EMERGENCY TRANSPORTATION INFRASTRUCTURE RECOVERY
WATER BASIN ASSESSMENT
AND FLOOD HAZARD MITIGATION ALTERNATIVES

SAUQUOIT CREEK
ONEIDA COUNTY, NEW YORK

April 2014

MMI #5231-01

Photo Source: Milone & MacBroom, Inc. (2013)

This document was prepared for the New York State Department of Transportation, in cooperation with the New York State Department of Environmental Conservation.

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ABBREVIATIONS/ACRONYMS

BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
BIN	Bridge Identification Number
CFS	Cubic Feet per Second
CME	Creighton Manning Engineering
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FT	Feet
FTP	File Transfer Protocol
GIS	Geographic Information System
HEC-RAS	Hydrologic Engineering Center – River Analysis System
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
LiDAR	Light Detection and Ranging
MMI	Milone & MacBroom, Inc.
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
NYSDEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSDOT	New York State Department of Transportation
PDM	Pre-Disaster Mitigation
SFHA	Special Flood Hazard Area
SQ. MI.	Square Mile
STA	River Station
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
YR	Year

1.0 INTRODUCTION

1.1 Project Background

A severe precipitation system in June 2013 caused excessive flow rates and flooding in a number of communities in the greater Utica region. As a result, the New York State Department of Transportation (NYSDOT) in consultation with the New York State Department of Environmental Conservation (NYSDEC) retained Milone & MacBroom, Inc. (MMI) through a subconsultant agreement with Creighton Manning Engineering (CME) to undertake a comprehensive water basin assessment of 13 watersheds in Herkimer, Oneida, and Montgomery Counties, including Sauquoit Creek. Prudent Engineering was also contracted through CME to provide support services, including field survey of stream cross sections.

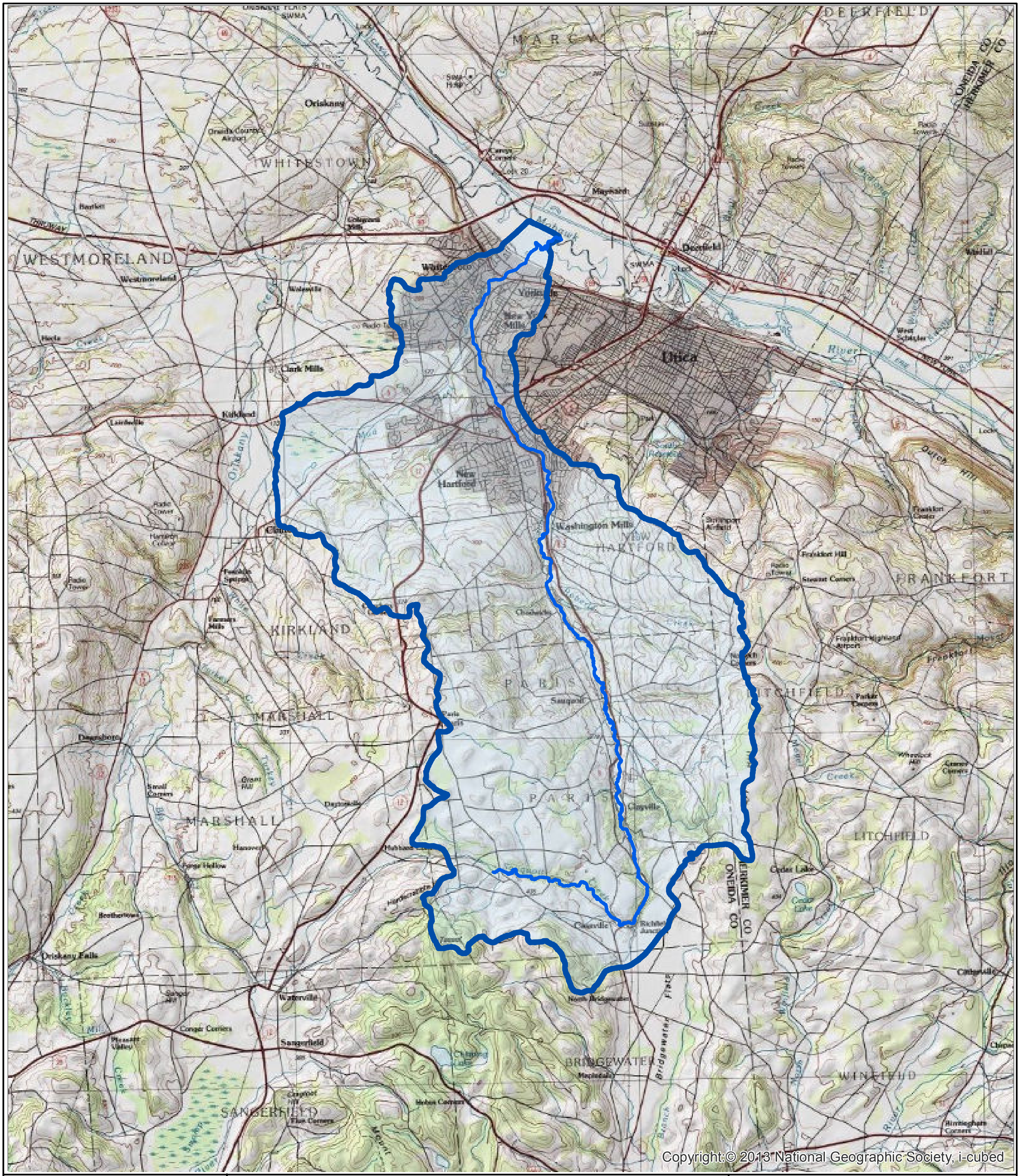
Work conducted for this study included field assessment of the watersheds, streams, and rivers; analysis of flood mitigation needs in the affected areas; hydrologic assessment; hydraulic modeling; and identification of long-term recommendations for mitigation of future flood hazards.

Sauquoit Creek flows through the town of Paris, the village of Clayville, the town and village of New Hartford, the village of New York Mills, the town of Whitestown, and the village of Whitesboro, in Oneida County, east central New York State. The creek drains an area of 62.2 square miles and flows into the Mohawk River west of Utica. The drainage basin is approximately 38 percent forested, with villages, rural residential and agriculture uses in the upper basin, and dense commercial land uses concentrated in the lower part of the basin, especially along Commercial Drive in the village of New York Mills. The creek has an average slope of 0.94 percent over its entire stream length of 20.6 miles. Figure 1 depicts the contributing watershed of Sauquoit Creek.

Sauquoit Creek flows in a generally northern direction and parallels Route 8 for much of its length. The creek's floodplain is broad and flat along its lower reaches where the most intense commercial development has occurred. Especially along its mid and lower reaches, the Sauquoit Creek corridor has been straightened and channelized, and its floodplain has been encroached upon by residential, industrial, and commercial development, leaving little room for floodwaters during storm events. In many areas, development has occurred within several feet of the creek. The creek is spanned by many undersized bridges, which act as hydraulic constrictions and exacerbate flooding, and a number of abandoned dams and grade control structures occur in the channel.

The goals of the subject water basin assessment were to:

1. Collect and analyze information relative to the June 28, 2013 flood and other historic flooding events.



SOURCE(S):

Figure 1: Sauquoit Creek Drainage Basin Location Map

LOCATION:

Oneida County, New York

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NYDOT: Emergency Transportation Infrastructure Recovery

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MMI#: 5231-01
Original: 01/06/2014
Revision: 4/1/2014
Scale: 1 inch = 12,000 feet

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2. Identify critical areas subject to flood risk.

3. Develop and evaluate flood hazard mitigation alternatives for each high risk area within the stream corridor.

1.2 Nomenclature

In this report and associated mapping, stream stationing is used as an address to identify specific points along the watercourse. Stationing is measured in feet and begins at the mouth of Sauquoit Creek at STA 0+00 and continues upstream to STA 1080+00. As an example, STA 73+00 indicates a point in the channel located 7,300 linear feet upstream of the mouth. Figure 2 depicts the stream stationing along Sauquoit Creek.

All references to right bank and left bank in this report refer to "river right" and "river left," meaning the orientation assumes that the reader is standing in the river looking downstream.

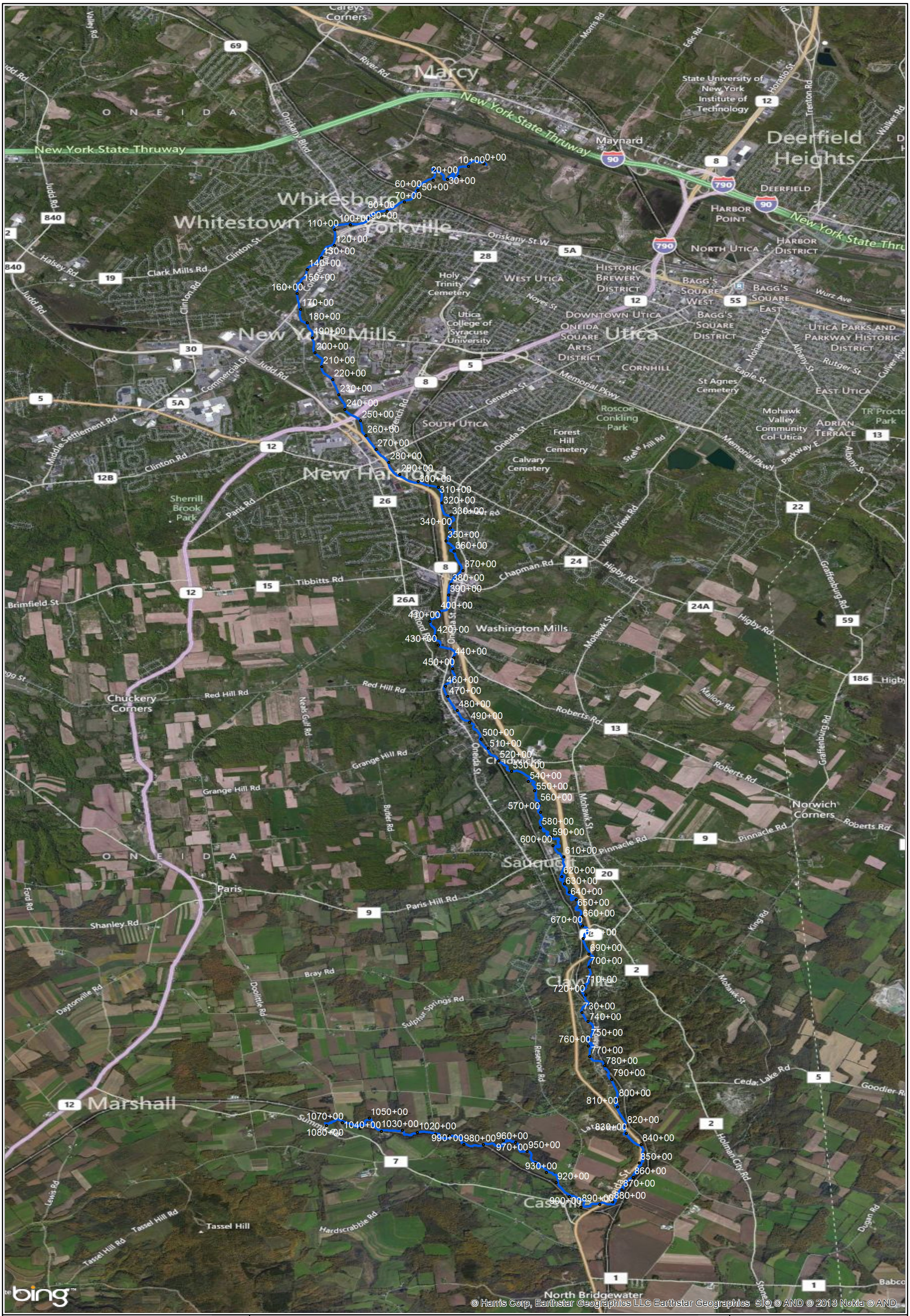
2.0 DATA COLLECTION

2.1 Initial Data Collection

Public information pertaining to Sauquoit Creek was collected from previously published documents as well as through meetings with municipal, county, and state officials. Data collected includes reports, photographs, newspaper articles, Federal Emergency Management Agency (FEMA) Flood Insurance Studies (FIS), aerial photographs, and geographic information system (GIS) mapping. Appendix A is a summary listing of data and reports collected.

2.2 Public Outreach

An initial project kickoff meeting was held in early October 2013 with representatives from NYSDOT and NYSDEC, followed by public outreach meetings held in the affected communities, including a meeting held in October 2013 at the New York Mills Village Offices to discuss Sauquoit and Mud Creeks. These meetings provided more detailed, firsthand accounts of past flooding events; identified specific areas that flooded in each community and the extent and severity of flood damage; and provided information on post-flood efforts such as bridge reconstruction, road repair, channel modification, and dredging. This outreach effort assisted in the identification of target areas for field investigations and future analysis.



SOURCE(S):

Figure 2: Sauquoit Creek Watercourse Stationing

Location:
Oneida County, New York

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2.3 Field Assessment

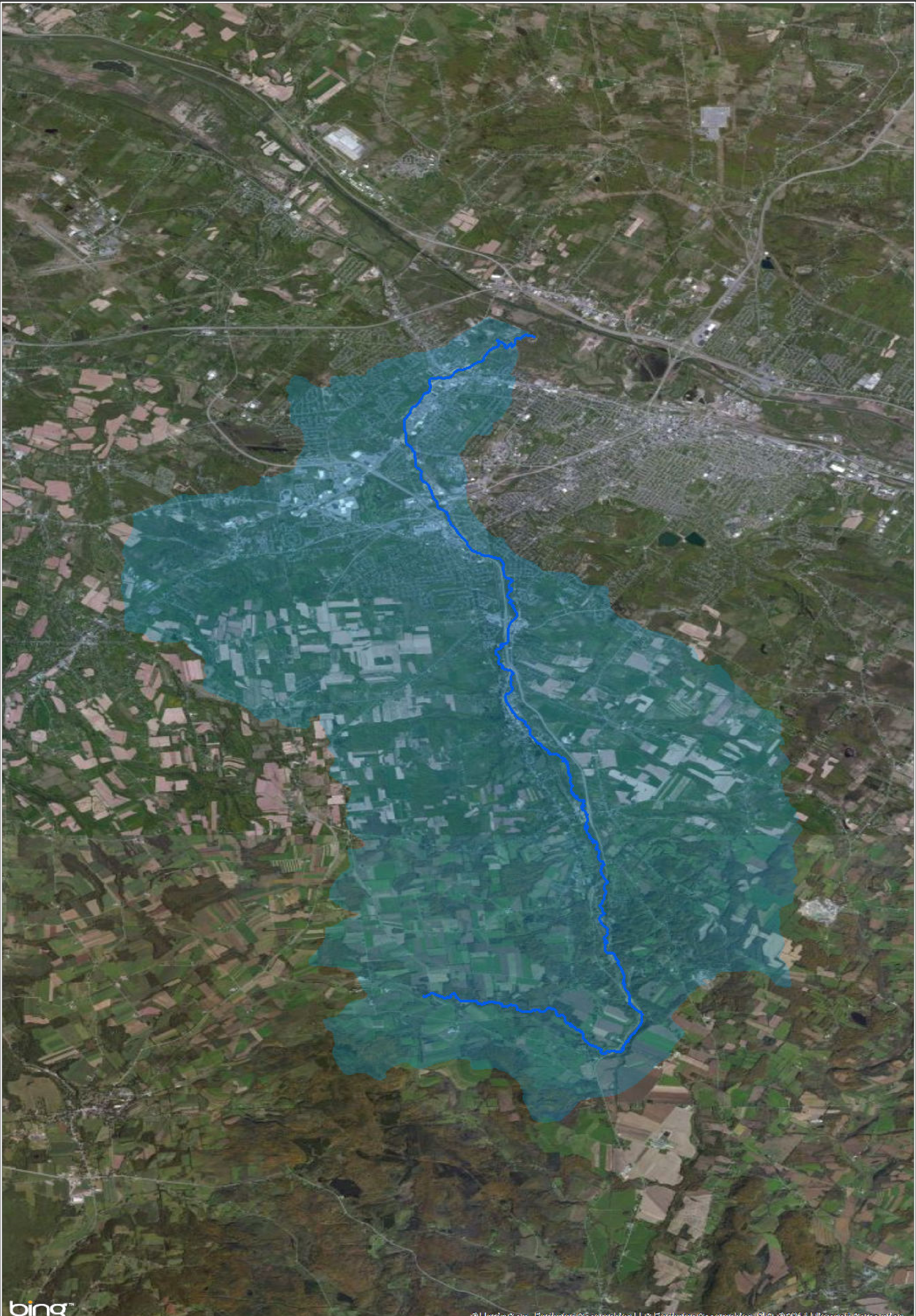
Following initial data gathering and outreach meetings, field staff from Prudent Engineering and MMI undertook field data collection efforts, with special attention given to areas identified in the outreach meetings. Initial field assessment of all 13 watersheds was conducted in October and November 2013. Selected locations identified in the initial phase were assessed more closely by multiple field teams in late November 2013. Information collected during field investigations included the following:

- Rapid "windshield" river corridor inspection
- Photo documentation of inspected areas
- Measurement and rapid hydraulic assessment of bridges, culverts, and dams
- Geomorphic classification and assessment, including measurement of bankfull channel widths and depths at key cross sections
- Field identification of potential flood storage areas
- Wolman pebble counts
- Cohesive soil shear strength measurements
- Characterization of key bank failures, headcuts, bed erosion, aggradation areas, and other unstable channel features
- Preliminary identification of potential flood hazard mitigation alternatives, including those requiring further analysis

Included in Appendix B is a copy of the River Assessment Reach Data Form, River Condition Assessment Form, Bridge Waterway Inspection Form, and Wolman Pebble Count Form. Appendix C is a photo log of select locations within the river corridor. Field Data Collection Index Summary mapping has been developed to graphically depict the type and location of field data collected. Completed data sheets, field notes, photo documentation, and mapping developed for this project have been uploaded onto the NYSDOT ProjectWise system and the project-specific file transfer protocol (FTP) site at MMI. The data and mapping were also provided electronically to NYSDEC.

