Barton & Loguidice

March 6, 2018
Revised August 3, 2018

Ms. Heather Ferrero
Livingston County Planning Department
Livingston County Government Center
6 Court Street, Room 305
Geneseo, New York 14454-1043

Re: Analysis of Recommended Short-term Streambank Stabilization Options
North McMillan Creek - Town of Conesus

File: 338.007.001

Dear Ms. Ferrero:

This report presents a summary report of findings that outlines issues identified from observed field conditions, identifies applicable restoration concepts/opportunities, and provides rough cost estimates to develop and implement a stream/watershed management plan for the assessed portions of the North McMillan Creek watershed. The Reach of Interest (ROI) consists of a portion of the North McMillan Creek Watershed upstream of McGinty Road and downstream of East Lake Road. The site reconnaissances were performed in July 2017 (downstream of East Lake Road) and June 2018 (upstream of McGinty Road) and included the collection of field data to support the information and conclusions presented in this report.

This report consists of the following six sections:

- Field-Identified Issues
- Recommendations to Address Identified Issues
- Potential Permit Requirements
- Estimates of Bank Erosion Rates
- Estimated Costs of Recommendation Implementation
- Framework for Detailed Study to Support Development of Stabilization/Restoration Plans

Field-Identified Issues

The following is a list of observations made in the field that are contributing to the bank erosion conditions observed in the ROI.

- McMillan Creek was observed to be in a state of dynamic lateral channel adjustment due to fluvial landscape/geomorphic setting. The high-gradient escarpment immediately upstream of the low-gradient delta of the ROI results in sediment storage/deposition, which is expressed

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The experience to listen The power to solve primarily through accelerated lateral migration (bank erosion) and episodic channel avulsions downstream of East Lake Road.

- Anticipated channel adjustment/bank erosion scenarios through the ROI are symptomatic of sediment transport/deposition regimes inherent to the decreased channel slope in the ROI. This condition is exacerbated by the supply of sediment from upstream sources located in the higher-gradient reaches upstream of McGinty Road. Therefore, any localized streambank stabilization measures through the ROI and adjoining downstream reaches of North McMillan Creek (including the rock revetment installed along Dacola Shores Road on the Koch property in 2016 under EPF Phase I) are likely to be relatively short-lived and subjected to a risk of failure unless upstream sourcing of sediment supply is addressed. This includes the recommendations for localized protection of the ROI herein.
- Within the last year, the upstream portion of ROI has relocated (through avulsion of an adjacent paleochannel) to an alignment approximately125 feet west of its previous position, abandoning a portion of the former channel adjacent to the Marino property (see "Meander 1" on Figure 1).
- The avulsion of the channel as described above has significantly reduced radius of curvature adjacent to the Koch and Parsons/Garbacik properties (see "Meander 2" and "Meander 3" on Figure 1). As a result, near-bank stress and erosion potential are significantly elevated due to the abrupt curvature of the stream in these locations. Streambanks are much more prone to failure, particularly as a result of fluvial entrainment of the bank toe (undermining).
- The current condition of the channel through the Garbacik, Koch, and Parsons properties greatly increases the risk of continued stream channel adjustment through aggressive lateral channel movement and erosion/undermining at the toe of bank. This condition is likely to result in subsequent streambank failures and the potential for undermining or bypassing of localized streambank revetment/protection structures.

Upstream of McGinty Creek

- Excessive flows from higher gradient stream slopes are channelized through roadway culverts that do not allow for velocity dissipation along floodplains. Where proficient riparian vegetation is lacking, there is lateral erosion due to the excessive flows, causing widening of the stream and deposition of gravel bars further downstream.
- Some areas have no floodplain to allow velocity dissipation due to the level of confinement of the reach. Shale rock bed and bank characteristics minimize lateral progression in select areas, however, channelize the flow with no velocity dissipation causing erosion issues further downstream where banks are more erodible.
- Reach 1, located between McGinty Road and North Railroad Avenue exhibits severely poor riparian vegetation along banks that induce lateral erosion during higher storm events. A large area of erosion and poor riparian vegetation growth was observed just upstream of the North Railroad Avenue crossing. Gravel bars were observed downstream near Federal Road, causing

stream migration and further lateral erosion. A drainage swale from a road side ditch connects to the stream at North Railroad Avenue and is not vegetated and is aiding in the progression of stream bank erosion.

