

Metzlers Brook Drainage Investigation

**BOROUGH OF BERGENFIELD
BERGEN COUNTY, NEW JERSEY**

RV&A FILE #: 0203T006

JULY 2013



Prepared By:



**300 PENHORN AVENUE, 3RD FLOOR
SECAUCUS, NEW JERSEY 07094
(201) 624-2137**



Frank J. Seney, P.E. - Lic. No. 35321



Paul D. Cray, P.E. - Lic. No. 37458



Date



Date

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 Introduction	2
2.0 Review of Previous Studies	2
3.0 Field Investigation	3
4.0 Conclusion & Recommendations	4
5.0 Required Permits	6

Appendix A – Field Investigation Photographs August 7, 2012

1.0 INTRODUCTION

Remington, Vernick & Arango Engineers (RV&A) was retained by the Borough of Bergenfield to perform a drainage investigation into flooding problems that currently exist along Metzlars Brook. The intent of the study was to examine the “big picture” of the watershed as well as the previous studies that have been performed and recommend improvements that will reduce the frequency of flooding along the Brook. The scope of this study did not include evaluation of localized drainage problems within the subject watershed but beyond the flood plain limits. Reduced peak flows within the Brook could provide for better opportunities for smaller pipe and overland drainage systems to convey water into the Brook. Other localized drainage issues may be independent of the Brook flooding and more related to problematic soils, high groundwater, poor yard drainage, or a combination of factors.

2.0 REVIEW OF PREVIOUS STUDIES

Two (2) previous studies have been performed for the flooding problems associated with Metzlars Brook. The first was completed in 1998 by Azzolina & Feury Engineering Company. This initial study focused on the flooding problems of the properties along the northerly side of Deerfield Street, between First Street and Martin Street. The engineer concluded that the contributing factors to the flooding problems were inadequate pipe capacity, back-pitched pipes, inadequate channel capacity and lack of flood storage. It was determined that the only feasible alternative to provide some relief at the Deerfield Street area was to construct a stormwater detention facility at the southwest corner of Hickory Avenue and Martin Street. This facility could either be constructed as an above-ground or underground facility. The engineer also recommended a diversion of the existing drainage system at the intersection of Third Street and Phelps Avenue. Currently, all runoff entering the system at this point can drain in two (2) directions; either to the west along Phelps Avenue or the south along Third Street and ultimately to the Deerfield Street area. It was recommended that all runoff arriving at this point be diverted into the Phelps Avenue system, thereby reducing the amount of water that ultimately reaches the Deerfield Street area.

The second study was completed in 2005 by Azzolina & Feury Engineering Company and focused more on the overall Metzlers Brook watershed. The results of the investigation indicate that the channel lacks the capacity to convey any significant storm events and that there is a lack of flood storage within the watershed. The engineer also indicated there are numerous encroachments along the stream. These included filling of bank areas, installation of retaining walls, miscellaneous structures and piping of the main channel. Note that the age of most of these encroachments indicated that they were constructed before the establishment of the New Jersey Department of Environmental Protection, and therefore were not regulated at the time. The engineer recommended that the 100-year discharge rates within Metzlers Brook be regulated by the construction of detention basins and accommodated by culvert enlargement and/or replacement and channel widening where feasible. This would be accomplished by performing the following activities once a detailed hydrologic and hydraulic analysis of the watershed was completed: perform stream cleaning, construct a 25-year detention basin at the P.A.L. Fields, construct a subsurface detention basin at Hickory Avenue and Martin Street (as detailed in the 1998 report), construct a 100-year detention basin and rebuild the P.A.L. Fields, construct a 100-year detention basin on Knickerbocker Country Club property and perform culvert replacement and/or enlargement and channel widening where feasible. The chronology of the improvements was chosen in order to provide some degree of flood relief as quickly as possible and not exacerbate existing downstream flooding of properties along Metzlers Brook.

3.0 FIELD INVESTIGATION

RV&A conducted a field investigation on August 7, 2012 in order to determine the current conditions of the stream. The stream was walked for the entire reach by one of our hydraulics engineers and photographs were taken in order to document the current conditions of the stream. These photographs are located in Appendix B. As in the previous studies, it was observed that the conveyance system is sufficiently lacking in capacity. Typical cross sections of the stream as it meanders through the properties are narrow and flat, thereby limiting the conveyance capacity of the stream. The fully developed nature of this area prohibits the reconstruction of the existing drainage system. In many areas, the stream is within ten (10) feet of existing residential dwellings. Further compounding the flooding problems is the lack of overflow storage

areas that can be utilized during the passage of larger magnitude storms. It appears that the only areas that can be utilized for temporary storage of runoff are at the P.A.L. Fields and within the Borough-owned vacant lot at the intersection of Hickory Avenue and Martin Street.