2.4 Watershed Land Use

Figure 3 is a watershed map of Sauquoit Creek. The creek flows through the town of Paris, the village of Clayville, the town and village of New Hartford, the village of New York Mills, the town of Whitestown, and the village of Whitesboro, in Oneida County. The creek drains an area of 62.2 square miles. The drainage basin is approximately 37.8 percent forested, with villages and rural residential and agriculture uses in the upper basin. Sauquoit Creek parallels Route 8 for much of its length. Residential, commercial, and industrial uses line the creek and in some cases are within a few feet of the banks. Residential development near Sauquoit Creek becomes increasingly dense moving downstream. The lower part of the basin, especially along Commercial Drive in the village of New York Mills, is dominated by dense commercial land uses. There is extensive development in the floodplain, especially in the lower reaches along Commercial Drive.



SOURCE(S):

Figure 3: Sauquoit Creek Drainage Basin Aerial

Location: **Oneida County, New York**

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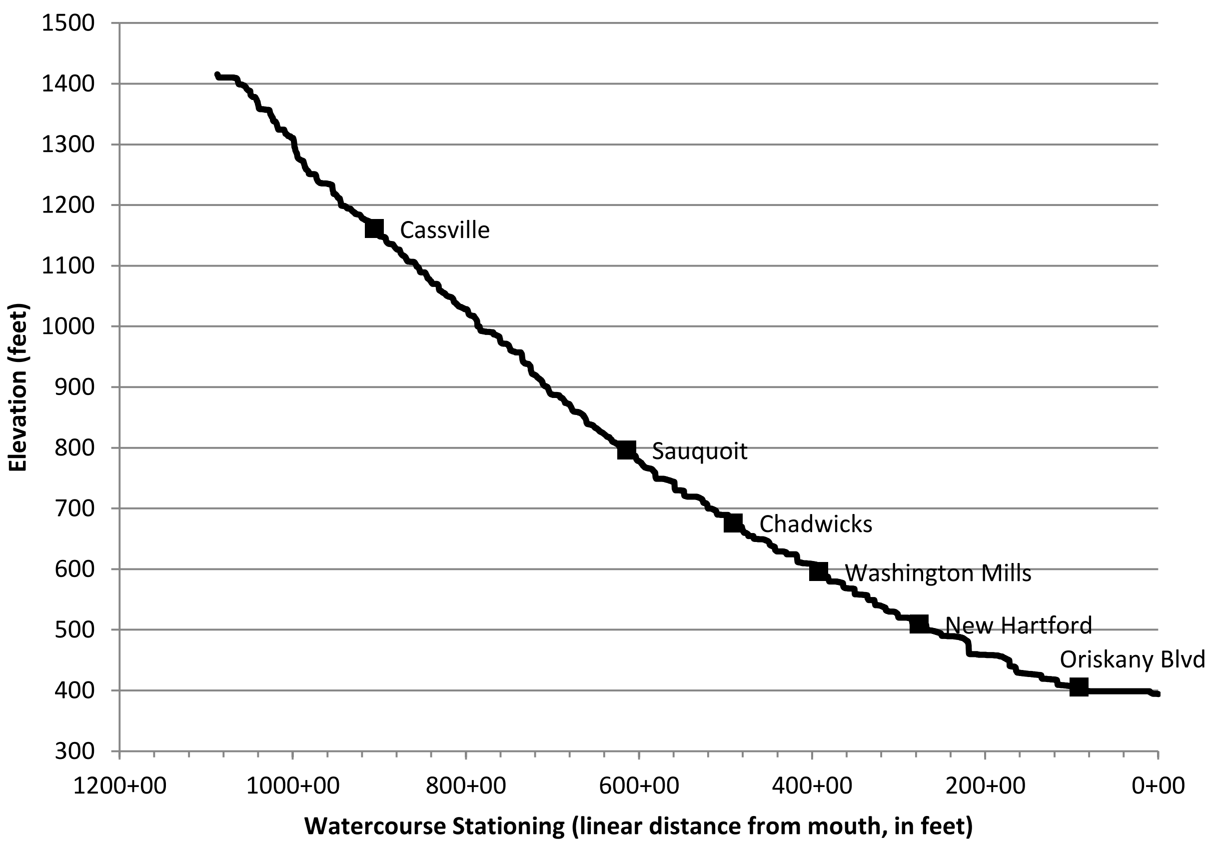
2.5 Geomorphology

Sauquoit Creek has been substantially altered by human use. The creek's floodplain has been extensively filled and developed, especially along the lower reaches in the vicinity of Commercial Drive, where the creek flattens and the floodplain becomes increasingly broad. The channel has been straightened in many areas along the creek to accommodate roads, neighborhoods, and commercial districts. For much of its length, especially along the mid and lower reaches, the creek banks consist of concrete or stacked rock walls that confine the channel, resulting in a channel that lacks the capacity to convey flows during storm events.

Figure 4 is a profile of Sauquoit Creek, showing the watercourse elevation versus the linear distance from the mouth of the watercourse. Sauquoit Creek has an average slope of 0.94 percent over its entire stream length of 20.6 miles, flattening out in its lower reaches as it approaches its outlet at the Mohawk River. The creek drops a total of 1,022 vertical feet over its length, from an elevation of 1,416 feet above sea level at its headwaters, to 394 feet at its mouth at the Mohawk River west of Utica.

FIGURE 4
Sauquoit Creek Profile



Sauquoit Creek passes under many bridges along its 20.6-mile length, including many that are undersized. The creek also flows over a number of small dams and grade control structures.

2.6 Hydrology

Alluvial river channels adjust their width and depth around a long-term dynamic equilibrium condition that corresponds to "bankfull" conditions. Extensive data sets indicate the channel forming or bankfull discharge in specific regions is primarily a function of watershed area and soil conditions. The bankfull width and depth of alluvial channels represent long-term equilibrium conditions and are important geophysical criteria that are used for design. Table 1 lists estimated bankfull discharge, width, and depth at several points along Sauquoit Creek, as derived from the United States Geological Survey (USGS) *StreamStats* program.

TABLE 1
Estimated Bankfull Discharge, Width, and Depth
(Source: USGS *StreamStats*)

Location	Station	Watershed Area (sq. mi.)	Discharge, (cfs)	Bankfull Width (ft)	Bankfull Depth (ft)
Brookside Mobile Manor	454+00	35.5	962	67	3.1
Behind Tahan's Furniture	110+00	60.2	1,510	85	3.78

Actual bankfull widths measured on Sauquoit Creek were compared to the regional bankfull channel dimensions reported above. The measured bankfull width at Brookside Mobile Manor was 40 feet compared to the regional bankfull channel width of 67 feet. The measured bankfull width behind Tahan's Furniture Store was 54.5 feet compared to the regional bankfull channel width of 85 feet. These comparisons indicate that the Sauquoit Creek channel is substantially undersized.

There are no USGS stream gauging stations on Sauquoit Creek. Hydrologic data on peak flood flow rates are available from the FEMA FIS and from *StreamStats* regional statistical data.

The most current FEMA FIS that applies to Sauquoit Creek is for all of Oneida County. The study is available in four volumes and became effective on September 27, 2013. According to this FIS, the most recent hydraulic models for Sauquoit Creek date from May 1982 for the village of Clayville; March 1982 for the town of New Hartford, the village of New Hartford, and the city of Utica; June 1982 for the town of Paris; and June 1997 for the village of New York Mills, the village of Whitesboro, the town of Whitestown, and the village of Yorkville.

The hydrologic analysis methods employed for the 1983 FIS, peak discharge-frequency relationships for Sauquoit Creek were obtained from a United States Army Corps of

Engineers (USACE) report, determined using the USACE HEC-1 flood hydrograph computer program (USACE, September 1981). For the May 4, 2000 revision, the NYSDEC utilized the HEC-1 computer program to update the hydrologic analysis for Sauquoit Creek due to increased development in the drainage basin. These discharges were then applied by FEMA in a backwater analysis of Sauquoit Creek, and the resulting water-surface elevations were compared with historical elevations and checked for reasonableness. The results were published in the FIS, and the resulting mapping was published as the effective Flood Insurance Rate Map (FIRM) for Oneida County.

Table 2 lists estimated peak flows on Sauquoit Creek at each of the cross sections reported in the FEMA FIS and similar drainage points delineated with the *StreamStats* program. When comparing discharges reported in the FEMA FIS report to those determined using *StreamStats*, discharge volumes are generally within 10 percent.

TABLE 2
Sauquoit Creek FEMA and *StreamStats* Peak Discharges

Location	Drainage Area (sq. mi.)	10-Yr	50-Yr	100-Yr	500-Yr
		FEMA Peak Discharges			
Upstream State Route 8	6.4	598	1,016	1,104	1,706
Upstream Oneida Street	8.9	872	1,394	1,512	2,300
Upstream Main Street	11.9	915	1,577	1,744	2,776
Upstream Holman City Road	13.2	1,185	1,914	2,187	3,515
Upstream Pinnacle Road	17.6	1,633	2,628	2,882	4,717
Upstream Elm Street	28.53	2,074	3,486	3,786	6,025
Upstream 4th Railroad Crossing	32.55	2,387	4,038	4,390	7,011
Upstream Kellogg Road	36.96	2,920	4,838	5,226	8,227
Upstream of City of Utica/Town of New Hartford Limits	40.19	3,161	5,242	5,634	8,790
Upstream 3rd Railroad Crossing	41.12	3,254	5,399	5,801	8,949
Limits of Village of Hartford/City of Utica	43.4	3,899	6,516	7,011	10,523
Upstream 2nd Railroad Crossing	43.66	3,394	5,681	6,124	9,504
Limits of Town of New Hartford/Town of Whitestown	47.11	3,899	6,516	7,011	10,523
State Route 5A	47.1	5,192	7,651	9,141	12,000
Stuart Court Extended	59.4	5,873	8,707	10,222	13,150
Main Street Bridge	60.1	6,014	8,702	10,120	13,205
Confluence with Mohawk	61.9	6,148	8,831	10,177	13,100

TABLE 2 (continued)
Sauquoit Creek FEMA and *StreamStats* Peak Discharges

Location	Drainage Area (sq. mi.)	10-Yr	50-Yr	100-Yr	500-Yr
	StreamStats Peak Discharges Reoccurrence				
State Route 8	11.5	1,120	1,650	1,910	2,540
Oneida Street	12.5	1,180	1,720	2,000	2,640
Main Street	13.3	1,230	1,810	2,090	2,760
Holman City Road	18.4	1,640	2,390	2,770	3,650
Pinnacle Road	22.9	2,050	3,000	3,470	4,580
Elm Street	28.8	2,630	3,850	4,460	5,890
4th Railroad Crossing	35.6	3,290	4,820	5,580	7,370
Kellogg Road	37.4	3,470	5,080	5,880	7,770
3rd Railroad Crossing	42.1	4,180	6,150	7,140	9,450
Limits of Village of Hartford/City of Utica	43.5	4,040	5,920	6,860	9,060
2nd Railroad Crossing	46.3	4,320	6,330	7,330	9,680
State Route 5A	47.6	4,400	6,440	7,450	9,840
Stuart Court Extended	59.9	5,340	7,780	9,000	11,900
Main Street Bridge	60.9	5,470	7,970	9,220	12,200
Confluence with Mohawk	62.3	5,520	8,040	9,300	12,200

2.7 Infrastructure

Bridge spans and heights were measured as part of the MMI field investigations in the fall of 2013. Table 3 summarizes the bridge measurements collected. For purposes of comparison, estimated bankfull widths at each structure are also included.

Table 3 indicates that many of the bridges are not wide enough to span the bankfull width of Sauquoit Creek, and may be undersized to convey flood flows. Flood profiles published in the FEMA FIS were evaluated to determine which bridges on Sauquoit Creek are acting as hydraulic constrictions and therefore backing up water during high flow events and contributing to flooding. The profiles indicate that many of the bridges that span the creek are acting as hydraulic constrictions, including, from upstream to downstream, Pinnacle Road (STA 608+50), Bleachery Place (STA 480+00), the railroad bridge at STA 455+00, Oneida Street (STA 436+00) and the adjacent railroad bridge (STA 434+00), Chapman Road (labeled on FEMA profiles as Kellogg Road) (STA 379+00), Genesee Street (STA 274+50), Chenango Road (STA 235+00), Commercial Drive (Route 5A) (STA 165+00), Oriskany Boulevard (STA 92+00), and Main Street (STA 80+00).

TABLE 3
Summary of Stream Crossing Data

Roadway Crossing	Station	BIN	Width (ft)	Height (ft)	Bankfull Width (ft)
Route 8 Crossing #2	688+50	000000001051460	87.9		45.0
Holman City Road	671+00	000000002205920	28.5	7.8	49.9
Pinnacle Road	608+50	000000003310890	45.0	7.0	55.1
Elm Street	507+00	000000002205890	56.0	8.0	61.0
Bleachery Place	480+00	000000002263300	57.0	8.5	62.4
Bleachery Avenue	472+00	000000002205900	24.0 x2	8.0	62.4
Oneida Street	436+00	000000002263320	98.0	7.0	67.1
Railroad Crossing	434+00	---	100.0	5.0-8.0	68.5
Route 8	398+00	000000001051501	87.9		68.5
Chapman Road	379+00	---	75.0	10.5	68.6
Genesee Street	274+50	000000001052070	64.5	6.0	73.4
Expressway 8-12-5 Northbound	245+00	000000001002221	99.0 x 2	14.0	73.8
Expressway 8-12-5 Southbound	244+00	000000001002222	99.0 x 2	14.0	73.8
Railroad Crossing	234+00	---	97.5	20.0	75.5
Chenango Road	235+00	000000002206680	97.5	20.3	75.5
Clinton Street	185+00	000000002206280	71.0	14.3	76.1
Commercial Drive	165+00	000000001002670	103.0	10.5	76.5
Oriskany Boulevard to Commercial Drive	97+50	---	107.0	7.2	85.4
Oriskany Boulevard	92+00	000000001009919	23.0	11.4	85.4
Main Street	80+00	000000002255640	93.5	8.8	85.4

In addition to the many undersized bridge crossings along Sauquoit Creek, there are a number of structures in the channel, including abandoned dams and grade control structures, which in many cases are acting to increase water surface elevations during high flow events, and exacerbating flooding. Several structures are located in the channel adjacent to Richardson Avenue downstream of the Genesee Street bridge (between STA 270+00 and STA 236+00). There is an abandoned dam in the vicinity of STA 525+00, upstream of Elm Street. At STA 538+00 is a dam that at one time impounded a substantial reservoir and is now mostly drained.

3.0 FLOODING HAZARDS AND MITIGATION ALTERNATIVES

3.1 Flooding History in Sauquoit Creek

The most severe flood-related damages on Sauquoit Creek have occurred within the area of dense commercial land uses along Commercial Drive, in the village of New York Mills. According to the FEMA FIS, significant floods occurred on Sauquoit Creek in

1910, 1913, 1914, 1936, 1945, 1950, 1951, 1960, 1964, June 1972 (Tropical Storm Agnes), 1996, 1998, and 2006. Many of these floods occurred in the spring as a result of snowmelt combined with rainfall. The flood of March 1936 was caused by 4.6 inches of rainfall on a heavy snow cover, causing a snowmelt equivalent to approximately 3 inches of water. The October 1945 flood was caused by intense rainfall of 4.2 inches in a 24-hour period and is locally considered the greatest flood of record. Ice jams and bridges have also caused localized flooding on Sauquoit Creek.