- Reach 2, located under South Livonia Road, exhibits atypically lower width to depth ratio due to its confined nature. Severe bank erosion on the downstream end of the culvert under South Livonia Road may be attributed to the high degree of confinement directly upstream. The lack of a floodplain allows no velocity dissipation. Lateral confinement may be attributed to an access road on the southern end and farm activities on the northern end, both on the east side of South Livonia Road.
- Reach 3, located under Federal Road, exhibits lateral scouring of the banks. Scouring is eroding private property and creating a large scour pool just downstream of the culvert as excessive flows exit the culvert.
- Reach 4, located under Partridge Corners Road, is farther upstream and conveys less flow being a first order stream. However, upstream of the culvert under the road exhibits a confined channel with no established floodplain. Downstream of the culvert, lateral scouring is eroding private property that is most likely attributed to a large meander directly downstream of the confined channel. A roadside swale, lined with rip rap in one section, exhibits high to severe bank erosion where rip rap is not present. This swale drains directly into Wilkins Creek at the Reach 4 location.
- Reach 5, located under Bishop Road, is also farther upstream and conveys less flow being a first order stream. Minor bank erosion was observed with no defined thalweg. Cobble bars have formed pocket pools full of turbid water. Cobble and gravel bars appeared to be typical for this area that will generally induce further stream migration and lateral erosion.

Recommendations to Address Identified Issues

The following is a list of recommendations that could be implemented in the ROI to address identified issues. The approximate locations of the recommended stabilization measures are illustrated on Figures 1 and 2. As mentioned above, any localized streambank stabilization measures through the ROI and adjoining downstream reaches of North McMillan Creek are likely to be relatively short-lived and subjected to a risk of failure unless upstream sourcing of sediment supply is addressed.

- As of July 2017, the Garbacik property appears to be available for sale. Livingston County should consider securing funding to purchase this property for the purpose of accommodating and maintaining stream corridor/floodplain management practices along this portion of North McMillan Creek and its adjacent left floodplain.
- Streambank protection measures in North McMillan Creek should extend downstream through the ROI to adjoin the 2016 EPF Phase I project along the left bank of Dacola Shores Road to

provide one continuous treatment that includes both the ROI and the previously-installed bank revetment.

- Install approximately 240 linear feet of rock toe along the left bank of North McMillan Creek, extending upstream from the upper end of the EPF Phase I project. Rock toe should be constructed at an elevation that allows engagement of a constructed floodplain bench behind the revetment along the left bank (see item #4 below). Rock toe should be positioned outward from the existing bank line to reduce the existing curvature of the stream at the location of the Parson's shed. It is also important to maintain appropriate curvature through the entirety of the segment, including a transition to the left bank of the now-existing upstream (avulsed) channel. Manipulation of the stream channel to appropriate dimensions, slope, and planform to accommodate this placement of rock toe should be professionally-engineered to ensure competent flood and sediment conveyance, as well as to maximize longevity of the structural elements of the work. Realignment of the channel without consideration to these aspects will not only minimize longevity of the project, but can exacerbate stream instability issues downstream, including the EPF Phase I project.
- Construct approximately 250 feet of floodplain bench along the left bank of North McMillan Creek at the location shown on Figure 1. The bench should be constructed at the bankfull elevation, providing for a section of nearly-flat ground extending from the top of the revetment back to the toe of the existing eroded streambank. The width of the bench would be dependent on final channel alignment and configuration of the rock toe and existing streambank. The bench would be constructed with fill, stabilized, and vegetated. A floodplain bench allows for increased flood conveyance, which reduces both flood elevation and velocity. Roughness provided by vegetation on the top of the bench reduces near-bank stress and increases resistance to erosion.
- Install grade/thalweg control measures in the stream channel of North McMillan Creek, as necessary, to maintain bed feature spacing, reduce potential for undermining of the rock revetment, and provide grade control through the ROI.
- Grade streambank along approximately 550 feet of the right bank on Koch/Marino properties to establish floodplain bench (see Figure 1). This would incorporate treatments to "Meander 1" and "Meander 2". Protect the bank toe with combined root wad/boulder clusters. Root wads could likely be sourced from trees removed to accommodate floodplain grading on both sides of the stream.
- Install all components of temporary/permanent site stabilization (seeding, mulch, plantings, etc.) along North McMillan Creek to increase resistance during stormflows and to reduce stormflow velocities.
- Grade streambank along approximately 150 feet of the left bank downstream of McGinty Road along Reach 1 to reestablish the flood plain and have a consistent width-depth ratio with the reach directly upstream. Live stakes should be planted along the bank to assure stability given the outside meander.

