., 19% of total flow) under the 7-day low flow and 17 cfs (18% of total flow) under the median flow scenario, which does not meet the requirements of the New York State Supreme Court order. An increase in the height of the fixed crest weir to fully address the requirements of the New York State Supreme Court order is expected to increase flooding upstream of Island Park. Water levels in the west channel near the Mill Intake are up to approximately 0.6 feet deep and 5.8 feet below the sill of the Mill Intake due to the removal of Klein Dam and excavation of the west channel. [Table 4.0-1](#) shows that lowering of the west channel has the potential

to slightly decrease water levels under flood flow conditions despite the weir acting as an impediment to flow in the east channel, but this reduction has virtually the same inundation extents under the 1% ACE event as shown in [Figure 4.1-1](#) for existing conditions. This alternative may reduce the likelihood of debris jams at Williamsville Dam due to removal of the piers separating each stop log bay. Finally, this alternative is generally not expected to have a significant impact on erosion, as it produces water levels and velocities similar to existing conditions. However, final design of this alternative would have to consider the potential for exposing the foundations of the Island Park Bridge and existing walls along the west channel due to a combination of channel excavation and future erosion.

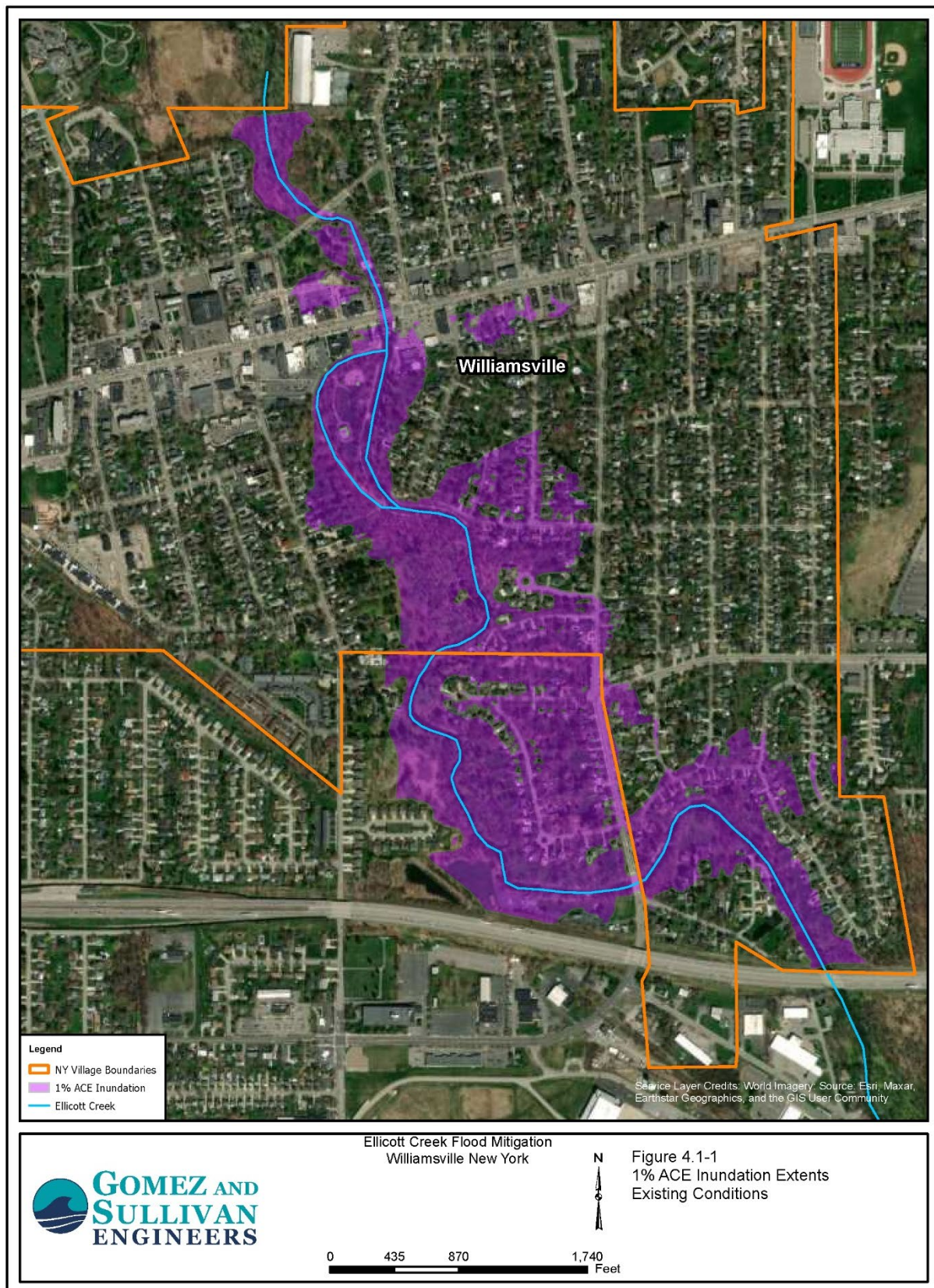
4.4 Alternative 3 – Fixed Crest Weir and Flood Bench