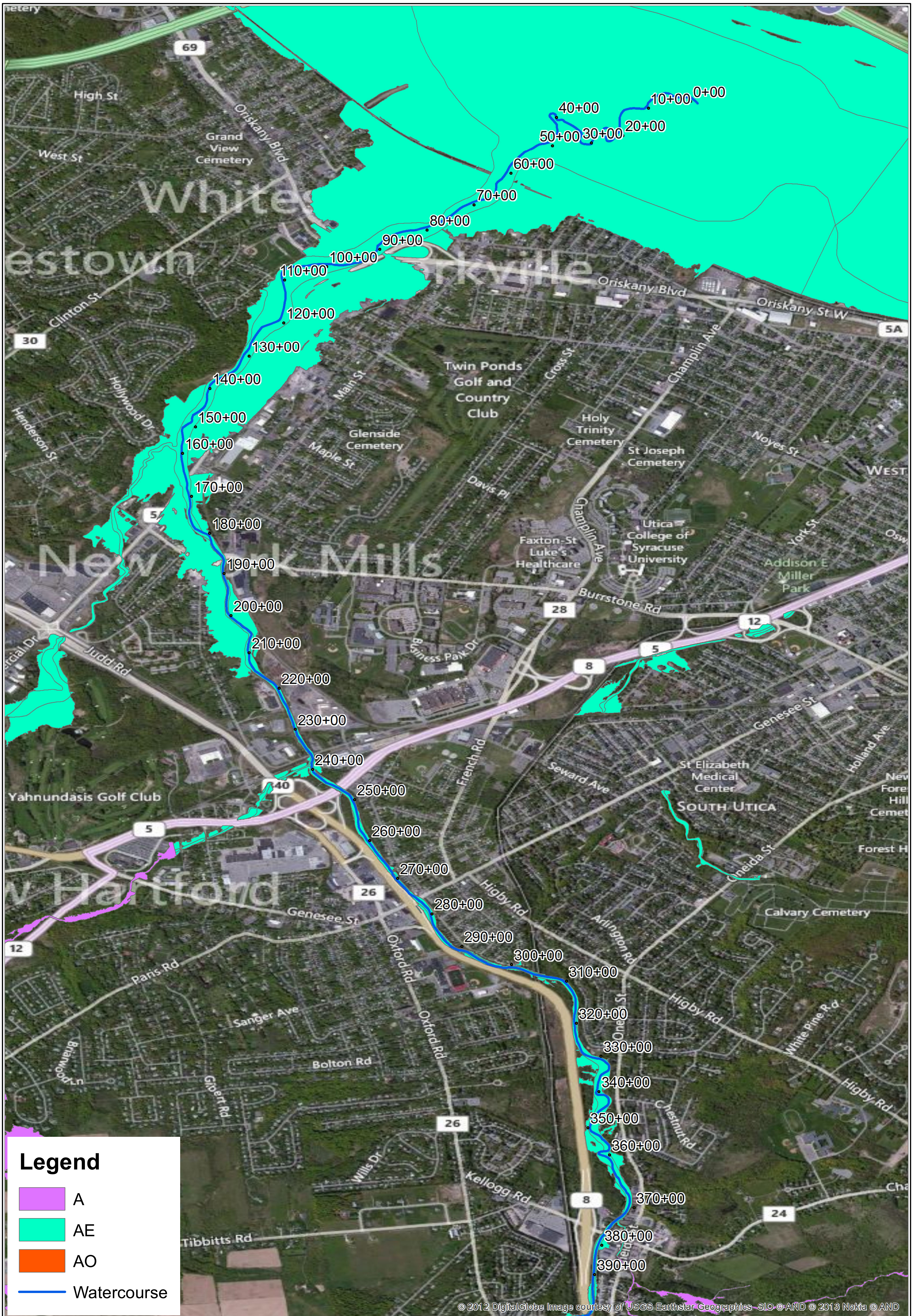
Figures 5 and 6 depict the FEMA delineated floodplain along the Sauquoit Creek corridor.

According to news reports, heavy rainfall in April 2011 and then Tropical Storm Irene in August 2011 caused flooding of Sauquoit Creek. In fall 2011, Whitesboro experienced severe flooding, and fire departments had to rescue people from their homes. As a result, houses and businesses were damaged, and people were without power for days. In January 2013, ice jams caused flooding along the creek.

Municipal officials provided a detailed summary of flood- and erosion-prone areas along Sauquoit Creek. In the town of Paris, the Pinnacle Road bridge has washed out multiple times and was subsequently replaced. Sauquoit Creek near the Town of Paris Department of Public Works garage has been subject to erosion problems. The bridge at Genesee Street has overtopped during floods. Extensive flooding of businesses and car dealerships has occurred along Commercial Drive downstream to Main Street. NYSDOT has periodically removed sediment from the channel in the lower portion of Sauquoit Creek.

In mid to late June and early July of 2013, a severe precipitation system caused excessive flow rates and flooding in a number of communities in the greater Utica region, including in the Sauquoit Creek Basin. Because rainfall across the region was highly varied and rainfall information is limited, it is not possible to determine exact rainfall amounts within the Sauquoit Creek Basin.

Historic records on the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) Advanced Hydrologic Prediction Service website indicate that the Utica area received between 10 and 15 inches of rainfall in the month of June and an additional 5 to 8 inches in July, 2013. Much of this rainfall occurred over several storm events that dropped between 3.5 and 4.5 inches of rain between June 11 and 14; 5.5 to 8.5 inches between June 24 and 28; and 1.5 to 2.0 inches on July 2. In between these more severe rain events were a number of smaller rain showers that dropped trace amounts of precipitation, which prevented soils from drying out between the larger rain events.



SOURCE(S):

Figure 5: Sauquoit Creek FEMA Floodzones

Location: **Oneida County, New York**

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NYDOT: Emergency Transportation Infrastructure Recovery

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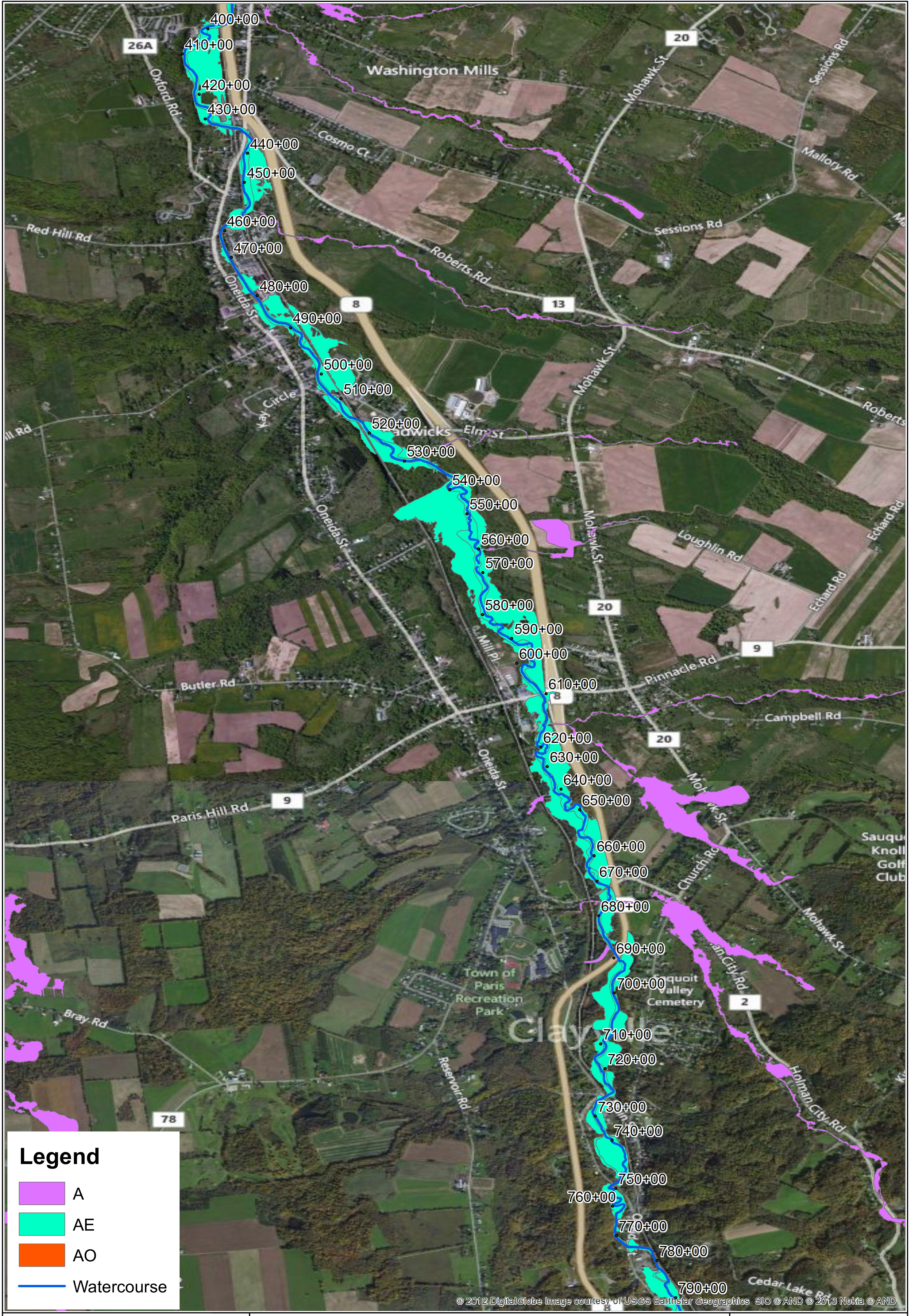

SOURCE(S):

Figure 6: Sauquoit Creek FEMA Floodzones

Location:
Oneida County, New York

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NYDOT: Emergency Transportation Infrastructure Recovery

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3.2 Post-Flood Community Response

Following the heavy flooding in June 2013, communities along Sauquoit Creek implemented numerous repairs. According to the Oneida County FIS, the Village of New York Mills annually removes silt and gravel sediment from the stream channel where eroded material from upstream has been deposited in an effort to prevent flooding along Sauquoit Creek and Mud Creek. The lower reaches of Sauquoit Creek from the Main Street bridge crossing to an existing railroad bridge have recently been dredged and appear to be dredged periodically.

The segment of creek from Oriskany Boulevard (STA 90+00) to Route 5A (STA 164+00) along Commercial Drive has a very low-lying, broad, and heavily developed floodplain that is subject to frequent inundation that is worsened by sediment aggradation. This reach of creek is routinely dredged. Exposed clay was observed in some areas where over-dredging has occurred.

Stacked stone wall was constructed along Brookline Drive (STA 300+00) at the outside of a bend, where flood flows reportedly overtopped and inundated the surrounding residences.

3.3 Flood Mitigation Analysis

Hydraulic analysis of Sauquoit Creek was conducted using the HEC-RAS program. The HEC-RAS computer program (*River Analysis System*) was written by the USACE Hydrologic Engineering Center (HEC), considered to be the industry standard for riverine flood analysis. The model is used to compute water surface profiles for one-dimensional, steady-state, or time-varied flow. The system can accommodate a full network of channels, a dendritic system, or a single river reach. HEC-RAS is capable of modeling water surface profiles under subcritical, supercritical, and mixed-flow conditions.

Water surface profiles are computed from one cross section to the next by solving the one-dimensional energy equation with an iterative procedure called the standard step method. Energy losses are evaluated by friction (Manning's Equation) and the contraction/expansion of flow through the channel. The momentum equation is used in situations where the water surface profile is rapidly varied, such as hydraulic jumps, mixed-flow regime calculations, hydraulics of dams and bridges, and evaluating profiles at a river confluence.

Hydraulic modeling that was originally generated by FEMA as part of its May 2000 study of the Sauquoit Creek was obtained and used as a starting point for the current analysis. Given the significant flood damages (including both erosion and deposition), along with post-storm activities, it can be assumed that conditions have significantly changed since the date of the FEMA study and, for that reason, updated cross sections were surveyed as part of the subject analysis. The updated survey information was incorporated into the hydraulic model in order to better characterize and understand modern flooding risks and causes.

The survey effort included the wetted area (within bankfull elevation) of 27 stream cross sections, plus the survey of seven bridges/culverts. These data were combined with countywide light detection and ranging (LiDAR) data provided by the NYSDEC to develop sufficient model geometry such that existing conditions flooding up to and including the 100-year recurrence interval could be modeled.

The model of existing conditions was then used to analyze certain alternatives, described further in the report sections that follow. Model input and output files have been uploaded onto the NYSDOT ProjectWise site and delivered electronically to NYSDEC.

3.4 High Risk Area #1 – Failing Dams in the Upper Sauquoit Creek Basin (STA 903+00 to STA 726+00)

High Risk Area #1 is located in the upper Sauquoit Creek basin and extends from Summit Road in Cassville (STA 903+00) downstream to Main Street in Clayville (STA 726+00). The area is depicted in Figure 7. While this part of the Sauquoit basin is less densely developed, the creek channel and floodplain have been encroached upon by residential and industrial development and by the roads and railroad line that run adjacent to the creek. Sauquoit Creek has been channelized for portions of this reach.

At least eight low-head dams span the channel in this reach, associated with factories along its banks. These dams are in various stages of disrepair, and some have completely failed, leaving behind an unstable channel, an eroding channel bed and banks, and high sediment load. Other dams are still in place but appear to be in danger of failing. The continued failure of these dams will lead to an increasingly unstable channel, contributing to downstream sediment loads. Dams in this reach include the following:

- A series of four dams associated with the factory building at STA 734+00, along Main Street in Clayville, including a large, partially dewatered impoundment between STA 738+00 and STA 748+00
- A series of three dams in the vicinity of STA 780+00, which are associated with a factory on Oneida Street, opposite Crooked Hill Road
- A dam at STA 825+00 associated with a factory building along Route 8 at Latus Road

Alternative 1-1: Remove Dams and Stabilize Channel

Full removal of low-head dams in the reach would help to restore and stabilize this section of Sauquoit Creek, would reduce water surface elevations upstream of the dams, and would prevent the uncontrolled downstream release of sediments that would occur in the event of dam failure. None of the dams appear to serve a useful purpose, and they do not impound enough water during high flow events to mitigate downstream flooding.

SOURCE(S):

Figure 7: Sauquoit Creek High Risk Area #1

Location: Oneida County, New York

N

NYDOT: Emergency Transportation Infrastructure Recovery

Map By: CMP
MMI#: 5231-01
MXD: Y:\5231-01\GIS\Maps\High Risk Areas\Sauquoit Creek High Risk #1.mxd
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3.5 High-Risk Area #2 – Legacy Dam (STA 538+00)

Figure 8 is a location plan of High Risk Area #2. This is an old concrete dam located in an undeveloped area in the upper watershed of Sauquoit Creek. This dam is located at STA 538+00, in a remote area between Route 8 on the east and railroad tracks on the west, just upstream of Elm Street and Donovan Memorial Park in the hamlet of Chadwicks.

The dam appears to be in poor structural condition. The flashboards on the spillway have been removed, and the low-flow drain has been left open, resulting in the drawdown of the impoundment behind the dam. However, the dam retains a substantial volume of water and accumulated sediments, which would pose a danger to downstream communities if this dam were to fail. The approximate elevation drop between the crest of the spillway and the pool below the dam is 15.5 feet. Its former impoundment, now heavily silted in, seems to extend upstream approximately 3,400 feet.

The owner of the dam is not known; however, under current State of New York law, they are responsible for the repair or removal of the dam. Dams are classified by hazard potential in the event of a failure. It is unclear without performing a dam breach analysis what type of flooding impacts this dam could have on downstream properties. Further investigations and analysis are warranted to inspect the dam, evaluate its structural integrity, and to provide recommendations to prevent its failure. Such an inspection should be carried out by a certified professional engineer registered with the State of New York, and with adequate experience in dam safety inspections. The results of such an assessment should include a dam breach assessment.

Three alternatives were evaluated for this site. All likely require extensive clearing and construction of an accessway to provide trucking routes to the structure. In its current state, the site is inaccessible by vehicle.