- Grade streambank along approximately 1,200 feet of the outside bank near South Livonia Road along Reach 1 to reestablish the flood plain. Additionally, remove approximately 20 cubic yards of gravel from existing gravel bars to minimize future potential for lateral scour.
- Install riparian vegetation with live stakes along approximately 500 feet of both banks along Reach 1 just upstream of North Railroad Avenue. The vegetation should extend 20 feet upslope from the stream. Additionally, install lined rip rap along 100 feet of a roadside drainage swale and a check dam prior to the stream confluence.
- Install approximately 100 feet of rock toe along the right bank within Reach 2 downstream of South Livonia Road. Rock toe should be constructed at an elevation that allows engagement of a constructed floodplain bench behind the revetment along the left. Rock toe should be positioned outward from the existing bank line to reduce the existing curvature of the stream. It is also important to maintain appropriate curvature through the entirety of the segment. Manipulation of the stream channel to appropriate dimensions, slope, and planform to accommodate this placement of rock toe should be professionally-engineered to ensure competent flood and sediment conveyance, as well as to maximize longevity of the structural elements of the work. Realignment of the channel without consideration to these aspects will not only minimize longevity of the project, but can exacerbate stream instability issues downstream.
- Grade streambank along approximately 150 feet of the right bank upstream of South Livonia Road along Reach 2 to reestablish the flood plain. This section is uncharacteristically confined and should be regraded to allow a larger width-depth ratio.
- Install approximately 100 feet of rock toe along the right bank within Reach 3 downstream of Federal Road. Remove approximately 10 cubic yards of gravel from existing gravel bars to minimize future potential for lateral scour. Additionally, install a cross vane downstream of the culvert to channelize flow and minimize potential for gravel bar formation.
- Grade streambank along approximately 50 feet of the left bank downstream of Partridge Corners Road within Reach 4 to reestablish the floodplain. Install riparian vegetation to prevent future lateral erosion.
- Regrade approximately 100 feet of streambed to redefine the thalweg and construct an inner berm to support flow to minimize potential for future lateral scour.

Permitting Requirements

Implementation of the recommended activities outlined above is likely to require the following regulatory authorizations and clearances:

- New York State Department of Environmental Conservation (NYSDEC) Section 401 Water Quality Certification
- New York State Environmental Quality Review Act (SEQRA) – Environmental Assessment Form (EAF)
- New York State Historic Preservation Office (SHPO) – already cleared for EPF Phase I project, but should be resubmitted.
- United States Fish and Wildlife Service (USFWS) consultation for project impacts on listed species (Northern Long-eared Bat).
- United States Army Corps of Engineers (USACE) Nationwide Permit #13 (Bank Stabilization) – would require Public Review/Comment and Pre-Construction Notification (PCN).
- Town of Conesus – Notice of compliance with floodplain regulations (issued by CEO upon project plan review).

Estimates of Bank Erosion Rates

Measurable benefits of the recommended conceptual projects was estimated in terms of reduced annual sediment yield using the Bank Assessment for Non-point source Consequences of Sediment (BANCS) model and application of the 'Yellowstone' bank erosion curve (Rosgen, 2001a). This methodology estimates the reduction in annual sediment supply to downstream reaches. Bank Erosion Hazard Indices (BEHI), Near Bank Stress (NBS), and length of eroding bank were determined at bank areas along the three meanders (Meanders 1, 2, and 3) and reaches (Reaches 1, 2, 3, 4, and 5) in the ROI. This information was used to calculate the current sediment yield and the sediment yield resulting from implementation of the recommended stabilization measures shown in the following sections.