4.0 CONCLUSION & RECOMMENDATIONS

Based on the review of the two (2) previous studies that have been performed for Metzlers Brook and our recent field investigation, we find that significant detention storage is needed as the first step of any improvement project. We did not find limited cost improvements that would significantly improve the Brook flooding conditions. The amount of storage volume needed, and limited available open space for placement, dictates that short term recreation area compromises will be needed and the associated costs will be significant. Therefore we have been exploring potential grant possibilities and will continue to do so in coordination with the Borough Grant Consultant.

As noted in the Introduction, the scope of this study did not include evaluation of localized drainage problems within the subject watershed but beyond the flood plain limits. Reduced peak flows within the Brook could provide better opportunities for smaller pipe and overland drainage systems to convey water into the Brook. Other localized drainage issues may be independent of the Brook flooding and more related to problematic soils, high groundwater, poor yard drainage, or a combination of factors. Either way, the Brook is the core feature of the watershed's drainage and it needs to be addressed before more localized drainage concerns can be evaluated as related or unrelated to the Brook flooding.

We have broken the project into phases due to the overall project cost. The first four (4) phases have costs associated with them. The 5th phase would be for private property owner implementation if desired. It pertains to bank stabilization which would be more manageable if peak flows are reduced through the Brook via the detention of upstream water runoff. We recommend the following for consideration:

Phase 1, 2 & 3

A detention facility constructed at the P.A.L. Fields in order to attenuate flood hydrographs as they enter the north end of the Borough from Tenaflly Borough. By temporarily storing floodwaters within the field area and discharging back into the stream at a much lower rate, the downstream residential properties will not be affected as often as they currently are. The previous study from 2005 recommended that the fields be reconstructed at a lower elevation and used as detention areas during storm events. Although this option would be less expensive, we believe this solution would present other problems such as constantly wet fields and potential mosquito breeding areas. Our recommendation is that the detention facility be constructed beneath the athletic fields at the site. The detention facility could provide approximately three (3) feet of vertical storage beneath each of the four (4) fields as well as beneath the parking area on the south side of the stream. A diversion structure would be designed in order to divert water from the 36" pipe that currently discharges runoff to Metzlers Brook to the athletic field areas. An outlet control structure would then be designed to control the release of stormwater back into the stream. Preliminary calculations indicate that the following volume of water could be stored within the storage media underneath each of the fields. For purposes of these calculations, a three (3) foot storage depth and 90% void ratio within the subsurface storage areas were assumed.

- Large field at east end of site – 220,000 ft³
- Two (2) smaller fields and parking area on south side of stream – 262,500 ft³
- Small field on north side of stream – 67,500 ft³

TOTAL STORAGE VOLUME – 550,000 ft³

It is recommended that the detention facility be constructed in phases, proceeding in the order listed above. The diversion structure, main conveyance system and outlet control structure should be constructed during the initial phase. The subsequent storage areas from later phases can then be tied into the conveyance system when constructed. We estimate that the construction costs associated with each phase as well as the reconstruction of the fields and parking areas above the storage areas are as follows:

- Phase 1 - \$1,540,000 (\$7 per ft³ of storage)
- Phase 2 - \$1,706,250 (\$6.50 per ft³ of storage)
- Phase 3 - \$438,750 (\$6.50 per ft³ of storage)

TOTAL COST = \$3,685,000

Phase 4

A subsurface detention facility can also be constructed at the Bergenfield Board of Education property adjacent to the Hickory Avenue and Martin Street intersection. These improvements should be done in conjunction with the diversion of the existing drainage system at the intersection of Third Street and Phelps Avenue as detailed in

the 1998 study, subject to further hydraulic study. These improvements will not only reduce the amount of runoff but also the peak flows that are conveyed through the downstream residential areas. Based on aerial imagery, it appears that an area of approximately 1.3 acres could be utilized for the underground system. This is assuming that only the existing grassed area at the site would be utilized. Once again, assuming three (3) feet of vertical storage and a 90% void area within the system, we estimate that 153,500 ft³ can be provided within the system. We estimate that the construction cost for the subsurface system and the reconstruction of the playfield above is as follow:

- Phase 4 - \$997,750 (\$6.50 per ft³ of storage)

Phase 5

The majority of the brook is contained on private property with no public easements associated with the Brook. Individual property owners may want to stabilize and/or modify the banks of the brook to improve their properties. Property owners need to be cognizant of the regulatory permitting associated with such activities from an ecological and hydraulic perspective. There are some tight turns within the brook that reduce the hydraulic flow capacity, however, modification to improve flow typically requires documentation that improvement of a hydraulic condition in one area does not shift it elsewhere. If the above Phases are implemented, there could be justification for property owners to modify a man-altered brook that what would then be conveying smaller peak flows. New Jersey Department of Environmental Protection (NJDEP) and County Soil Conservation Permits would still be required, but their path to permit issuance may be less complicated from a hydraulic perspective. The ecological criteria would most likely remain the same regardless of hydraulic improvements from upstream detention.