Alternative 2-1: Remove Dam

Removal of the dam would provide an array of ecological benefits and is likely to be the most economical solution on a long-term basis by virtue of eliminating operation and maintenance costs. Preserving any type of flow regulation structure at this location will require periodic maintenance, will accumulate sediment that may require removal at a later date, and will always bear a certain risk of failure. However, the capital cost of dam removal and sediment management can also be very high. Dam removal has the potential to reduce any flood attenuation provided by the dam; however, without analysis, the magnitude of flood protection is unknown.

The composition of impounded sediments and the potential for contaminants is often the biggest cost element associated with dam removal. Sediment quality and potential flood protection currently provided are key issues that would need to be explored to fully evaluate the cost and feasibility of dam removal.

SOURCE(S):

Figure 8: Sauquoit Creek High Risk Area #2

Location: **Oneida County, New York**

N

NYDOT: Emergency Transportation Infrastructure Recovery

Map By: CMP
MMI#: 5231-01
MXD: Y:\5231-01\GIS\Maps\High Risk Areas\Sauquoit Creek High Risk #2.mxd
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Alternative 2-2: Repair Dam

Repair or rehabilitation of the dam to meet present day hydraulic and structural specifications under current dam safety regulations is an alternative to removal. Dam repair or rehabilitation would alleviate the need for sediment management and would eliminate any potential for worsening of downstream flooding. The feasibility and extent of such repairs can only be made upon full assessment of the dam.

Alternative 2-3: Repair and Repurpose Dam

As an additional step beyond dam repair, the design of the dam was evaluated relative to ascertain the ability to mitigate downstream flooding. This would involve raising the height of the dam or removing aggraded sediment from behind it in an effort to increase the volume of peak floodwater capable of being stored. Such an alternative would involve a similar level of analysis and financial commitment as the prior alternatives but with the potential added benefit of peak flood flow attenuation for downstream areas.

During field investigations, a number of sites within the Sauquoit Creek basin were investigated for their potential use as floodwater detention areas, to potentially reduce peak flows at downstream locations along Sauquoit Creek. The dam site at STA 538+00 was identified as a potentially feasible site for further evaluation. By raising the current water surface elevation in the impoundment by five feet and allowing for one foot of freeboard, the total storage during a 100-year frequency flood event could equal approximately 67,348 cubic yards, or one percent of the total estimated runoff during a 100-year event. Calculations are included in Appendix D. The goal or "rule of thumb" for a feasible, cost effective flood detention area is to store at least 10 percent of the runoff generated during the 100-year event. Increasing storage volume by raising the spillway elevation by more than five feet, combined with excavation of the impoundment or constructing berms to protect nearby properties from flooding was not considered to be a cost-effective option.

Recommendations

Further detailed analysis is recommended at this site to guide the decision of whether dam repair/rehabilitation or dam removal is the best course of action. No action will eventually lead to complete failure of this structure.

3.6 High-Risk Area #3 – Brookside Mobile Manor (STA478+00 to STA 455+00)

Figure 9 is a location plan of High Risk Area #3. This area begins at STA 478+00 and extends downstream to STA 455+00. It includes a densely developed area at the center of the hamlet of Chadwicks, including the Brookside Mobile Manor trailer park, a strip mall with two restaurants, an existing low-head run-of-river dam, and two undersized bridges at Bleachery Avenue and a railroad crossing. Community officials report that extensive flooding occurs in this area.

SOURCE(S):

Figure 9: Sauquoit Creek High Risk Area #3

Location: **Oneida County, New York**

N

NYDOT: Emergency Transportation Infrastructure Recovery

Map By: CMP
MMI#: 5231-01
MXD: Y:\5231-01\GIS\Maps\High Risk Areas\Sauquoit Creek High Risk #3.mxd
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Inspection of the FEMA FIRM indicates that many residential structures, homes, and mobile home trailers were constructed in the delineated 100-year floodplain in this reach of the Sauquoit. At its narrowest point (near STA 462+00), buildings are located on both sides of the creek, with only 65 feet of width between structures on opposite banks. According to FEMA FIRM, these structures barely span the floodway, and they cut off the floodplain of the creek entirely.

The FEMA FIRM also indicates that an existing railroad bridge at STA 455+50 is undersized, raising flood elevations during the 100-year flow as much as six feet, for a length of 600 feet upstream. This rise in water surface elevation exacerbates flooding that would occur even without the bridge being present as a result of floodplain encroachment and development.

Four alternatives have been identified to mitigate flooding through this reach.

Alternative 3-1: Replace Bleachery Avenue Bridge (STA 472+00) and Downstream Railroad Bridge (STA 456+00)

The Bleachery Avenue bridge (STA 472+00) and surrounding area was surveyed, as described above, and a hydraulic model was developed to assess the flooding behavior of this reach. According to modelling results, the bridge is undersized and causes backwater behind it. The water surface elevations are predicted to reach the deck during the 10-year event. Combined with the low-head dam located directly upstream of the bridge, which also raises water surface elevations, backwater begins to flood an existing strip mall, multiple restaurants, and multiple rehabilitated mill buildings located just upstream of the crossing. These results are consistent with anecdotal reports of flooding in the area.

Removal of the dam and replacement of the bridge were evaluated. An adequately sized crossing at this location would require an increased bridge span from 50 feet to approximately 75 feet, along with modification of channel banks upstream and downstream to accommodate the larger span. Preliminary hydraulic modeling indicates that bridge replacement in combination with dam removal and channel modifications will reduce water surface elevations directly upstream by over five feet during the 100-year event.

The downstream railroad bridge (STA 455+50) causes a more localized rise in water surface elevation, limited to approximately 600 feet upstream of the bridge. However, the effective span length of 56 feet is reduced hydraulically due to the skew of the bridge. Similar to the Bleachery Avenue bridge, replacement of this crossing is recommended. A structure should be adequately sized, including consideration of the skew angle. Preliminary modeling indicates an effective span of 75 feet would be necessary, not including the hydraulic area lost to a skewed crossing.

Alternative 3-2: Strategic Acquisition of Repetitive Loss Properties

In areas along Sauquoit Creek where dwellings have suffered repeated losses due to flooding such as the Bleachery Avenue area, property acquisition is a potentially viable mitigation alternative either through a FEMA buyout program or governmental buyout. Such properties can be converted to passive, non-intensive land uses such as streamside parks, picnic areas, fishing access sites, or wildlife observation areas.

Property acquisitions may be funded by FEMA under three grant programs: the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). The PDM Program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act) and provides funds for hazard mitigation planning and mitigation projects. The HMGP is authorized under Section 404 of the Stafford Act and provides grants to implement hazard mitigation measures after a major disaster declaration. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.

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

The NFIP provides the funding for the FMA program. The PDM and FMA programs are subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds. FEMA is the entity that dispenses funds for all three programs.

Historically, acquisitions and elevations of structures have been eligible for funding only when the project is found to be cost effective using FEMA's benefit-cost analysis (BCA) program. The BCA utilizes data from the FIS or previous flood damage claims to calculate the benefit-cost ratio (BCR) associated with the acquisition. The project cost (acquisition fees plus site restoration) must be known to determine the BCR. While this process has proved effective for funding many property acquisitions nationwide, there were many instances where BCRs above 1.0 were not computed due to site-specific challenges or data gaps.

The Biggert-Waters Flood Insurance Reform Act of 2012 made several changes to the mitigation programs, and the new Hazard Mitigation Assistance (HMA) guidance was released in July 2013. One potentially important change to the PDM, HMGP, and FMA programs is that green open space and riparian area benefits can now be included in the project BCR once the project BCR reaches 0.75 or greater. This is one potential method of bridging the gap between a BCR of 0.75 and a BCR of 1.0.

On August 15, 2013, FEMA issued new guidance for acquisitions and elevations of structures within Special Flood Hazard Areas (SFHAs). According to the guidance, acquisitions with a project cost lower than $276,000 and elevations with a project cost lower than $175,000 may be considered *automatically cost-effective for structures in SFHAs*. Although this is a new interpretation of cost effectiveness, it could mean that acquisitions and elevations may be more easily funded without consideration of the BCA.

Once a structure has been acquired and demolished, the property must remain as open space. The intent of the mitigation programs is that structures will not be built in the open space although passive recreation is permitted. To offset the loss of the structure and its occupant, the community should strive to facilitate relocation nearby in areas outside of the floodplain.

Alternative 3-3: Flood Protection Measures of Individual Properties

Potential measures for property protection include the following:

Elevation of the structure. Home elevation involves the removal of the building structure from the basement and elevating it on piers to a height such that the first floor is located above the 1 percent annual chance flood level. The basement area is abandoned and filled to be no higher than the existing grade. All utilities and appliances located within the basement must be relocated to the first-floor level.

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

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

Wet floodproofing of the structure to allow floodwaters to pass through the lower area of the structure unimpeded. Wet floodproofing refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures. Wet floodproofing should only be used as a last resort. If considered, furniture and electrical appliances should be moved away or elevated above the 1 percent annual chance flood elevation.

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

- Relocate valuable belongings above the 1 percent annual chance flood elevation to reduce the amount of damage caused during a flood event.
- Relocate or elevate water heaters, heating systems, washers, and dryers to a higher floor or to at least 12 inches above the high water mark (if the ceiling permits). A wooden platform of pressure-treated wood can serve as the base.
- Anchor the fuel tank to the wall or floor with noncorrosive metal strapping and lag bolts.
- Install a backflow valve to prevent sewer backup into the home.
- Install a floating floor drain plug at the lowest point of the lowest finished floor.
- Elevate the electrical box or relocate it to a higher floor and elevate electric outlets to at least 12 inches above the high water mark.

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

Alternative 3-4: Floodplain Restoration

Development along Sauquoit Creek has encroached heavily on the floodplain and in some cases encroaches within the FEMA designated floodway. Development has occurred to the edge of the creek on both banks of the Sauquoit. The higher flows generated during a flood do not have sufficient floodplain area to effectively be conveyed downstream and, instead, they overtop the banks.

Restoration of the floodplain through this reach would involve widening the banks of the Sauquoit Creek to incorporate a floodplain bench. Preliminary modeling indicates that the bench should be approximately 75 feet wide, starting at the existing railroad bridge (STA 455+50) and extending a minimum of 750 feet upstream. This will involve the removal of approximately 13 trailer homes and one conventional home that are currently located on the right bank of the Sauquoit.

The ability to recreate a floodplain and fully mitigate flooding through this reach will require more detailed analysis and careful planning as it will impact many private properties located on the banks of the Sauquoit. Such an approach will require property easements and acquisition of entire parcels such that existing structures can be removed along the project area. In some cases, it is unrealistic to undertake comprehensive stream corridor improvement projects all at once; however, a long-range plan can help guide future acquisitions and potential FEMA buyouts over time.

Recommendations

Alternatives 3-1 and 3-4 are primary recommendations. Implementing these in combination will enable conveyance of the 100-year flood event through this reach. In the event that these large-scale projects do not occur in a reasonable time frame, Alternatives 3-2 and 3-3 may be appropriate on a case-by-case basis.

3.7 High-Risk Area #4 – Flooding Near Victoria Drive (STA 330+00 to STA 262+00)

Figure 10 is a location plan of High Risk Area #4. In this area, Sauquoit Creek overtopped its right bank during the flooding in June 2013 near STA 330+00 and reportedly caused flood damage to houses north of the creek on Victoria Drive. The creek overtopped its banks at two other locations near STA 300+00 and STA 291+00 along Brookline Drive. The damaged banks at these locations were treated with stacked rock walls. The FEMA profile and maps show these areas to be located in the floodplain of the Sauquoit.

Dense residential development along Victoria Drive (STA 330+00 to STA 309+00), Brookline Drive (STA 301+00 to STA 276+00), and Richardson Avenue (STA 275+00 to STA 262+00) along the northeastern bank of the Sauquoit has encouraged fill and construction to the edge of the creek, with homes, outbuildings, and filled yard areas extending to the edge of the normal flow channel. On the opposite bank through this entire reach, the Route 8 highway embankment forms the southeastern bank of the creek and appears to have been constructed through what used to be the floodplain of the Sauquoit.

The highway construction on one bank and residential development on the other have significantly encroached on the floodplain. The remaining available floodplain is restricted to a width of 60 to 80 feet. The natural floodplain width in this reach of the Sauquoit should be at least 650 feet wide. Natural floodplains and wetland areas are important because they can reduce flood flow velocities, reduce flooding height, allow sediment deposition, detain peak flows, and reduce flooding in downstream areas.

The Sauquoit reach between STA 330+00 and STA 262+00 does not have the necessary capacity to convey floods without causing overtopping of the banks.

Alternative 4-1: Creation of Naturalistic Channel with Floodway

Restoration of the floodplain through this reach would involve widening the banks of the Sauquoit Creek to incorporate a floodplain bench. This could affect up to 6,000 linear feet of channel, cause roadway impacts, and require modification of at least 17 properties and the removal of at least 17 additional homes on the right bank of the creek.

SOURCE(S):	Figure 10: Sauquoit Creek High Risk Area #4	Location: Oneida County, New York
N	**NYDOT: Emergency Transportation Infrastructure Recovery**	Map By: CMP MMI#: 5231-01 MXD: Y:\5231-01\GIS\Maps\High Risk Areas\Sauquoit Creek High Risk #4.mxd 1st Version: 01/06/2014 Revision: 4/2/2014 Scale: 1 in = 400 ft

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The ability to recreate a floodplain and fully mitigate flooding through this reach will require more detailed analysis and careful planning, as it will impact many private properties located on the banks of the Sauquoit. Such an approach will require property easements and acquisition of entire parcels such that existing structures can be removed along the project area. In some cases, it is unrealistic to undertake comprehensive stream corridor improvement projects all at once; however, a long-range plan can help guide future acquisitions and potential FEMA buyouts over time.

Alternative 4-2: Floodwater Storage

The feasibility of storing floodwater within the area upstream of STA 326+00 and upstream to approximately STA 353+00, between Route 8 to the west and Oneida Street to the east, was investigated. Excavation of a detention area at this site combined with construction of a berm to increase storage capacity and protect nearby roads and structures from flooding was investigated. The total storage during a 100-year frequency flood event would equal 245,832 cubic yards, or approximately three percent of the total storm runoff. The goal or "rule of thumb" for a feasible, cost-effective flood detention area is to store at least 10 percent of the runoff generated during the 100-year event. Therefore, floodwater detention is not considered to be a feasible alternative at this location and was not investigated further. Calculations are included in Appendix D.

Recommendations

Alternative 4-1 is recommended as a long-term flood mitigation solution in this reach of Sauquoit Creek. However, implementation of this alternative would require partial or full taking of many of the properties it is endeavoring to protect. This approach to mitigation will be costly and could take a decade or longer to complete. In the meantime, individual property acquisitions though FEMA buyout may be appropriate.

3.8 High Risk Area #5 – Undersized Bridge at STA 165+00

High Risk Area #5 is depicted on Figure 11. FEMA FIRMs indicate that extensive flooding occurs on the left bank of Sauquoit Creek in the area downstream of Clinton Street (STA 185+00) and upstream of Commercial Drive (STA 165+00), between the creek and Henderson Street. FEMA profiles indicate that there is a substantial increase in water surface elevations in this area during the 50-, 100-, and 500-year flow events as a result of the undersized bridge crossing at Commercial Drive.

Modeling by MMI indicates that the hydraulic constriction at this structure is not as significant as reported by FEMA but is a hydraulic constriction nonetheless. The bridge is poorly aligned with the channel, which further reduces the capacity of the bridge. The backwater effect extends upstream nearly to Clinton Street. The impacted area includes several commercial structures, a park, and several homes.

SOURCE(S):	Figure 11: Sauquoit Creek High Risk Area #5		Location: Oneida County, New York
	NYDOT: Emergency Transportation Infrastructure Recovery	Map By: CMP MMI#: 5231-01 MXD: Y:\5231-01\GIS\Maps\High Risk Areas\Sauquoit Creek High Risk #5.mxd 1st Version: 01/06/2014 Revision: 4/2/2014 Scale: 1 in = 100 ft	MILONE & MACBROOM 99 Realty Drive Cheshire, CT 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com

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Alternative 5-1: Replace Commercial Drive Bridge at STA 165+00

Replacement of the Commercial Drive bridge (STA 165+00) with a larger structure that spans the full bankfull width of the creek will eliminate the hydraulic constriction.

Recommendations

Replacement of the bridge at STA 165+00 is recommended as a long-term flood mitigation measure; however, given the magnitude of cost in comparison to the affected area of impact, this replacement should be a lower priority compared to other risk areas along Sauquoit Creek. At the time when this bridge is scheduled for replacement, it should be modeled and appropriately sized such that it does not cause a hydraulic constriction.