- *Meander #1:*
  - Erosional surface: 285 linear feet x ~3.1 feet bank height (average) = 883.5 square feet
  - BEHI rating*: High
  - NBS rating*: Low
  - Estimated Sediment Yield: =0.46 ft/yr. x 883.5 square feet = 406.5 cubic feet (21 tons) annually
  - Erosion reduction**: 90%
  - Estimated Sediment Yield Reduction: 18.9 tons/yr

- *Meander #2:*
  - Erosional surface: 105 linear feet x ~2.8 feet height (average) = 294 square feet
  - BEHI rating*: High
  - NBS rating*: Very High
  - Estimated Sediment Yield: 1.7 ft/yr x 294 square feet = 499.8 cubic ft (27 tons) annually
  - Erosion reduction**: 90%
  - Estimated Sediment Yield Reduction: 24.3 tons/yr
- *Meander #3:*
  - Erosional surface: 170 linear feet x ~3.3 feet height (average) = 561 square feet
  - BEHI rating*: Very High
  - NBS rating*: High
  - Estimated Sediment Yield: 1.2 ft/yr x 561 square feet = 673 cubic ft (36.4 tons) annually
  - Erosion reduction**: 90%
  - Estimated Sediment Yield Reduction: 32.7 tons/yr
- *Reach #1:*
  - *Erosional surface: 1300 linear feet x~ 1.0 feet bank height (average) = 1,300 square feet*
  - *BEHI rating*: Moderate*
  - *NBS rating*: Low*
  - *Estimated Sediment Yield: 0.15 ft/yr x 1,300 square feet = 195 cubic feet (10.5 tons) annually*
  - *Erosion reduction**: 90%*
  - *Estimated Sediment Yield Reduction: 9.5 tons/yr*
- *Reach #2:*
  - *Erosional surface: 250 linear feet x ~ 4 feet bank height (average) = 1,000 square feet*
  - *BEHI rating*: High*
  - *NBS rating*: High*
  - *Estimated Sediment Yield: 0.55ft/yr x 1,000 square feet = 550 cubic feet (30 tons) annually*
  - *Erosion reduction**: 90%*
  - *Estimated Sediment Yield Reduction: 27 tons/yr*
- *Reach #3:*
  - *Erosional surface: 100 linear feet x ~3 feet bank height (average) =300 square feet*
  - *BEHI rating*: High*
  - *NBS rating*: Moderate*
  - *Estimated Sediment Yield: 0.38 ft/yr x 300 square feet = 114 cubic feet (6 tons) annually*
  - *Erosion reduction**: 90%*
  - *Estimated Sediment Yield Reduction: 5.4 tons/yr*

- *Reach #4:*
    - *Erosional surface: 50 linear feet x 1.0 feet bank height (average) = 50 square feet*
    - *BEHI rating*: High*
    - *NBS rating*: Moderate*
    - *Estimated Sediment Yield: 0.38 ft/yr x 50 square feet = 19 cubic feet (1 ton) annually*
    - *Erosion reduction**: 90%*
    - *Estimated Sediment Yield Reduction: 0.9 tons/yr*
- *Reach #5:*
    - *Erosional surface: 100 linear feet x ~ 1 foot bank height (average) = 100 square feet*
    - *BEHI rating*: Low*
    - *NBS rating*: Low*
    - *Estimated Sediment Yield: 0.035 ft/yr x 100 squre feet = 3.5 cubic ft (0.2 tons) annually*
    - *Erosion reduction**: 90%*
    - *Estimated Sediment Yield Reduction: 0.18 tons/yr*

**BEHI (Bank Erosion Hazard Index) and NBS (Near Bank Stress) ratings reflect prevailing conditions at the time the geomorphic assessment was conducted (2012/13). In some instances, it is possible that continued impairment of these eroding streambank segments would have occurred between that time and the project construction date (2015 or 2016). As a result, estimated sediment yield and corresponding yield reduction values would be greater than those shown.*

***Erosion reduction refers to the anticipated effectiveness of the constructed stabilization/ remediation measure at preventing future erosion, in terms of the percentage of pre-remediation sediment yield retained within the post-remediation streambank.*

Construction of this project would result in an estimated annual reduction in sediment yield of 17.8 tons. Due to the decision of the Village of Livonia to not proceed with the construction phase of this project in August 2016, design and permitting were completed for the project, but none of the prescribed stabilization/remediation measures listed above were installed.