5.0 REQUIRED PERMITS

Based on the recommendations presented above, we anticipate the following permits will be required for the initial Phases:

- NJDEP Freshwater Wetlands General Permit No. 11 – Outfalls and Intake Structures.
- NJDEP Flood Hazard Area Individual Permit for the construction of a stormwater management facility.
- Soil Erosion & Sedimentation Control Plan Certification

Any subsequent work within the existing Brook could require the following permits:

- NJDEP Freshwater Wetlands General Permit No. 1, 10, 11, 20, 26 and/or Individual Permit.

- NJDEP Flood Hazard Area various General Permits, Individual Permits and/or Hardship Exception.
- Soil Erosion & Sedimentation Control Plan Certification.

APPENDIX A

Field Investigation Photographs August 7, 2012



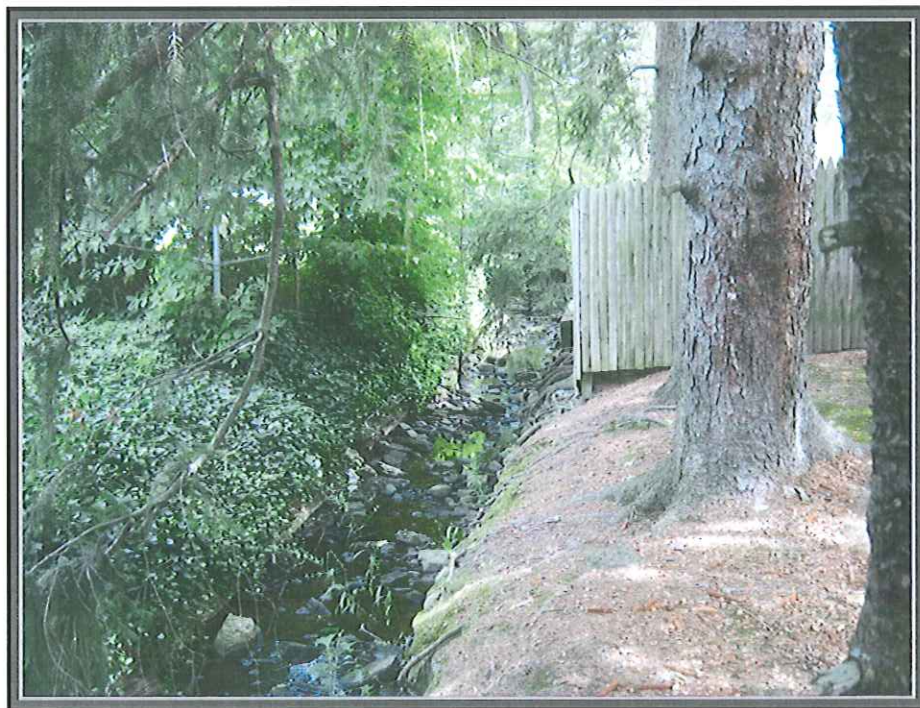
Proposed detention facility location at the intersection of Hickory Avenue and Martin Street (Third Street).



Discharge point to Metzler's Creek on east side of P.A.L. Fields.



Typical stream section through the P.A.L. Fields.



Metzler's Brook leaving the P.A.L. Fields area, approaching Bogert Place.



Upstream end of Bogert Place culvert, immediately downstream of P.A.L. Fields area.



Channel immediately downstream of Bogert Place culvert.



Channel immediately upstream of Deerfield Street culvert.



Channel immediately downstream of Deerfield Street culvert.



Downstream side of Deerfield Street culvert.



Channel upstream of Bradley Avenue culvert.



Channel downstream of Bradley Avenue culvert.



Channel between Bradley Street and East Main Street.



Channel upstream of East Main Street.



Channel downstream of East Main Street.



Downstream side of East Main Street culvert.



Channel upstream of Grove Street culvert.



Channel downstream of Grove Street culvert.



Channel upstream of Bergen Avenue culvert.



Channel downstream of Bergen Avenue culvert.



Channel upstream of Carnation Street culvert.



Channel downstream of Carnation Street culvert.