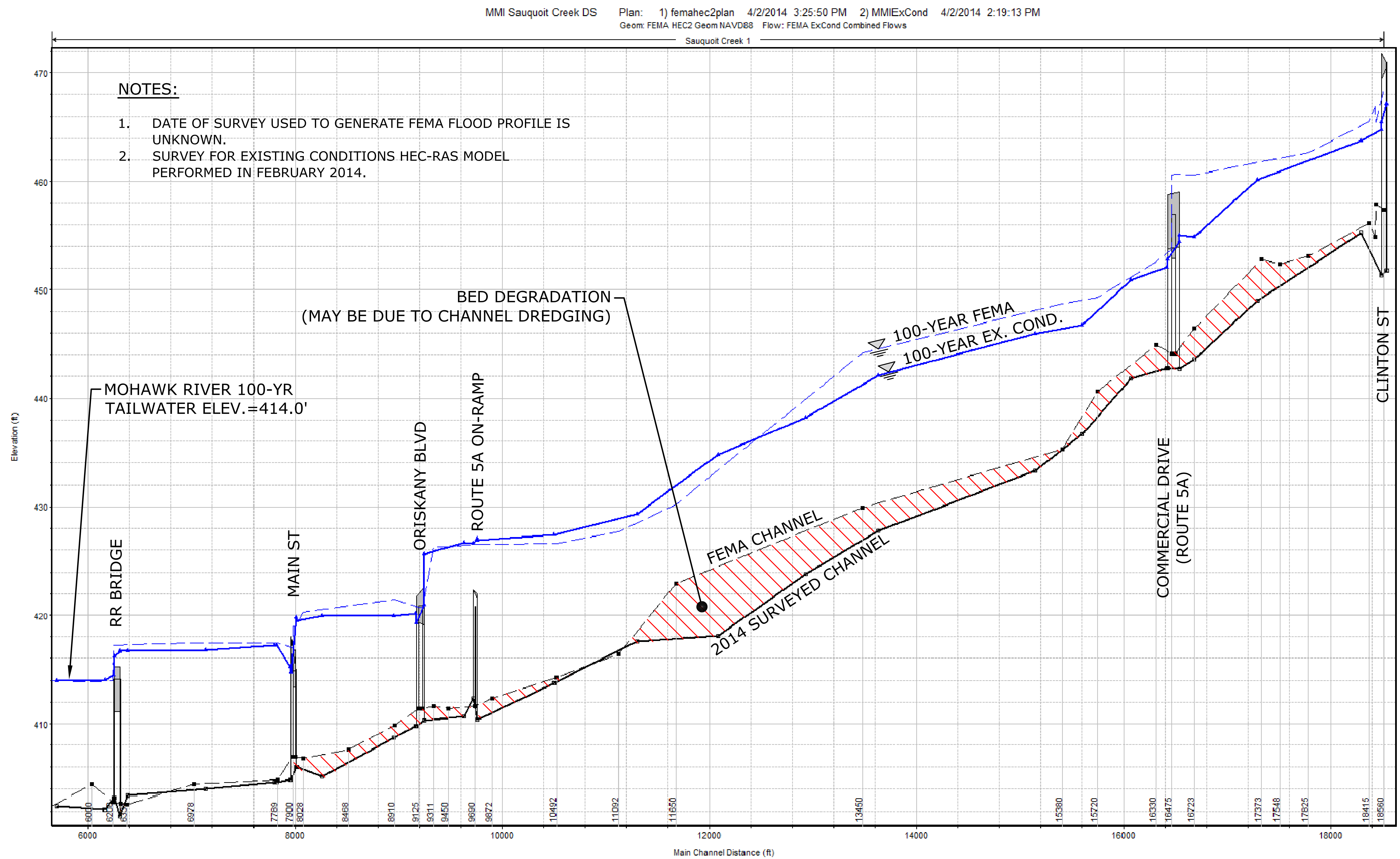
3.9 High-Risk Area #6 – Lower Sauquoit Near Commercial Drive (STA 176+00 to STA 0+00)

Figure 12 is a location plan of High Risk Area #6. This area extends from just upstream of Commercial Drive, at STA 176+00, downstream to the Mohawk River at STA 0+00. Mud Creek enters Sauquoit Creek at STA 157+00. This heavily developed corridor experiences extensive flooding of businesses, car dealerships, and the school in the vicinity of STA 104+00. Flooding is exacerbated at the outlet of a hydraulic canal, which reportedly backs up and contributes to flooding at STA 96+00. A stormwater outflow at the Main Street bridge also backs up during high flows, contributing to flooding. This reach is extremely flat, and small rises in water surface elevations can have marked impacts on the area of inundation.

A comparison of the FEMA baseline model elevations to the recently surveyed conditions suggests that dredging may have occurred through this reach. In some cases, the difference in streambed elevation is five or more feet. Figure 13 shows the FEMA geometry profile against the more recent survey.

Due to the combination of multiple undersized bridges, an undersized channel, heavily developed floodplain, and flat stream grade, there will be no simple, low-cost solution to widespread flood mitigation in this reach. The alternatives described below may well occur in multiple phases over a time frame that could span decades and cost many millions of dollars. The community may wish to approach flood mitigation through this reach as a master plan of improvements, including bridge replacement, channel alteration, sediment management, and individual property protection that occurs over time. The alternatives that follow focus on developing a long-term solution to accommodate the 100-year flood event, thus removing the vast majority of residents and businesses out of the floodplain.

SOURCE(S):	Figure 12: Sauquoit Creek High Risk Area #6		Location: Oneida County, New York
	N	NYDOT: Emergency Transportation Infrastructure Recovery	Map By: CMP MMI#: 5231-01 MXD: Y:\5231-01\GIS\Maps\High Risk Areas\Sauquoit Creek High Risk #6.mxd 1st Version: 01/06/2014 Revision: 4/2/2014 Scale: 1 in = 1,000 ft	MILONE & MACBROOM 99 Realty Drive Cheshire, CT 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com



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REVISIONS

HEC-RAS MODEL PROFILE - FEMA FIRM VS. 2014 SURVEY

WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES

OTSQUAGO CREEK
FORT PLAIN, NEW YORK

DESIGNED	DRAWN	CHECKED
JCM	DRM	JCM

SCALE: N.T.S.

DATE: 4/2/2014

PROJECT NO.: 5231-01

SHEET NO.: FIG. 13

Alternative 6-1: Replacement of Undersized Bridges

Undersized bridges that flow through this reach include the railroad bridge at STA 62+75, the Main Street bridge at STA 80+00, Oriskany Boulevard (Route 69) bridge at STA 92+00, and the Route 5A on-ramp bridge at STA 97+50. The railroad bridge creates backwater approximately 1,500 feet upstream, flooding the residential area almost up to Main Street. Main Street creates backwater conditions approximately 1,200 feet upstream.

The Oriskany Boulevard bridge creates 2,000 feet of backwater conditions and inundates the Route 5A on-ramp bridge, which is slightly undersized but does not appear to be a significant contributor to flooding on its own.

Replacement of undersized bridges will be an important element of flood mitigation; however, bridge replacement alone will not be sufficient to fully mitigate flooding in this area. Alternative 6-2 explores a combination approach.

Alternative 6-2: Bridge Replacement in Combination with Floodplain Creation

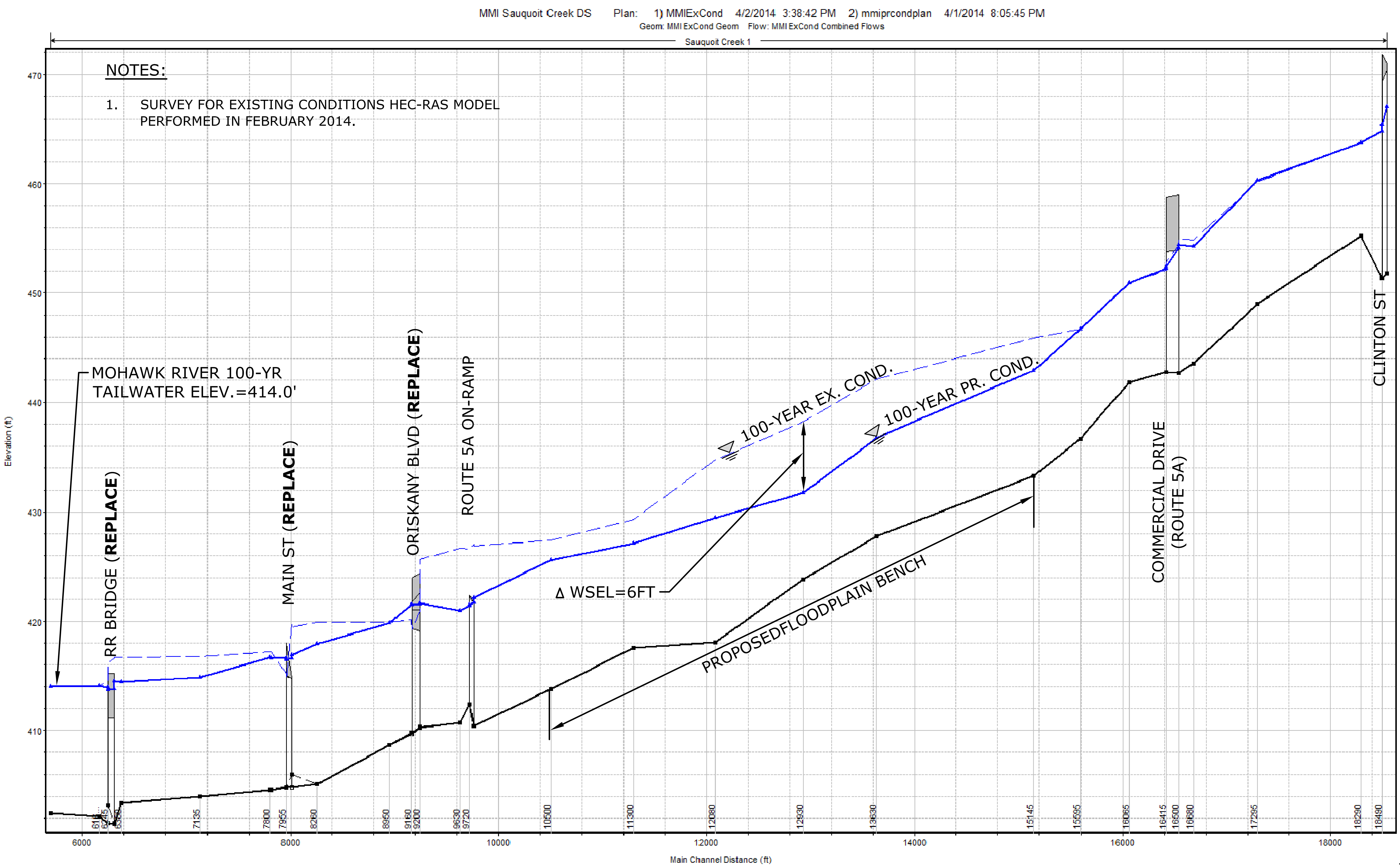
This alternative involves replacing undersized bridges at the railroad bridge, Main Street bridge, and Oriskany Boulevard bridge to span approximately 160 feet (a substantial increase), in combination with creation of a floodplain bench from STA 105+00 to STA 151+45, a distance of 4,650 feet. The existing left bank channel would generally be held in place while cutting a flood bench along the right bank to create an approximately 125-foot-wide flood bench. This combination would contain the 100-year event and reduces flood depths by 1.25 to 5.0 feet. Figure 14 depicts a profile through this area, comparing existing and proposed conditions. Figure 15 shows the concept in plan view.

This approach would impact five commercial buildings, nine parking lots, and one residence. The rough first cut on the floodplain restoration area would need to be studied in greater detail to refine the flood bench locations, to minimize property impacts, to prioritize areas for restoration, and to identify opportunities for property easement and/or acquisition.

Alternative 6-3: Sediment Management

Anecdotal reports indicate that the lower reaches of the Sauquoit are subject to sediment accumulation that raises the bed and reduces flood conveyance. Field investigations in October and November 2013 support the reports of post-flood dredging, with exposed clay visible in some areas, indicating that over-excavation is likely to have occurred.

Dredging is often the first response to sediment deposition and clogging of the stream channel or bridge openings; however, over-widening or over-deepening through dredging can initiate headcutting, foster poor sediment transport, result in low habitat quality, and will not necessarily provide significant flood mitigation.



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HEC-RAS MODEL PROFILE - FEMA FIRM VS. 2014 SURVEY

WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES

OTSQUAGO CREEK
FORT PLAIN, NEW YORK

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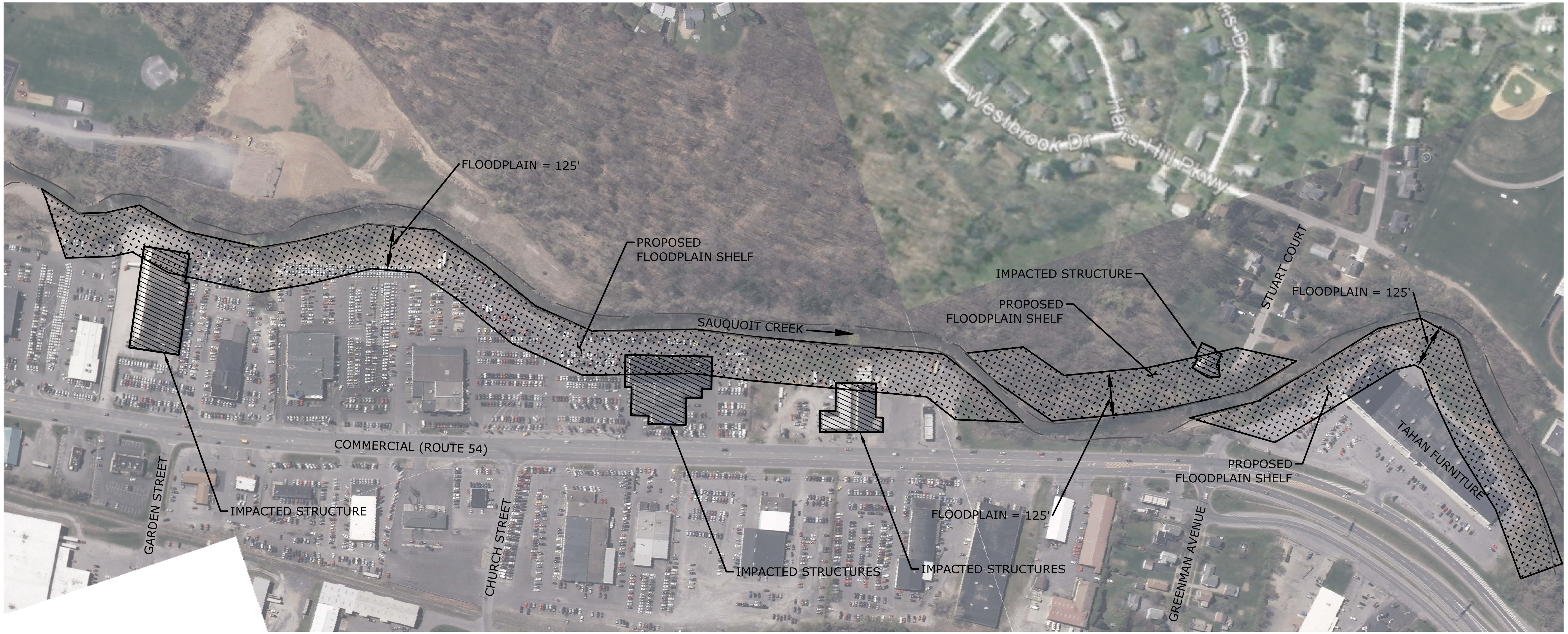
DATE: 3/28/2014
PROJECT NO.: 5231-01