Estimated Costs of Recommendation Implementation

A rough estimate of the costs associated with the design and construction of the actions recommended in this report are summarized in Table 1, below. The estimated construction costs would be better defined upon completion of the designs for the projects.

Table 1. Cost Estimate				
Item No.	Unit	Quantity	Cost/Unit ($)	Cost Blue Hill ($)
Unclassified Excavation	CY	5445	14	$ 76,230
Clearing and Grubbing	LS	1.5	15,000	$ 22,500
Various Bank Protection	LF	1000	50	$ 50,000
Instream Structures	EA	3	3,500	$ 10,500
Mobilization	LS	0.5	26,000	$ 13,000
Seeding	SF	28150	0.05	$ 1,410
Plantings (shrubs & live stakes) (6' O.C)	EA	600	20	$ 6,000
			Total Construction Cost:	**$179,640**
			Contingency (10%):	**$ 17,960**
			Engineering (20%):	**$ 35,930**
			Final Project Cost:	**$233,530**

Framework for Detailed Study to Support Development of Stabilization/Restoration Plans

Additional field data is required to prepare construction plans for the activities recommended in this report. Provided below is the framework for the anticipated data collection efforts with brief descriptions of the need and use of the data.

- *Topographic Survey*

  The services of a certified professional land surveyor in New York are required to prepare a topographic survey of the project area along North McMillan Creek. Data included in the survey will include locations of all above ground and underground infrastructure, topography of the site at one-foot contour intervals, project area boundaries, land parcel ownership, and notable landscape features including historical and archaeological resources. Stream corridor characteristics such as cross-section geometry and detailed bed profile survey will also be included.

- *Survey of Cross-sections and Longitudinal Profile*

  Survey of channel cross-sections provides measured values that define a range of physical characteristics of channel geometry including channel width and depth, flood capacity (bankfull cross-sectional area), floodplain availability (entrenchment and incision ratios), width/depth ratio, etc. Comparison of cross-sections through various features of the stream can indicate areas of bed scour or sediment aggrading, loss of flood capacity, and other components of channel morphology that directly impact channel performance, bank stability, bed/bank erosion, and sediment accumulation. Collection of cross-section data is also a critical component of producing the required data to inform hydraulic and sediment transport competency models, and is a necessary mechanism in identifying the stream type through the ROI.

Survey of the longitudinal profile through the study reach provides measured values that define average bed slope through the reach, frequency and spacing of bed features (riffles, pools, etc.) and can identify locations along the bed where accelerated bed scour or sediment deposition is occurring. Oftentimes, accelerated scour or deposition of sediment along the streambed is a contributor to lateral channel migration and/or channel incision, both of which destabilize streambanks and ultimately lead to more erosion of bed and banks, and delivery of more sediment downstream. Evaluating channel slope is a critical component in modeling channel hydraulics and in evaluation of sediment transport competency, and is a necessary mechanism in identifying stream type through the ROI.

- *Pebble Counts and Bar Samples*

  Pebble counts at riffle features and throughout the ROI provide particle size distributions that describe channel substrate in the reach. Grain size on point bars will be determined from particle samples collected from the midpoint of point bars. Measured substrate particle distribution will be used to assist in calculation of sediment transport competency through each study reach, which provides valuable insight as to channel performance and potential causes of channel (and bank) stability issues.

- *Final Design*

  Following the data collection efforts discussed above, a comprehensive study of the stream reach and an evaluation of alternatives to reducing the ongoing erosion and destabilization of the reach. Planimetric and geometric data will be used to classify the stream using the stream classification methodology developed by Rosgen (1996). Available data defining the stable form of the identified stream type will be used to determine the bankfull discharge and bankfull cross-sectional area to define the widths and depths of stream features to be constructed in the reach to address the identified issues contributing to bank erosion. Design features could include bed grade control, flow deflectors, floodplain reconnection, or bank armoring, among others. Preliminary designs are run through HEC-RAS model to evaluate storm flow elevations, and the modified channel dimensions and substrate are modeled to confirm that the design is capable of transporting sediment through the reach without significant erosion of aggradation. Once the dimensions and slope are confirmed, detailed drawings are prepared for construction purposes.

Thank you for the opportunity to assist the Livingston County Planning Department with this stream assessment and development of recommended short-term stabilization options to address bank erosion and conditions contributing to instability in North McMillan Creek. Feel free to give me (585-325-7190) or Anthony Esposito (315 457-5200) a call if you have any questions or wish to pursue detailed design development for any proposed options.

