



National Institute of
BUILDING SCIENCES™

Panel Decision and Report

SRP NJMCLPMT031119
Borough of Lincoln Park &
Township of Montville, MC, NJ

June 5, 2020

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1. Summary

Based on the submitted scientific and technical information, and within the limitations of the Scientific Resolution Panel (SRP), the Panel has determined that FEMA's data does not satisfy NFIP mapping standards defined in FEMA's Guidelines and Standards for Flood Risk Analysis and Mapping and must be revised. The Panel decision was unanimous.

This report guides the reader through the proceedings of the Panel, gives a brief overview of each appeal item, and provides details supporting the Panel's choices for each of the following items in Section 8, Rational for Findings:

BOROUGH OF LINCOLN PARK, MORRIS COUNTY, NEW JERSEY

- a. Passaic River Flows
- b. East and West Ditch Hydrology
- c. West Ditch at Jacksonville Road
- d. East Ditch Left Overbank Flooding
- e. Passaic River Floodway Modeling

TOWNSHIP OF MONTVILLE, MORRIS COUNTY, NEW JERSEY

- f. Passaic River Floodway
- g. Passaic River Discharges
- h. Crooked Brook Tributary Discharges

The Panel is treating items a. and g. as one item, as well as e. and f. as one item. Item c. was resolved by FEMA and is no longer applicable to this Panel. Item h. was determined not to be an appealable item based on the scope and the approach FEMA used to re-delineate Crooked Brook.

The basis of upholding this appeal surrounds the issues with the calculation of the Passaic River Floodway and the combined hydrology of the East and West Ditch.

2. Introduction

This report serves as the recommendation to the Federal Emergency Management Agency (FEMA) Administrator from the National Institute of Building Sciences (NIBS) Scientific Resolution Panel (SRP). SRPs are independent panels of experts organized, administered, and managed by NIBS for the purpose of reviewing and resolving conflicting scientific and technical data submitted by a community challenging FEMA's proposed flood elevation. The SRP is charged with helping to efficiently resolve appeal and protest issues between FEMA and communities by acting as an independent third party in an effort to obtain the best data possible for the community's Flood Insurance Rate Maps (FIRMs).

3. Panel

Panel ID: NJMCLPMT031119

Panel Name: Lincoln Park & Montville, MC, NJ

FEMA Region: II

Panel Members:

- **Matthew Anderson, P.E., CFM, Product Manager, Innovyze, Portland, Oregon**
Mr. Anderson is a Professional Engineer with over 25 years of experience as an engineering consultant in water resources. He has performed numerous hydrologic and hydraulic studies to establish floodplains and floodway analysis. Mr. Anderson's current focus is enabling technology that engineers use to study and model complex floodplains as a Product Manager for Innovyze. Mr. Anderson holds a professional Civil Engineer's license in Illinois, Indiana, and various other Midwestern states.
- **Avalisha Fisher, P.E., CFM, Principal and Project Manager with Driven Engineering, Inc., in the Mobile, Alabama area.** Mrs. Fisher has over 30 years of experience as a civil engineer with specialized expertise in hydraulics and hydrology with most of her career including numerous projects involving remapping of floodplains and floodways. Mrs. Fisher began her career performing flood studies using HEC-2 and progressed to using other programs like HEC-RAS, and is very familiar with FEMA map revisions requirements. She founded Driven Engineering in 2006 and provides technical advice and training to their team of engineers as well as serving as the floodplain manager for the University of South Alabama and is currently assisting the City of Semmes with joining the NFIP.
- **Charles Patterson, Ph.D., P.E., CFM, Vice President, and Hydro Division Manager of Allgeier, Martin and Associates, Inc., in the Rolla, Missouri office of Allgeier, Martin and Associates.** Dr. Patterson has over 30 years of experience in hydrologic and hydraulic modeling, analysis, and design. He has worked as a consulting engineer his entire career and has taught numerous engineering courses in the fields of hydrology and hydraulics as an adjunct professor.
- **Tom Wright, P.E., CFM, Panel Chair, Senior Water Resources Engineer, AECOM Salt Lake City, Utah.** Mr. Wright has worked on FEMA study updates throughout his 21-year career including from HUC-12 level mapping updates down to single property letters of map changes inclusive of 1-dimensional, coupled 1-D/2-D, and 2-dimensional steady state and unsteady state hydraulic models throughout the United States. He is licensed as Professional Engineer in Utah and California.