FIG. 14



SAUQUOIT CREEK PLAN VIEW

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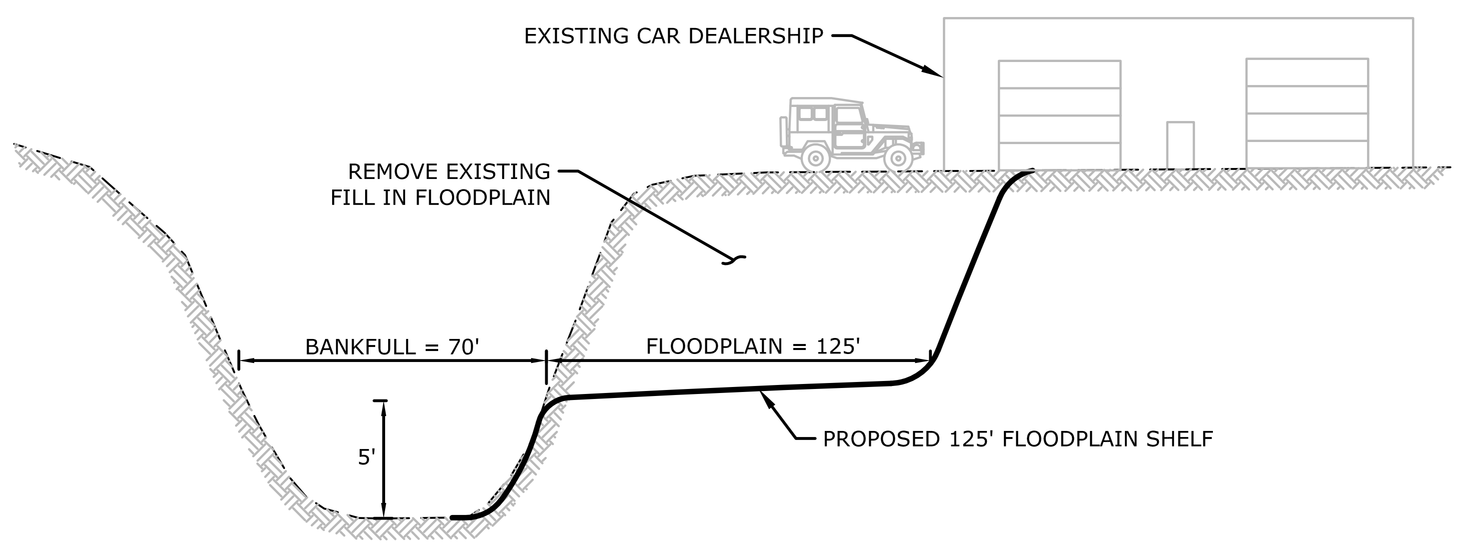

TYPICAL CROSS SECTION

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REVISIONS

SAUQUOIT CREEK HIGH RISK AREA #6

WATER BASIN ASSESSMENT
AND FLOOD HAZARD MITIGATION ALTERNATIVES

SAUQUOIT CREEK
NEW HARTFORD, NEW YORK

JCM	DRM	DRM
DESIGNED	DRAWN	CHECKED

SCALE: AS NOTED

DATE: 4/2/2014

PROJECT NO.: 5231-01

SHEET NO.: **FIG.15**

Drawing: W:\DESIGN\5231-01-DE\CAD\CONCEPT\FULMER-SAUQUOIT CONCEPT DESIGN.DWG Layout Tab:FIG 15
Plotted by: DANME On this date: Wed, 2014 April 2 - 3:31pm

Improperly conducted dredging action can further isolate a stream from its natural floodplain, disrupt sediment transport, expose erodible sediments, cause upstream bank/channel scour, and encourage additional downstream sediment deposition. Improperly dredged stream channels often show signs of severe instability, which can cause larger problems after the work is complete. Such a condition is likely to exacerbate flooding on a long-term basis.

A sediment maintenance program would involve the development of standards to delineate how, when, and to what dimensions sediment excavation should be performed. It will also require the proper regulatory approval, as well as budgetary considerations to allow the work to be funded on an ongoing or as-needed basis as prescribed by the standards to be developed.

Conditions in which active sediment management should be considered include:

- Situations where the channel is confined, without space in which to laterally migrate
- For the purpose of infrastructure protection
- At bridge openings where hydraulic capacity has been compromised
- In reaches with low habitat value

In cases where sediment management of the stream channel is necessary, a methodology should be developed that would allow for proper channel sizing and slope. The following guidelines are provided:

1. Maintain the original channel slope and do not overly deepen or widen the channel. Excavation should not extend beyond the channel's estimated bankfull width unless it is to match an even wider natural channel. Estimated bankfull widths on Sauquoit Creek are provided in Table 1 of this report.

2. Sediment management should be limited in volume to either a single flood's deposition or to the watershed's annual sediment yield in order to preclude downstream bed degradation from lack of sediment.

3. Excavation of fine-grain sediment releases turbidity. Best available practices should be followed to control sedimentation and erosion.

4. Sediment excavation requires regulatory permits. Prior to initiation of any in-stream activities, NYSDEC should be contacted, and appropriate local, state, and federal permitting should be obtained.

5. Disposal of excavated sediments should always occur outside of the floodplain. If such materials are placed on the adjacent bank, they will be vulnerable to remobilization and redeposition during the next large storm event.

6. No sediment excavation should be undertaken in areas where rare or endangered species are located.

Recommendations

Alternatives 6-2 and 6-3 are recommended for long-term flood mitigation.

4.0 RECOMMENDATIONS

1. *Remove Low-Head Dams in Upper Sauquoit* – A number of low-head dams are located in the upper Sauquoit from Summit Road in Cassville (STA 903+00) downstream to Main Street in Clayville (STA 726+00). Full removal of these low-head dams is recommended to help to restore and stabilize the channel, reduce water surface elevations upstream of the dams, and prevent the uncontrolled downstream release of sediments that would occur in the event of dam failure.

2. *Conduct Further Evaluation for Repair/Removal of the Dam at STA 538+00* – The dam at STA 538+00 is in poor structural condition, with a substantial amount of accumulated sediment behind it. The dam should be repaired, rehabilitated, or removed; however, further detailed analysis is required to guide the best course of action. Specific tasks that are necessary include sediment testing and volume computations of the impounded material; a detailed structural assessment of the dam; conceptual design analysis, including cost assessment of repair versus removal; and permitting feasibility. No action will eventually lead to complete failure of this structure.

3. *Dam and Bridge Removal and Floodplain Restoration* – A densely developed area at the center of the hamlet of Chadwicks from STA 478+00 extending downstream to STA 455+00 is subject to flooding. Removal of an existing low-head run-of-river dam and the undersized bridge at Bleachery Avenue (STA 472+00) in conjunction with floodplain restoration is recommended. This will involve the removal of approximately 13 trailer homes and one conventional home that are currently located on the right bank of the Sauquoit. Replacement of the Railroad Bridge at STA 455+50 is also recommended.

4. *Channel and Floodplain Restoration Near Victoria Drive* – Dense floodplain development along the Sauquoit from STA 330+00 to STA 262+00 has resulted in extensive flooding. Restoration of the floodplain through this reach is recommended, including widening the banks of the creek to incorporate a floodplain bench. This could affect up to 6,000 linear feet of channel, create roadway impacts, and require modification of at least 17 properties and the removal of at least 17 additional homes on the right bank of the creek. This approach to mitigation will be costly and could take a decade or more to complete. In the meantime, individual property acquisitions though FEMA buyout may be appropriate.

5. *Replace the Bridge at STA 165+00* – Replacement of the bridge at STA 165+00 is recommended as a long-term flood mitigation measure; however, given the magnitude of cost in comparison to the affected area of impact, this replacement should be a lower priority compared to other risk areas along Sauquoit Creek. At the time when this bridge is scheduled for replacement, it should be modeled and appropriately sized such that it does not cause a hydraulic constriction.

6. *Bridge Replacement and Channel and Floodplain Restoration in Lower Sauquoit (STA 176+00 to STA 0+00)* – The lower three miles of the Sauquoit are characterized by flat slopes; a wide, expansive, heavily developed floodplain; undersized bridges; and a channel with insufficient capacity to convey flood flows. Due to the combination of complex issues, there will be no simple, low-cost solution to widespread flood mitigation in this reach. A long-term flood mitigation program of bridge removal, floodplain restoration, and sediment management is recommended in this reach. This approach would impact five commercial buildings, nine parking lots, and one residence. The rough first cut on the floodplain restoration area would need to be studied in greater detail to refine the flood bench locations, minimize property impacts, prioritize areas for restoration, and identify opportunities for property easement and/or acquisition.

7. *Adopt Sediment Management Standards* – When excavation of depositional areas is necessary, it should be undertaken in a manner that maintains channel stability, avoiding over-widening and/or over-deepening the channel. Development of sediment management standards is recommended to provide guidance to contractors and local municipal and county public works departments on how to maintain proper channel sizing and slope as well as the application of best practices.

8. *Strategic Acquisition of Repetitive Loss Properties* – In areas along Sauquoit Creek where dwellings and businesses have suffered repeated losses due to flooding, property acquisition should be considered, either through a FEMA buyout program or governmental buyout. Such properties can be converted to passive, non-intensive land uses such as streamside parks, picnic areas, fishing access sites, or wildlife observation areas.

9. *Evaluate Floodplain Regulations* – A critical evaluation of existing floodplain law and policies should be undertaken to evaluate the effectiveness of current practices and requirements. Local floodplain regulations should be consistent with the NFIP and FEMA regulations. Identification of a floodplain coordinator and development of a detailed site plan review process for all proposed development within the floodplain would provide a mechanism to quantify floodplain impacts and ascertain appropriate mitigation measures.

10. *Install and Monitor a Stream Gauge* – There is currently no stream gauge on Sauquoit Creek, making statistical analysis difficult. Installation of a permanent stream gauge is recommended.

11. *Develop Design Standards* – There is currently no requirement to design stream crossings to specific capacity standards. For critical crossings such as major roadways or crossings that provide sole ingress/egress, design to the 50- or 100-year storm event may be appropriate whereas less critical crossings in flat areas may be sufficient to pass only the 10-year event. When a structure that is damaged or destroyed is replaced with a structure of the same size, type, and design, it is reasonable to expect that the new structure will be at risk for future damage as well.

The above recommendations are graphically depicted on the following pages. Table 4 provides an estimated cost range for key recommendations.

TABLE 4
Cost Range of Recommended Actions

Sauquoit Creek Recommendations	< $100k	$100k-$500k	$500k-$1M	$1M-$5M	>$5M
	Approximate Cost Range				
Remove Low Head Dams in Upper Sauquoit				X	
Conduct Further Evaluation for Repair/Removal of the Dam at STA 538+00	X				
Dam and Bridge Removal at STA 478-00 and Floodplain Restoration				X	
Channel and Floodplain Restoration Near Victoria Drive					X
Replace the Bridge at STA 165+00				X	
Bridge Replacement & Channel and Floodplain Restoration in Lower Sauquoit					X
Install and monitor a Stream Gauge	X				

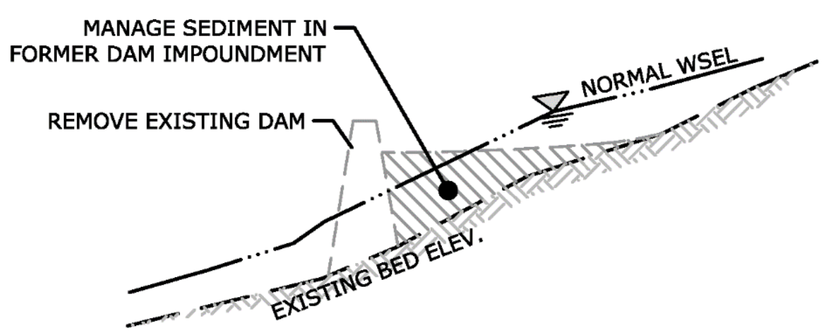
WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES
SAUQUOIT CREEK, ONEIDA COUNTY, NEW YORK

High-Risk Area #1: Failing Dams in the Upper Sauquoit Creek Basin (STA 903+00 to 726+00)

Site Description: Extending form Summit Road in Cassville at STA 903+00 downstream to Main Street in Clayville at STA 726+00, are several low head dams that are in various stages of disrepair. These have created unstable channels with eroding channel bed and banks as well as high sediment load.

Recommendations:

- Remove low head dams to restore and stabilize this section of Sauquoit Creek.



	BENEFITS
✓	Improved safety
✓	Improved hydraulic capacity
✓	Reduced flood hazard
✓	Improved ecological connectivity

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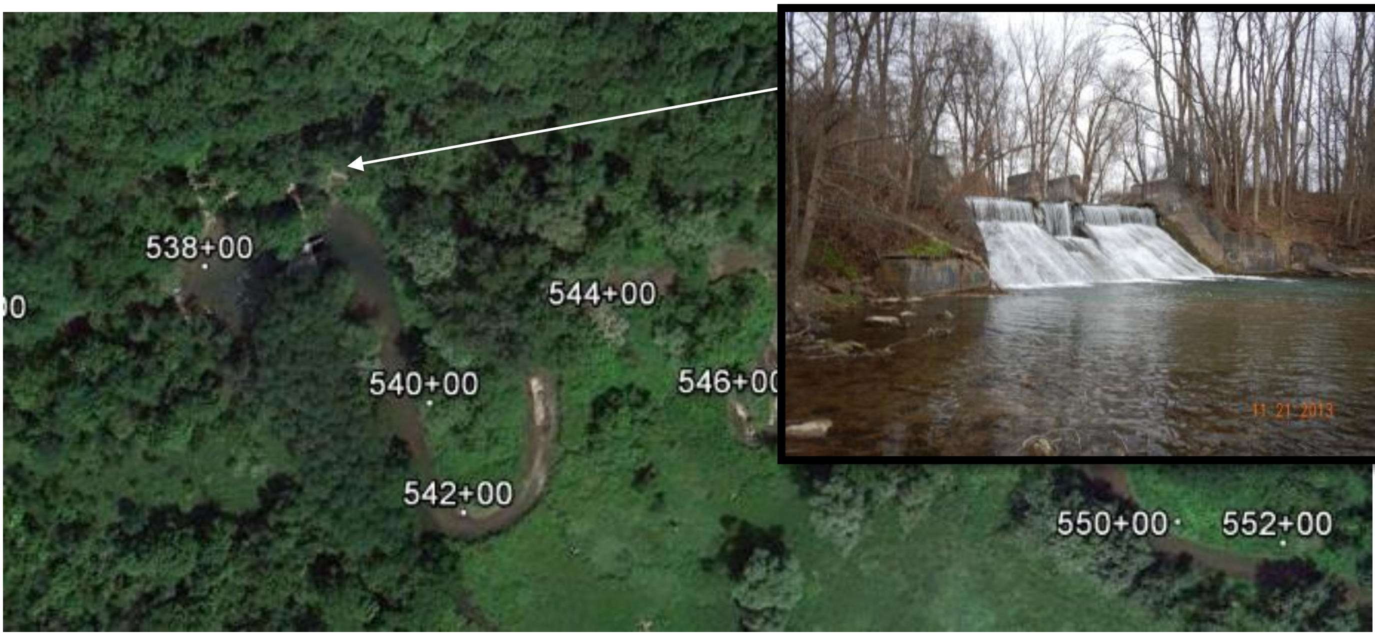
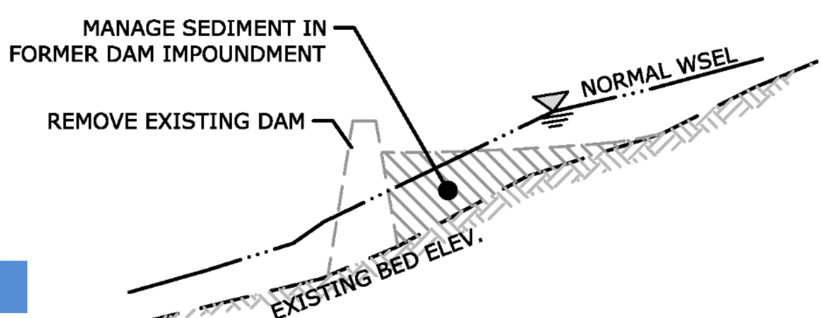
High-Risk Area #2: Dam in Poor Condition (STA 538+00)

Site Description: This dam is located in a remote area between Route 8 and the railroad line and is in poor condition. The dam is holding back a substantial amount of water as well as sediment posing a threat to downstream communities. Immediate action should be taken to inspect the dam for structural integrity.



Recommendation:

- Further analysis is needed to guide the decision of whether dam repair/rehabilitation or dam, removal is the best course of action. Sediment quality and potential flood protection are key issues that need to be explored. No action will eventually lead to complete failure of this structure.



	BENEFITS
✓	Improved safety
✓	Improved hydraulic capacity
✓	Reduced flood hazard
✓	Improved ecological connectivity

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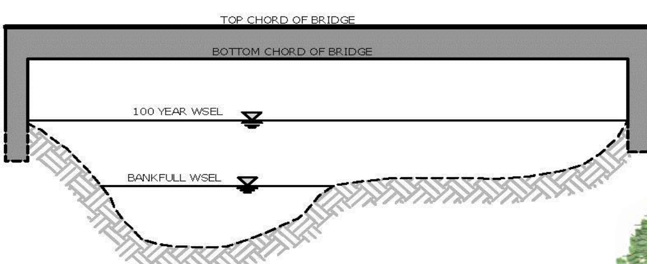
High-Risk Area #3: Brookside Mobile Manor (STA 478+00 to STA 455+00)

Site Description: The Brookside Manor Trailer Park area is a tightly developed section along the banks of Sauquoit Creek and has experienced heavy flooding in the past. Undersized bridges, a low head dam, and inadequate channel are the primary contributions to flooding issues in this reach.