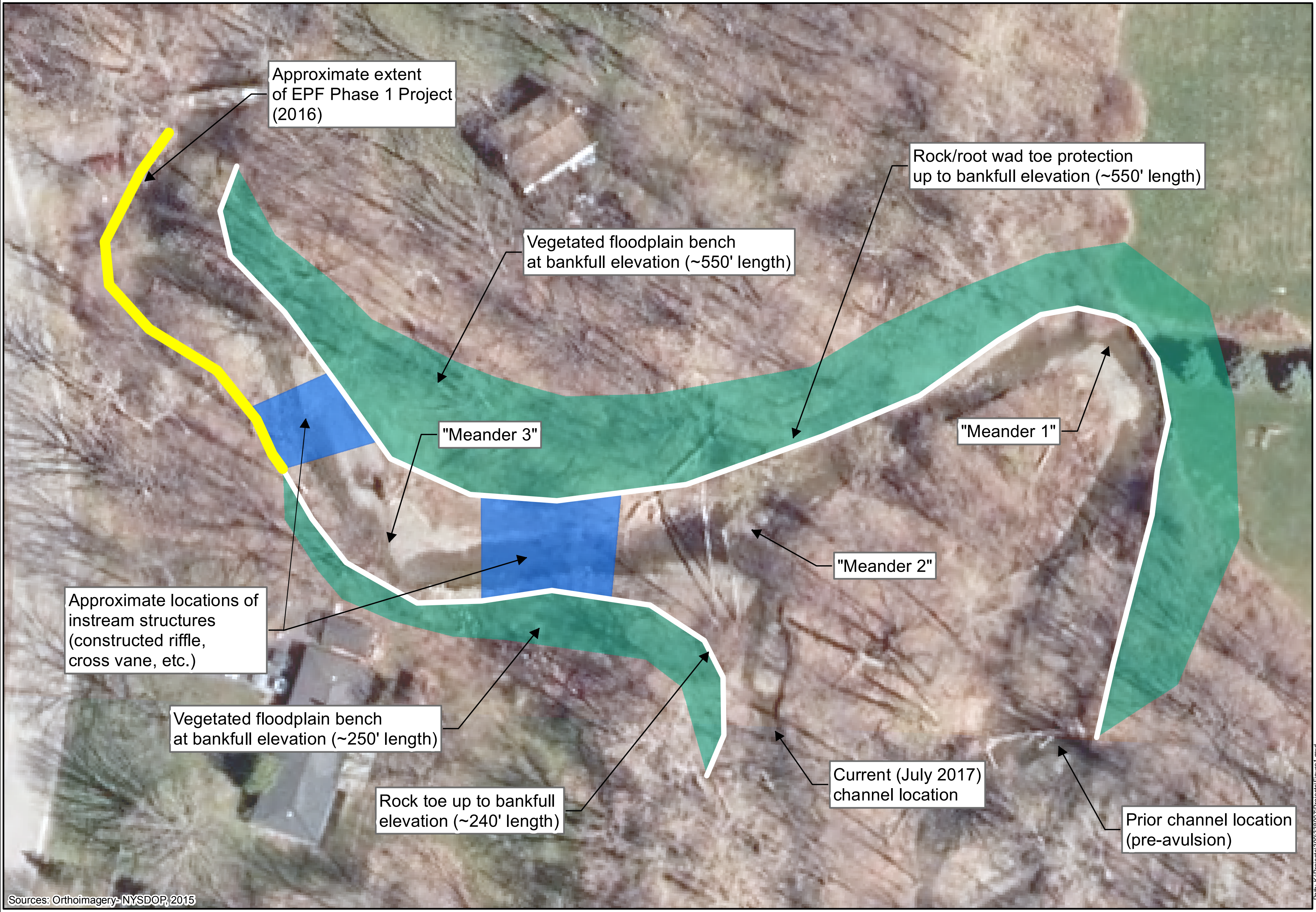
Sincerely,

BARTON & LOGUIDICE, D.P.C.