- **Andrew Yung, P.E., CFM, D.WRE, Principal/Chief Hydrologist with WALTER P MOORE AND ASSOCIATES, INC., in The Woodlands, Texas.** Mr. Yung has 32 years of experience as an engineer, planner, and hydrologist. He began his career as a technical reviewer in **FEMA's** National Flood Insurance Program. Since that time, he has managed and provided technical support to a wide range of engineering projects involving hydrology, hydraulics, master drainage planning, flood control features, floodplain management, watershed impact analyses, dam safety analyses, and flood warning systems. Mr. Yung is very familiar with HEC-HMS/HEC-1, HEC-RAS/HEC-2, HEC-DSS, and HEC-SSP and has provided technical support and training to users of these programs.

4. Basis for Appeal

By letters and/or email dated April 27, 2018 and May 14, 2018, the Borough of Lincoln Park and Township of Montville appealed the base flood elevations (BFEs), Special Flood Hazard Area (SFHA) determinations, and floodway delineations, as proposed by the Federal Emergency Management Agency (FEMA) on the revised preliminary Flood Insurance Rate Map for Morris County, New Jersey dated August 22, 2017.

The appeals were supported by several technical reports and associated data sets. One report, which focused primarily on the hydraulic analyses used for floodway and BFE determinations on the Passaic River, was prepared by Storm Water Management (SWM) Consulting, LLC, titled Technical Report in Support of Appeal by 46 and Chapin Road, LLC and Avalon Bay Communities, of Revised Preliminary Flood Insurance Studies and Revised Preliminary Flood Insurance Rate Maps for Morris County, New Jersey, dated April 27, 2018. Other letter reports, which focused primarily on the hydrologic analysis used for flood discharge determinations on the Passaic River and the East and West Ditches, were prepared by Agnoli Engineering and dated May 10 and May 14, 2018.

The appeals contend that:

FEMA's floodway determinations for the Passaic River are incorrect (excessively wide) because: a.) the proposed floodways included ineffective flow areas; and b.) the unsteady flow (HEC-RAS) model, used to develop the floodway, took into consideration the reduction in flood storage, and corresponding discharge increases, caused by potential floodplain encroachments. This was inconsistent with the traditional use of only conveyance loss in floodway determinations.

FEMA's hydrologic analyses of flood flows on the Passaic River and East and West Ditches are incorrect because: a.) in the case of the Passaic River, the appellant's statistical analysis of the record available at USGS gage 01381900 (Passaic River at Pine Brook NJ) provides a more correct estimate of flood discharges than the watershed modeling approach used by FEMA; and b.) in the cases of East and West Ditches, the appellant's use of USGS regional regression equations (Watson, K.M., and Schopp, R.D., 2009, Methodology for estimation of flood magnitude and frequency for New Jersey streams: U.S. Geological Survey Scientific Investigations Report 2009–5167) provides a more correct estimate of flood discharges than the method used by FEMA (Stankowski, S.J., 1974, Magnitude and frequency of floods in New Jersey with effects of urbanization: New Jersey Department of Environmental Protection, Division of Water Resources, Special Report 38).

5. Data Submitted by the Community and FEMA

5.1. APPELLANT

This SRP addresses a combined set of issues from two separate appeals, the following data was provided by the appellants.

BOROUGH OF LINCOLN PARK, MORRIS COUNTY, NEW JERSEY

- SRP Request Form dated March 9, 2019
- SRP Request Form Attachment A: Summary of Appeal Information dated March 11, 2019
- Appeal/Comment Submission form dated May 14, 2018.
- Letter from Agnoli Engineering, dated May 14, 2018, detailing the Borough's concerns and reasons for appealing. The letter included appendices with United States Geological Survey (USGS) stream flow analyses of the Passaic River, East Ditch, and West Ditch, and an April 27, 2018, Technical Report prepared by SWM Consulting: "Technical Report in Support of Appeal by 46 and Chapin Road, LLC and AvalonBay Communities LLC of Revised Preliminary Flood Insurance Studies and Revised Preliminary Flood Insurance Rate Maps for Morris County, New Jersey" that is provided as also being relevant to the Borough of Lincoln Park.

TOWNSHIP OF MONTVILLE, MORRIS COUNTY, NEW JERSEY

- SRP Request Form dated March 11, 2019
- SRP Request Form Attachment A: Summary of Appeal Information dated March 13, 2019
- Appeal/Comment Submission form dated May 14, 2018.
- Technical report prepared by Storm Water Management (SWM) Consulting, titled Technical Report in Support of Appeal by 46 and Chapin Road, LLC and AvalonBay Communities, LLC of Revised Preliminary Flood Insurance Studies and Revised Preliminary Flood Insurance Rate Maps for Morris County, New Jersey, dated April 27, 2018, and hereafter referred to as "the Report."
- Document containing the appeal/comment submission form and a letter from Agnoli Engineering dated May 10, 2018, that included technical information in support of the appeal. This document included appendices of USGS data as well as the document referenced above in the first bullet.