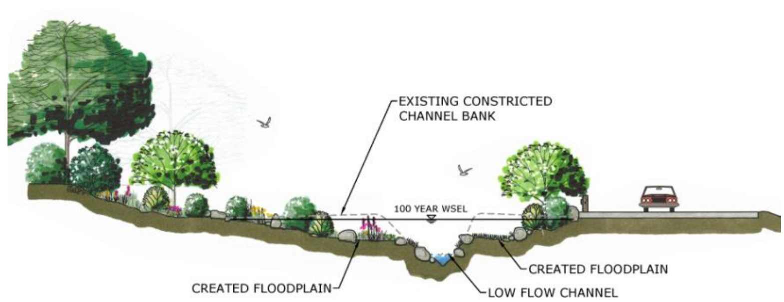
Recommendations:

- Replace the Bleachery Avenue bridge at STA 472+00, remove the low head dam immediately upstream, and undertake channel modifications in this reach.
- Replace the Railroad Bridge at STA 455+50.



TYPICAL UNCONSTRAINED BRIDGE CROSSING

	BENEFITS
✓	Improved safety
✓	Improved hydraulic capacity
✓	Reduced flood hazard
✓	Improved ecological connectivity



TYPICAL COMPOUND CHANNEL

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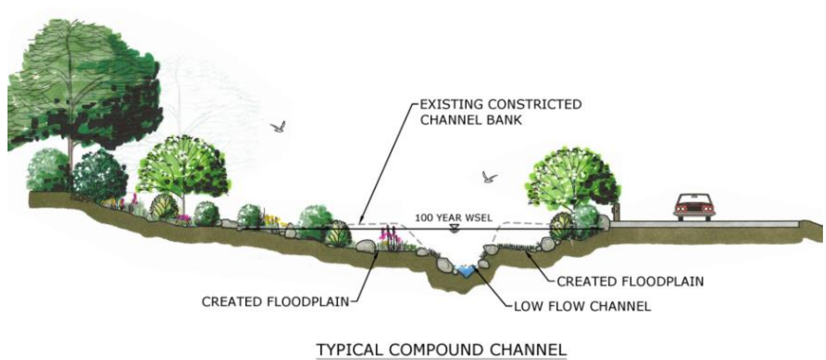
SAUQUOIT CREEK, ONEIDA COUNTY, NEW YORK

High-Risk Area #4: Flooding Near Victoria Drive (STA 330+00 to 262+00)

Site Description: Beginning at STA 330+00, adjacent to Victoria Drive, Sauquoit Creek overtops its banks and causes flood damage to homes along the drive. Floodwaters also overtop the banks downstream at STA 300+00 and 291+00, causing flooding of homes along Brookline Drive. The photograph below shows the repaired bank with a stacked rock wall along Brookline Drive and an aerial image of the floodprone section of Victoria Road.

Recommendation:

- Restore the channel and floodplain through this reach including widening of banks of Sauquoit Creek to incorporate a floodplain bench. This could affect up to 6,000 feet of channel, with roadway and property impacts.



	BENEFITS
✓	Improved safety
✓	Improved hydraulic capacity
✓	Reduced flood hazard
✓	Improved ecological connectivity

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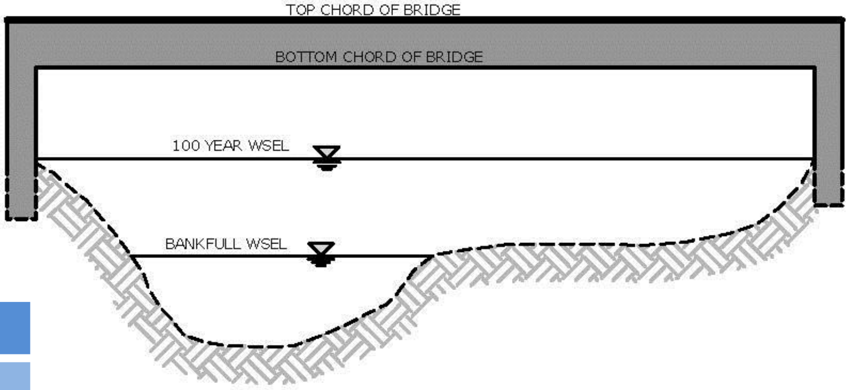
SAUQUOIT CREEK, ONEIDA COUNTY, NEW YORK

High-Risk Area #5: Undersized Bridge at STA 165+00

Site Description: The Commercial Drive bridge crossing at STA 165+00 acts as a constriction to floodwaters. The bridge is poorly aligned with the channel, which further reduces the capacity of the bridge. The impacted area includes several commercial structures, a park, and several homes.

Recommendation:

- Replace the Commercial Drive Bridge with a larger structure that spans the full bankfull width of the creek.



TYPICAL UNCONSTRAINED BRIDGE CROSSING

	BENEFITS
✓	Improved safety
✓	Improved hydraulic capacity
✓	Reduced flood hazard

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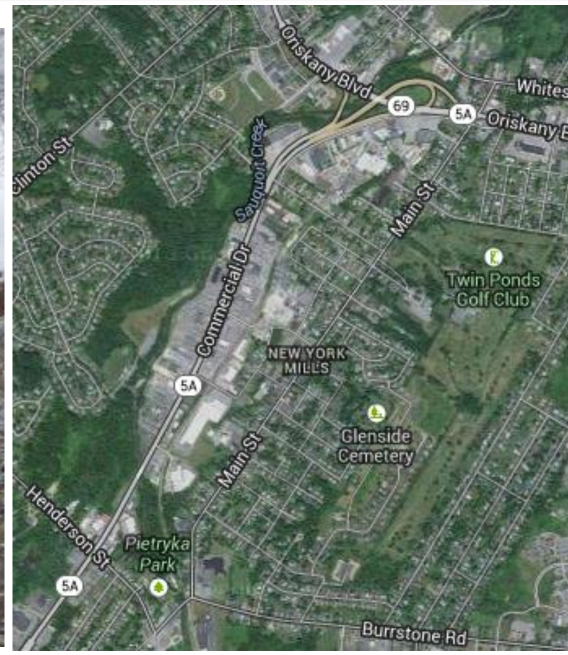
WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES SAUQUOIT CREEK, ONEIDA COUNTY, NEW YORK

High-Risk Area #6: Commercial Drive (STA 176+00 to STA 0+00)

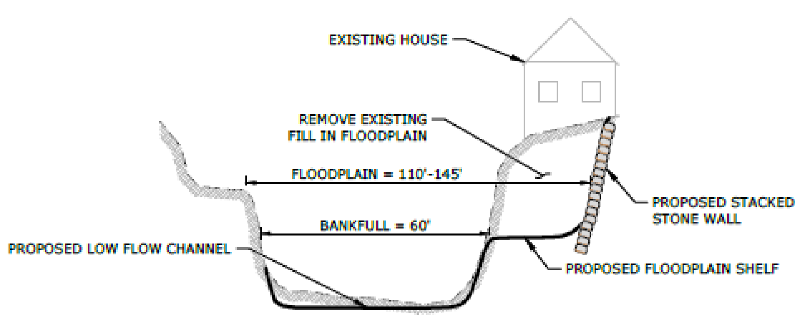
Site Description: The highly commercialized area from Commercial Drive downstream to the confluence with the Mohawk River experiences severe flooding during high magnitude storm events. High concentration of development in combination with inadequately sized channels create the conditions for the extreme flooding that occurs.



Recommendations:

- Replace undersized bridges including the railroad bridge at STA 62+75, Main Street Bridge at STA 80+00, Oriskany Boulevard Bridge at STA 92+00, and the Route 5A on-ramp Bridge at STA 97+50.
- Create a floodplain bench from STA 105+00 to STA 151+45.

	BENEFITS
✓	Improved safety
✓	Improved hydraulic capacity
✓	Reduced flood hazard
✓	Improved ecological connectivity



TYPICAL CROSS SECTION

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APPENDIX A
DATA INVENTORY

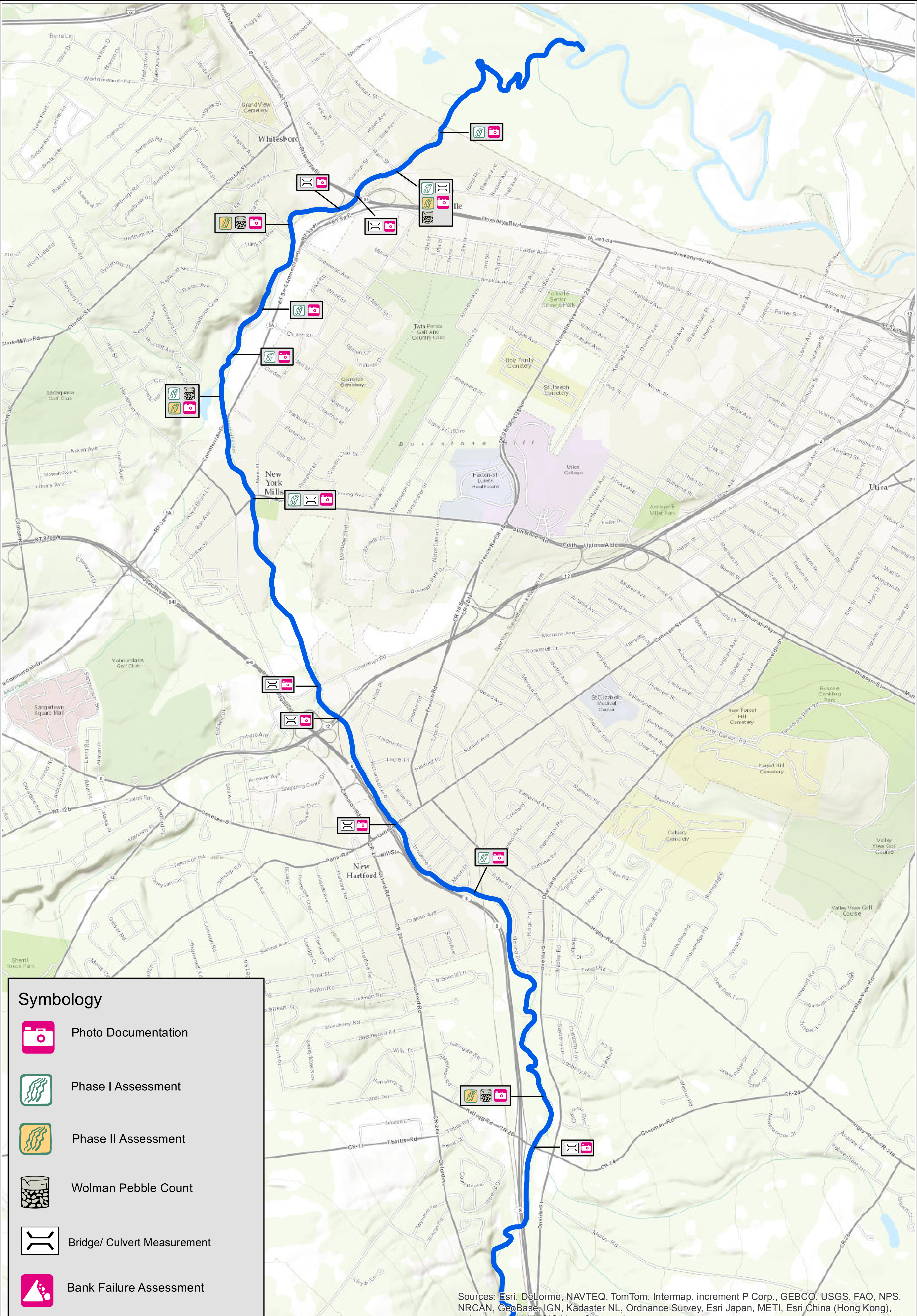
EMERGENCY TRANSPORTATION INFRASTRUCTURE RECOVERY, WATERBASIN ASSESSMENT
HERKIMER, ONEIDA, AND MONTGOMERY COUNTIES, NEW YORK

ATTACHMENT A: DATA INVENTORY

Year	Data Type	Document Title	Author
2013	Presentation	Flood Control Study for Fulmer Creek	Schnabel Engineering
2012	Map	Sauquoit Creek Watershed/Floodplain Map	Herkimer-Oneida Counties Comprehensive Planning Program
2011	Report	Oriskany Creek Conceptual Plan and Feasibility Study for Watershed Project	Oneida County SWCD
2009	Presentation	Ice Jam History and Mitigation Efforts	National Weather Service, Albay NY
2007	Report	Cultural Resources Investigations of Fulmer, Moyer, and Steele Flood Control Projects	United States Army Corps of Engineers (USACE)
2006	Report	Riverine High Water Mark Collection, Unnamed Storm	Federal Emergency Management Agency (FEMA)
2005	Report	Fulmer Creek Flood Damage Control Feasibility Study	United States Army Corps of Engineers (USACE)
2005	Report	Steele Creek Flood Damage Control Feasibility Study	United States Army Corps of Engineers (USACE)
2004	Report	Fulmer Creek Basin Flood Hazard Mitigation Plan	Herkimer-Oneida Counties Comprehensive Planning Program
2004	Report	Moyer Creek Basin Flood Hazard Mitigation Plan	Herkimer-Oneida Counties Comprehensive Planning Program
2004	Report	Steele Creek Basin Flood Hazard Mitigation Plan	Herkimer-Oneida Counties Comprehensive Planning Program
2003	Report	Fulmer, Moyer, Steele Creek - Stream Bank Erosion Inventory	Herkimer-Oneida Counties Comprehensive Planning Program
1997	Report	Sauquoit Creek Watershed Management Strategy	Herkimer-Oneida Counties Comprehensive Planning Program
2011	Report	Flood Insurance Study (FIS), Herkimer County	Federal Emergency Management Agency (FEMA)
2011	Report	Flood Insurance Study (FIS), Montgomery County	Federal Emergency Management Agency (FEMA)
2013	Report	Flood Insurance Study (FIS), Oneida County	Federal Emergency Management Agency (FEMA)
2010	Report	Bridge Inspection Summaries, Multiple Bridges	National Bridge Inventory (NBI)
2002	Hydraulic Models	Flood Study Data Description and Assembly - Rain CDROM	New York Department of Enviromental Conservation (NYDEC)
2013	Data	June/July 2013 - Post-Flood Stream Assessment	New York State Department of Transportation (NYSDOT)
2013	GIS Data	LiDAR Topography, Street Mapping, Parcel Data, Utility Info, Watersheds	Herkimer-Oneida Counties Comprehensive Planning Program
2013	GIS Data	Aerial Orthographic Imagery, Basemaps	Microsoft Bing, Google Maps, ESRI
2011	GIS Data	FEMA DFIRM Layers	Federal Emergency Management Agency (FEMA)
2013	Data	Watershed Delineation and Regression Calculation	US Geological Survey (USGS) - Streamstats Program

APPENDIX B

Field Data Collection Forms



SOURCE(S):

Appendix B-1: Sauquoit Creek Data Collection Points

Location: **Oneida County, New York**

N

NYDOT: Emergency Transportation Infrastructure Recovery

MXD: Y:\5231-01\GIS\Maps\Phase II Icon Maps\Sauquoit 8-1.mxd

Map By: CMP
MMI#: 5231-01-02
1st Version: 12/5/2013
Revision: 12/12/2013
Scale: 1 in = 2,083 ft

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SOURCE(S):

Figure B-2: Sauquoit Creek Data Collection Points

Location: **Oneida County, New York**

N

NYDOT: Emergency Transportation Infrastructure Recovery

MXD: Y:\5231-01\GIS\Maps\Phase II Icon Maps\Sauquoit 8-2.mxd

Map By: CMP
MMI#: 5231-01-02
1st Version: 12/5/2013
Revision: 12/12/2013
Scale: 1 in = 2,083 ft

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MMI Project #5231-01 Phase I River Assessment Reach Data

River ________________ Reach _____________ U/S Station _______________ D/S Station ___________

Inspectors __________________ Date ______________ Weather ____________________________________