Matthew J. Widay, P.E.
Senior Project Engineer

Anthony N. Esposito
Managing Environmental Scientist

MJW/ANE/akg
Attachments



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N W E S

1 inch = 50 feet

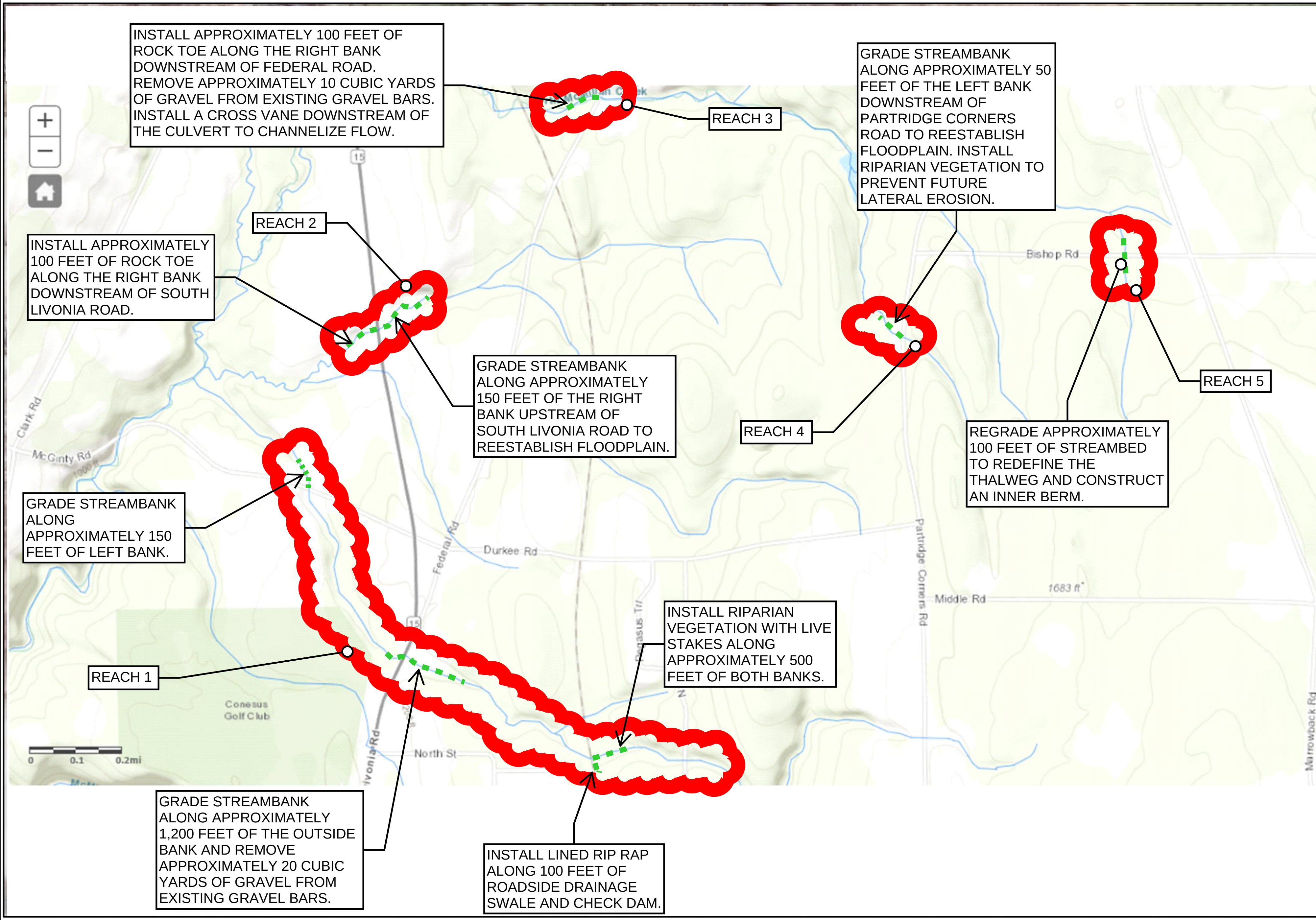
Livingston County Planning Dept.

Channel Stabilization Recommendation Options

Livingston County 2/22/18 New York

Figure 1

Project No. 338.007



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1 inch = 50 feet

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Channel Stabilization Recommendation Options

Livingston County 8/3/18 New York

Figure 2

Project No. 338.007