The results show that the flow in the west channel is approximately 5 cfs (i.e., 19% of total flow) under the 7-day low flow and 17 cfs (18% of total flow) under the median flow scenario, which does not meet the requirements of the New York State Supreme Court order. An increase in the height of the fixed crest weir to fully address the requirements of the New York State Supreme Court order is expected to increase flooding upstream of Island Park. Water levels in the west channel near the Mill Intake are up to approximately 0.6 feet deep and 5.8 feet below the sill of the Mill Intake due to the removal of Klein Dam and excavation of the west channel. [Table 4.0-1](#) shows that creating a flood bench has the potential to slightly decrease water levels under flood flow conditions compared to Alternative 2, but this reduction is not anticipated to significantly reduce the inundation extents under the 1% ACE event, as shown in [Figure 4.1-1](#) for existing conditions. This alternative may reduce the likelihood of debris jams at Williamsville Dam due to removal of the piers separating each stop log bay and the creation of the flood bench. Finally, this alternative is generally not expected to have a significant impact on erosion, as it produces water levels and velocities similar to existing conditions. However, final design of this alternative would have to consider the potential for exposing the foundations of the Park Island Bridge and existing walls along the west channel due to a combination of channel excavation and future erosion.

Table 4.0-1: Results Just Upstream of Island Park

Flow Scenario	Water Level (feet, NAVD88)				Difference from Existing Conditions (feet)		
	Existing Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
7- Day Low	666.27	666.27	663.13	663.13	0.00	-3.14	-3.14
Median	667.02	667.02	663.84	663.84	0.00	-3.18	-3.18
Bankfull	669.04	669.03	668.67	668.67	-0.01	-0.37	-0.37
Current 10% ACE	672.23	672.16	671.95	671.86	-0.07	-0.28	-0.37
Current 2% ACE	673.89	673.84	673.71	673.61	-0.05	-0.18	-0.28
Current 1% ACE	674.49	674.46	674.33	674.21	-0.03	-0.16	-0.28
Current 0.2% ACE	675.10	675.07	674.95	674.83	-0.03	-0.15	-0.27
Future Projected 10% ACE	672.65	672.56	672.36	672.26	-0.09	-0.29	-0.39
Future Projected 2% ACE	674.29	674.25	674.12	674.01	-0.04	-0.17	-0.28
Future Projected 1% ACE	674.84	674.82	674.69	674.57	-0.02	-0.15	-0.27
Future Projected 0.2% ACE	675.47	675.44	675.31	675.20	-0.03	-0.16	-0.27

Figure 4.1-1: 1% ACE Inundation Extents – Existing Conditions



5 Summary

A concrete facing on the existing stone walls or new concrete walls is anticipated to provide a better long-term solution for future stability of the retaining walls along Ellicott Creek downstream of Glen Falls. However, various factors including cost must be further examined. Regarding modifications to Williamsville Dam, Alternative 2 appears to provide the best combination of upfront cost, long-term operations and maintenance responsibility, and flood reduction benefit. The ROM cost for final design and construction of Alternative 2 is estimated to be \$0.7 million. Depending on the objective, amount of flow desired in the west channel under normal flow conditions versus flood reduction benefit, the amount of excavation could potentially be reduced to lower costs during final design. Note that no alternatives considered will allow for Mill operations to resume due to the removal of Klein Dam.

All of the alternatives presented in this report will require further engineering design, as well as applications (e.g., Letter of Map Revision) and permits (e.g., environmental, construction) to various agencies. Several state and federal grants have historically been available to assist with funding for alternatives like those presented in this report. However, the future availability of these grant programs is currently unclear. Additionally, it should be noted that some of these grant programs require a benefit-to-cost analysis indicating that the alternative produces a benefit to cost ratio greater than one.