BOROUGH OF LINCOLN PARK & TOWNSHIP OF MONTVILLE, MORRIS COUNTY, NEW JERSEY

- Joint Oral Presentation and supporting slides from the April 14, 2020 meeting.

5.2. FEMA

FEMA provided the following data to the SRP during this review:

- Borough of Lincoln Park Appeal Resolution Letter dated February 12, 2019
- Township of Montville, Morris County, New Jersey Appeal Resolution Letter dated February 12, 2019
- Readme file titled "Overview and Description off the Passaic River Model and its Components" dated May 22, 2018
- The Preliminary Hydrology and Hydraulic Analysis Technical Support Data Network for Task Order HSFE02-09-J-0001 for Passaic River Watershed Hydrologic & Hydraulic Study, New Jersey dated December 2012
- HEC-HMS model for the Passaic Watershed and tributaries (Date uncertain, files modified May 2016)
- HEC-RAS hydraulic modeling files for (1) Central Passaic River, (2) Deepavaal Brook, (3) Pompton River, (4) Rockaway River, and (5) Upper Passaic River
- HEC-RAS hydraulic modeling files for (1) East Ditch, (2) West Ditch, and (3) Pompton River
- Report titled Hydraulic Analysis of East Ditch Floodplain, Morris County, New Jersey dated August 2017
- West Ditch Final Hydrology Report, Riverine Flood Insurance Studies in FEMA Region II, New Jersey FY-07, Morris County, New Jersey dated February 3, 2009
- Hydraulics Summary (NJDEP) for the Pompton River (Date uncertain, file modified on October 22, 2019)
- Oral Presentation and slides from April 14, 2020 meeting
- Written Responses to SRP questions Received April 21, 2020
- East Ditch HEC-RAS hydraulic model update Received May 7, 2020

6. Summary of Panel Procedures

The Panel was selected on February 5, 2020. At that time, the FEMA and Community data was available for review from NIBS secure file share portal. The Panel officially kicked off and convened on March 6, 2020 to review the purpose and scope of the Panel, and to step through an overview of the data received and the schedule. The following meetings were held for deliberation of each appeal item, review of the data, and development of questions for both FEMA and the appellants:

- March 24, 2020
- April 7, 2020
- April 14, 2020 (Oral Presentations)

The Panel then met additionally to further review the provided data, deliberate each appeal item, and document the decisions.

- April 21, 2020
- May 12, 2020
- May 15, 2020
- May 19, 2020
- May 22, 2020
- May 27, 2020
- June 1, 2020
- June 3, 2020 (Report Presented to NIBS)

7. Recommendation

The Panel recognizes the inherent complexities in the Passaic River/Pompton River/Great Piece Meadows system and appreciate the years of effort by FEMA and the FEMA contractor to create/update the detailed hydrologic and hydraulic models. It is the understanding of the Panel that determination of peak stages and flowrates were within the FEMA guidelines but poor calibration in the vicinity of Great Piece Meadow yielded questionable results in the encroachment model. Specifically, it does not appear that the lateral inflow from the Pompton River considers the attenuating effects of floodplain storage on the Pompton before it reaches the confluence with the Passaic River and the Great Piece Meadow. As a result, the inflow from the Pompton into the Passaic is defined by a steep rising limb that peaks earlier than expected creating significant backwater into the Meadow. This in turn may yield a floodway that is wider than expected within the Meadow due to a high volume of water from the Pompton occupying the Meadow before the peak of the Passaic. An unsteady flow hydraulic model for analysis of the regulatory floodplain of the Passaic River was deemed necessary by the mapping contractor and the local communities. The mapping contractor used a calibrated modeling effort (HEC-HMS and 1-dimensional unsteady flow HEC-RAS) for the floodplain analysis. However, the calibration effort concentrated around the peak stage records and to a lesser degree, the peak flowrates. This left a significant hole in the analysis since the modeling efforts did not appear to match the USGS hydrographs of recorded events.

The FEMA NFIP calibration guidelines 1-dimensional unsteady flow model calibration have shown little changes since 2009. The methodology for calibration spelled out in the Guidelines and Specifications for Flood Hazard Mapping Partners [November 2009] Appendix C states that the calibration is to fit the entire hydrograph and synchronization of hydrographs is the job of the FEMA mapping partner. Peak outflow is mentioned in one sentence so, in cases where "peak" is not mentioned, it seems logical that it would be interpreted as the entire hydrograph. (See Guidelines and Specifications for Flood Hazard Mapping Partners [November 2009] Appendix C.2.3, C.2.4.4, C3.1, C3.3.2)

The oversight of not matching the entire hydrograph and not matching the timing of the hydrographs from the Pompton River, caused a majority of the peak inflow at the Passaic River from the Pompton River to travel upstream in the Passaic River into the Great Piece Meadow.