Photo Log ____

A) Channel Dimensions: Bankfull
Width (ft) __________
Depth (ft) __________

Watershed area at D/S end of reach (mi^2) ___________

B) Bed Material: Bedrock Boulders Cobble
Gravel Sand Clay
Concrete Debris Riprap

Notes: ____

C) Bed Stability: Aggradation Degradation Stable Note: ___________________

D) Gradient: Flat Medium Steep Note: ___________________

E) Banks: Natural Channelized Note: _________________

F) Channel Type: Incised Colluvial Alluvial Bedrock Note: __________

G) Structures: Dam Levee Retaining Wall Note: ________________

H) Sediment Sources: ____

I) Storm Damage Observations: ____
____

J) Vulnerabilities: Riverbank Development Floodplain Development Road Trail Railroad
Utility Bridge Culvert Retaining Wall Ball field Notes: _________________

K) Bridges: Structure # _____________ Inspection Report? Y N Date _________________

Notes: ____

Record span measurements if not in inspection report: ____

Damage, scour, debris: ____

L) Culverts: complete culvert inspection where necessary. Size: ____

Type: _________________ Notes: ____

____

Phase II River Assessment
Reach Data

River ____________________ Reach ____________ Road _____________ Station ______________

Inspector _________________ Date _____________ Town ____________ County ______________

Identification Number _____________________ GPS # ________________ Photo # ________________

A) River Reach ID _________________________ Drainage Area, sm ________________________
D/S Boundary ____________________________, U/S Boundary ____________________________
D/S STA _______________________________, U/S STA _______________________________
D/S Coordinates __________________________, U/S Coordinates __________________________

B) Valley Bottom Data:

Valley Type (Circle one)	Confined >80% L	Semiconfined 20-80%	Unconfined <20%
Valley Relief	<20'	20-100'	>100
Floodplain Width	<2 W_b	2-10 W_b	>10 W_b

	Left Side	Right Side
Natural floodplain	_______%	_______%
Developed floodplain	_______%	_______%
Terrace	_______%	_______%
Floodplain Land Use	____________	____________

C) Pattern: Straight S=1-1.05 | Sinuous S=1.05 – 1.25 | Meanders S=1.25 – 2.0 | Highly Meandering S>2.0 | Braided | Wandering | Irregular

D) Channel Profile Form: (Percent by Class in Reach)

Cascades	__________	Alluvial	__________	Channel Transport
Steep Step/Pool	__________	Semi Alluvial	__________	Sed. Source Area
Fast Rapids	__________	Non Alluvial	__________	Eroding
Tranquil Run	__________	Channelized	__________	Neutral
Pool & Riffle	__________	Incised	__________	Depositional
Slow Run	__________	Headcuts	__________	

E) Channel Dimensions (FT):

	Bankfull	Actual Top of Bank	Regional HGR
Width	__________	__________	__________
Depth	__________	__________	__________
Inner Channel Base Width	__________		
W/D Ratio	__________		

F) Hydraulic Regime:
Mean Bed Profile Slope ________________ Ft/Ft
Observed Mean Velocity ______________________ FPS

G) Bed Controls:

Bedrock	Weathered Bedrock	Dam
Static Armor	Cohesive Substrate	Bridge
Boulders	Dynamic Armor	Culvert
Debris	Riprap	Utility Pipe/Casing

Overall Stability _______________________

H) Bed Material:

D50 __________

Bedrock	__________	Sand	__________	Riprap	__________
Boulders	__________	Silt and Clay	__________	Concrete	__________
Cobble and Boulder	__________	Glacial Till	__________		
Gravel and Cobble	__________	Organic	__________		
Sand and Gravel	__________				

I) Flood Hazards:

Developed Floodplains	Bank Erosion
Buildings	Aggradation
Utilities	Sediment Sources
Hyd. Structures	Widening

Bridge Waterway Inspection Summary

River ____________________ Reach ____________ Road _____________ Station ______________

Inspector _________________ Date _____________ NBIS Bridge Number ____________________

NBIS Structure Rating _____________________ Year Built __________________________________

Bridge Size & Type _______________________ Skew Angle ________________________________

Waterway Width (ft) ______________________ Waterway Height (ft) _________________________

Abutment Type (circle) Vertical Spill through Wingwalls

Abutment Location (circle) In channel At bank Set back

Bridge Piers _____________________________ Pier Shape __________________________________

Abutment Material ________________________ Pier Material _________________________________

Spans % Bankfull Width ____________________ Allowance Head (ft) __________________________

Approach Floodplain Width _________________ Approach Channel Bankfull Width _______________

Tailwater Flood Depth or Elevation ___________ Flood Headloss, ft ____________________________

	Left Abutment	Piers	Right Abutment
Bed Materials, D_{50}			
Footing Exposure			
Pile Exposure			
Local Scour Depth			
Skew Angle			
Bank Erosion			
Countermeasures			
Condition			
High Water Marks			
Debris			

Bed Slope	Low	Medium	Steep
Vertical Channel Stability	Stable	Aggrading	Degrading
Observed Flow Condition	Ponded	Flow Rapid	Turbulent

Lateral Channel Stability ____

Fish Passage ____

Upstream Headwater Control ____

Project Information	
Project Name	
Project Number	
Stream / Station	
Town, State	
Sample Date	
Sampled By	
Sample Method	Wolman Pebble Count

Particle Distribution (%)	
silt/clay	
sand	
gravel	
cobble	
boulder	
bedrock	

Sample Site Descriptions by Observations	
Channel type	
Misc. Notes	

Particle Sizes (mm)	
D16	
D35	
D50	
D84	
D95	

(Bunte and Abt, 2001)

Particle Name	Size Limits (mm) lower	upper	Tally	Count	Percent Passing	Cumulative % Finer
silt/clay	0	**0.063**			0.0	0.0
very fine sand	0.063	**0.125**			0.0	0.0
fine sand	0.125	**0.250**			0.0	0.0
medium sand	0.250	**0.500**			0.0	0.0
coarse sand	0.500	**1**			0.0	0.0
very coarse sand	1	**2**			0.0	0.0
very fine gravel	2	**4**			0.0	0.0
fine gravel	4	**5.7**			0.0	0.0
fine gravel	5.7	**8**			0.0	0.0
medium gravel	8	**11.3**			0.0	0.0
medium gravel	11.3	**16**			0.0	0.0
coarse gravel	16	**22.6**			0.0	0.0
coarse gravel	22.6	**32**			0.0	0.0
very coarse gravel	32	**45**			0.0	0.0
very coarse gravel	45	**60**			0.0	0.0
small cobble	60	**90**			0.0	0.0
medium cobble	90	**128**			0.0	0.0
large cobble	128	**180**			0.0	0.0
very large cobble	180	**256**			0.0	0.0
small boulder	256	**362**			0.0	0.0
small boulder	362	**512**			0.0	0.0
medium boulder	512	**1024**			0.0	0.0
large boulder	1024	**2048**			0.0	0.0
very large boulder	2048	**4096**			0.0	0.0
bedrock	4096	**-**			0.0	0.0
			Total	0	0.0	-

(Wenthworth, 1922)

F-T Particle Sizes (mm)	
F-T n-value	0.5
D16	
D5	

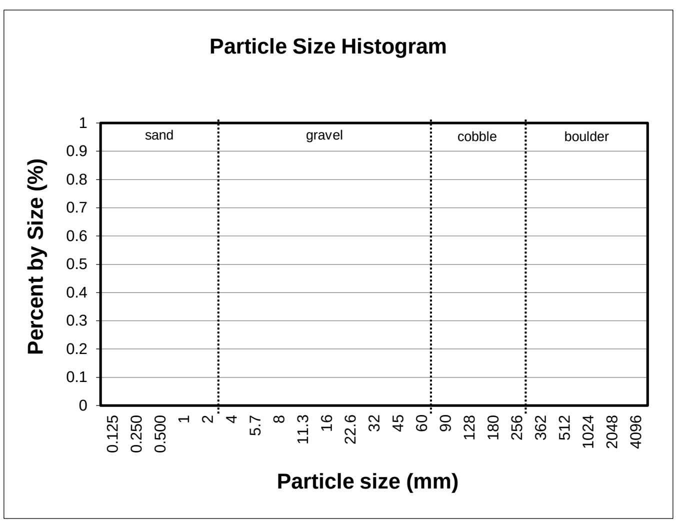
(Fuller and Thompson, 1907)

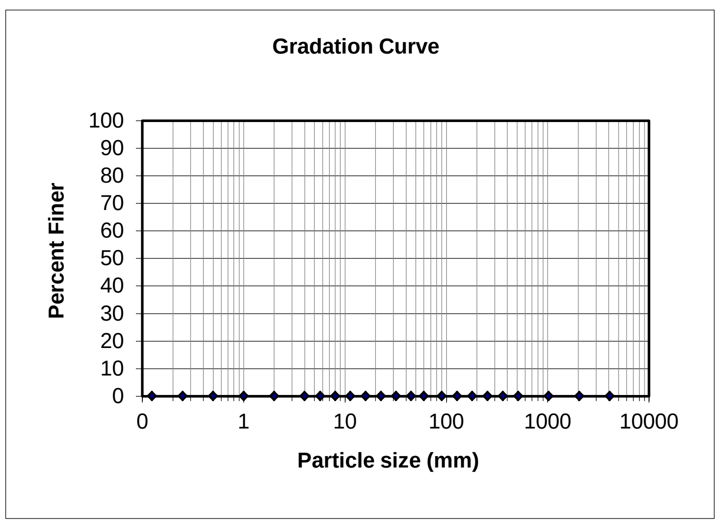
D (mm) of the largest mobile particles on bar	
Mean	

Riffle Stability Index (%)

(Kappesser, 2002)

Notes





APPENDIX C

Sauquoit Creek Photo Log

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive
Cheshire, Connecticut 06410
(203 271-1773

PROJECT PHOTOS

PHOTO NO.: **1** DESCRIPTION: Located at station 538+00, this dam is in poor condition posing a risk to downstream development.	
PHOTO NO.: **2** DESCRIPTION: An upstream railroad bridge around station 456+00 adjacent to a tightly developed area. Represents one of the undersized railroad bridges along Sauquoit Creek.	

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Sauquoit Creek High Risk Areas

PHOTO NO.:

3

DESCRIPTION:

A look upstream from station 300+00 where a stone reventment wall was installed to deter incising of the channel banks.

PHOTO NO.:

4

DESCRIPTION:

Looking downstream from the same location as Photo 2, the area just downstream at station 291+00 is reported as jumping its banks during peak flows.

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(203 271-1773

Sauquoit Creek High Risk Areas

MMI# 5231-01
NYDOT
January 2014

PHOTO NO.: 5	
DESCRIPTION: Photo taken looking upstream from station 236+00 at the Chenango Road crossing which is believed to cause hydraulic constriction.	
PHOTO NO.: 6	
DESCRIPTION: Located at the Clinton Street crossing, station 187+00, upstream is a recently installed flood control berm and downstream the heavily developed Commercial Drive that experiences severe flooding.	

PHOTO NO.:

7

DESCRIPTION:

The convergence of Mud Creek and Sauquoit Creek behind Commercial Drive at station 157+00.

PHOTO NO.:

8

DESCRIPTION:

Just downstream of Mud Creek's mouth, this area of car dealerships along Commercial Drive, experiences severe flooding exacerbated by the input of Mud Creek.

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Sauquoit Creek High Risk Areas

MMI# 5231-01
NYDOT
January 2014

PHOTO NO.: **9** DESCRIPTION: This low railroad bridge crossing at station 63+00 is an example of an undersized bridge crossing.	

APPENDIX D

Detention Basin Computations

Engineering, Planning, Landscape Architecture and Environmental Science

MILONE & MACBROOM®
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773 Fax (203) 272-9733

JOB 5231-01
SHEET NO. ______ OF ______
CALCULATED BY JCS DATE 1/30/14
CHECKED BY ______ DATE ______
SCALE ______

Sauquoit Creek
@ Sta. 542+00 to 570+00

Total Watershed Contributing to Potential Storage Area:

$A = 26.3\ mi^2 = 733,201,920\ ft^2$

Assume 7in rainfall & 30% runoff over entire watershed:

$\forall = 733,201,920\ ft^2 \times 7in \times \frac{1ft}{12in} \times 0.3$

$= 128,310,336\ CF$

$= 4,752,235\ CY$

Available Storage at Site

Alt. 1 (Restore Dam) 542+00 to 570+00

Storage	Storage (% of $\forall$)
0 cy w/ 1ft freeboard	0 %
4,940 cy w/out freeboard	0.1 %

Alt. 2 (Raise Dam 5ft, Grade & Berm)

Storage	Storage (% of $\forall$)
106,228 CY	2 %

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JOB 5231-01
SHEET NO. ____ OF ____
CALCULATED BY JCS DATE 1/28/14
CHECKED BY ____ DATE ____
SCALE ____

Sauquoit Creek
@ Sta. 326+00 to 353+00

Total Watershed Contributing to Potential Storage Area:

$A = 41.1\ mi^2$ (Stream Stats)
$= 1,145,802,240\ ft^2$

Assume 7 in rainfall & 30% runoff over entire watershed:

$$V = 1,145,802,240\ ft^2 \times 7 in \times \frac{1 ft}{12 in} \times 0.3$$

$$= 200,515,392\ CF$$

$$200,515,392\ CF \times \frac{CY}{27\ CF} = 7,426,496\ CY$$

Available Storage at Site - includes 1 ft freeboard

Alt. 1 (Berm & Grading) 326+00 to 353+00

Storage	Storage (% of V)
245,832 CY	3%

3% < 10% therefore not feasible

Sauquoit Creek
Stage Storage Analysis

Computed By: JCS 1/27/14
Checked By:_______________
MMI# 5231-01

Alt. 1 - Restore Existing Dam

Stage vs. Storage

Distance Below Spillway (ft)	Elevation (ft.)	Area (s.f.)	Incremental Volume (c.f.)	Incremental Volume (c.y.)	Incremental Volume with 1 ft Freeboard (c.y.)
0	755	209,744	133,374	4,940	0
1	754	57,003	0	0	0
		Total:	**133,374**	**4,940**	**0**

Alt. 2 - Raise Dam, Grade, and add Berm

Stage vs. Storage

Distance Below Spillway (ft)	Elevation (ft.)	Area (s.f.)	Incremental Volume (c.f.)	Incremental Volume (c.y.)	Incremental Volume with 1 ft Freeboard (c.y.)
0	760	1,001,457	948,264	35,121	0
1	759	895,070	855,071	31,669	31,669
2	758	815072	750,111	27,782	27,782
3	757	685,149	596,671	22,099	22,099
4	756	508,192	425,610	15,763	15,763
5	755	343,027	240,700	8,915	8,915
6	754	138,372	0	0	0
		Total:	**3,816,425**	**141,349**	**106,228**

Restore Existing Dam - Using Google Earth Elevations

Stage vs. Storage

Distance Below Spillway (ft)	Elevation (ft.)	Area (s.f.)	Incremental Volume (c.f.)	Incremental Volume (c.y.)	Incremental Volume with 1 ft Freeboard (c.y.)
0	756	869,205	815,425	30,201	0
1	755	761,644	683,134	25,301	25,301
2	754	604623	525,239	19,453	19,453
3	753	445,855	374,502	13,870	13,870
4	752	303,149	235,510	8,723	8,723
5	751	167,870	0	0	0
		Total:	**2,633,809**	**97,548**	**67,348**

Sauquoit Creek
Stage Storage Analysis

Computed By: JCS 1/27/14
Checked By:________________
MMI# 5231-01

Existing Conditions
Stage vs. Storage

Existing conditions calculations could not be completed due to lack of existing berm.

Alt. 1 - Berm and Grading: 326+00 to 353+00
Stage vs. Storage

Distance Below Spillway (ft)	Elevation (ft.)	Area (s.f.)	Incremental Volume (c.f.)	Incremental Volume (c.y.)	Incremental Volume with 1 ft Freeboard (c.y.)
0	582	968,578	912,062	33,780	0
1	581	855,545	914,181	33,859	33,859
2	580	972,817	854,107	31,634	31,634
3	579	735,397	714,653	26,469	26,469
4	578	693,908	660,519	24,464	24,464
5	577	627,129	608,378	22,533	22,533
6	576	589,626	545,325	20,197	20,197
7	575	501,024	484,871	17,958	17,958
8	574	468,718	454,610	16,837	16,837
9	573	440,501	425,944	15,776	15,776
10	572	411,386	398,070	14,743	14,743
11	571	384,754	292,205	10,822	10,822
12	570	199,655	138,102	5,115	5,115
13	569	76,548	68,199	2,526	2,526
14	568	59,850	49,837	1,846	1,846
15	567	39,824	28,455	1,054	1,054
16	566	17,086	0	0	0
		Total:	**7,549,514**	**279,612**	**245,832**