Modeling the floodplain encroachment (floodway analysis) with an unsteady flow model requires the proper calibration of the hydrographs. The Panel recognizes the difficulty of calibration to peak stages, peak flowrates and the rising and falling limbs of the Pompton River and Passaic River hydrographs. However, FEMA regulations require calibration of the hydrographs to these factors for unsteady flow models *especially where storage is of utmost importance*. The calibration of the rising and falling limbs of the input hydrographs could have significant impacts on the final location of the floodway.

8. Rationale for Findings

BOROUGH OF LINCOLN PARK, MORRIS COUNTY, NEW JERSEY

a. Passaic River Flows

The Panel agrees that while the update to the river flows is somewhat greater than the USGS stream gage 01381900 (Passaic River at Pine Brook, NJ), FEMA reasonably calibrated the watershed model to match peak flows through a wide array of conditions, including a variety of return periods with very close agreement to the 1% change event, and historic storm events in the watershed, and that the use of multiple gages to aid in calibration is good engineering practice and follows the FEMA guidance.

b. East and West Ditch Hydrology

The Panel determined that FEMA did, in fact, establish the flows for the west ditch hydrology and that both ditch systems combine north of Jacksonville Road and integral in nature during a 100-year event, and that updating both the hydrology and hydraulics, and mapped floodplains should have been undertaken by FEMA in this unique circumstance. The FEMA analysis fails to take into consideration that the systems become one 'diverted' flows (per regulations) where the shared floodplain becomes one system.

c. West Ditch at Jacksonville Road

This item was resolved by FEMA and is excluded from this Panel's review.

d. East Ditch Left Overbank Flooding

This item is addressed under the Panel's review of item b. above.

e. Passaic River Floodway Modeling

The Panel is of the opinion that FEMA followed the appropriate procedures for defining the floodplain and has gone through considerable effort calibrating the peak and volumes of the Central Passaic River and its tributaries. But in reference to Section 2.3.1 of FEMA's guidance for Flood Risk Analysis and Mapping, synchronization of hydrographs is a part of the calibration. In this model we see two irresolvable issues. (1) The timing of the peak flow from the Pompton River and specifically, (2) the rising limb of the Pompton inflow hydrograph to the Passaic River is unrealistically taking up too much volume of the available storage in the combined river system, and constraining the possibility of further floodway encroachments, resulting in an overly-restrictive floodway delineation. River flow

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gage records in the area support a longer duration than timing of the rising limb of the Pompton River hydrograph should be longer than one day.

Note that some of the community's concerns regarding the floodway were unfounded due to the unsteady modeling approach chosen for the Central Passaic River. Specifically, the communities stated that the floodway encroachments were outside of the effective flow area in numerous model cross sections. While this approach is not valid for a steady state model, the unsteady computational engine accounts for storage and routing of the stored flows through the model and setting the encroachment beyond the ineffective area still affects the computed floodway surcharges.

Evidence of this can be done in conceptual models but is also apparent in the number of FW iterations that FEMA incorporated into the model (US_FW, US FW_Update, US_FW_RSC) where encroachment changes within the ineffective areas affect surcharge in the model.

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f. Passaic River Floodway

See previous item e., these were treated as one item by the Panel.

g. Passaic River Discharges

See previous item a., these were treated as one item by the Panel.

h. Crooked Brook Tributary Discharges

The Panel acknowledges that the scope of this analysis was a re-delineation of the floodplain on better topography. Since no hydrologic analysis was performed, there is no basis for an appeal unless the appellant noted something incorrect in the terrain used, which they did not. FEMA completed their scope of work within the guidelines and the hydrology is not subject to an appeal.

Miscellaneous Notes

During the course of this review, a Manning's n typographic error was found on cross sections 189374.2 and 189279.9 where an overbank, forested area was assigned a value of 0.01 and should have been 0.1, while this may not have an effect on the results, it should be corrected during any subsequent analysis.

9. References:

1. Federal Emergency Management Agency, Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix C: Guidance for Riverine Flooding Analyses and Mapping, November 2009.
2. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS River Analysis System, User's Manual (Version 5.0), February 2016.
3. Federal Emergency Management Agency, Guidance for Flood Risk Analysis and Mapping, General Hydraulic Considerations, November 2016.
4. Federal Emergency Management Agency, Guidance for Flood Risk Analysis and Mapping, Hydraulics: One-Dimensional Analysis, November 2016.
5. Federal Emergency Management Agency, Guidance for Flood Risk Analysis and Mapping, General Hydrologic Considerations, February 2019.
6. Federal Emergency Management Agency, Guidance for Flood Risk Analysis and Mapping, Floodway Analysis and Mapping, November 2019.
7. New Jersey Administrative Code 7:13 Flood Hazard Area Control Act Rules. Date last amended: July 15, 2019