Board 29: A Service-Learning Project for Surveying Students: Establishing Base-Flood Elevations in Special Flood Hazard Area A

Dr. Salvatore Marsico, Pennsylvania State University

Dr. Marsico is an Associate Professor of Engineering and Legal Issues in Engineering in the University College of Penn State University.

Henrique Candido de Oliveira, Pennsylvania State University

Dr. Henrique Oliveira is currently an assistant teaching professor in the Department of Surveying Engineering – at Penn State University - Wilkes-Barre campus. His teaching responsibilities are in a broad area of Geomatics encompassing the areas of Photogrammetry, Remote Sensing, GIS. And Geodesy. His appointment began in August 2022 at PSU. Previously, Dr. Henrique was an Associate Professor at the University of Campinas (Brazil), enrolled in the School of Civil Engineering, Architecture, and Urban Design (from 2017 until 2022), teaching courses related to plane surveying, Photogrammetry, and Remote Sensing. His research is primarily in Surveying and Geospatial Science, working with topics related to engineering problems with attention to the Transport field. In 2010, he graduated in Cartographic Engineering, followed by a master's degree in Cartographic Science in 2013, both from the Sao Paulo State University in Brazil. During his PhD, he had the opportunity to develop part of his major at Purdue University and obtained his Doctorate certificate from Sao Paulo State University in 2016.

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Introduction

Floods occur naturally and can happen almost anywhere. They may not even be near a body of water, although rivers and coastal flooding are two of the most common types. Heavy rains, poor drainage, and even nearby construction projects can put you at risk for flood damage. A Base Flood Elevation (BFE) is the elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year. Designated BFE zones are shown on Flood Insurance Rate Maps (FIRM)[1]. However, detailed flood elevation analyses are not performed in Special Flood Hazard Zone A requiring maintaining flood insurance when financing a residence.

This paper describes a real-world project that surveying engineering students participated in. The project presented a unique opportunity for students to apply their skills to an important segment of surveying practice. The project was incorporated into a fall 2023 senior surveying engineering independent study one credit course. This project is typical of those that students from time to time are engaged in. The course's focus was on special topics within geomatics relating to GNSS and GIS applications. The course schedule provided for one hour lecture/recitation and two hours for lab and/or research. The enrollment for this independent study course was limited to two students: one third year and one 4th year having a GIS career path. The surveying faculty member, a cartographic engineer, enlisted an engineering and law faculty member for FEMA related aspects.

Flood Maps

Flood maps are one tool which communities use to identify areas having the highest risk of flooding. FEMA maintains and updates data through flood maps and risk assessments.[2] The flood maps show the likelihood that an area may experience a high risk of flood for which there is a 1% or higher chance of experiencing a flood during a 30-year mortgage[3]. Flood maps help the lenders determine the level of risk of flooding of a property with the understanding that there is "no such thing as a no risk zone, but some areas have a lower or moderate risk". The mapping process helps one to understand the flood risk and to make informed decisions about how to manage the risk.

A Community participating in the National Flood Insurance Program[4] has a floodplain administrator working with the FEMA team throughout the mapping process:

> "FEMA and the floodplain administrator work with local engineers and surveyors to collect the data to inform the maps. Community members are also invited to provide information to help local officials better understand how water drains in the area. FEMA works with local experts to create updated flood maps."[5]

Preliminary flood maps are available for community review during a 90-day period prior to adopting the maps. Subsequently, a property owner may challenge the designation that their property was incorrectly identified as a Special Flood Hazard Area (SFHA)[6] by submitting a

Letter of Map Change (LOMC) request. After FEMA reviews the map change request, it will issue a **determination document**, either a **Letter of Map Amendment (LOMA)** or a **Letter of Map Revision Based on Fill (LOMR-F)** approving or denying the map change.[7]

Once the determination letter is received, the property owner may send the letter to their lender and request that the federal flood insurance requirement be removed. Properties located in flood zones are subject to existing statutory limits on rate increases no more than 18% per year.[8] A recent study shows that properties in the 0.1% (100-year-flood) zone sale price decreased by 8.2%.[9]

Problem Statement:

Does a residence indicated as "out-as-shown"[10] on a FEMA Flood Map but reported as zone X on a Risk Summary require a request for a Letter of Map Change (LOMC) and can the request be made without the services of a surveyor or engineer establishing the elevations?

The faculty received a request from a homeowner to review the FEMA Flood Map Service Center[11] official map of their property. The Flood Map of the property indicated that the residence was within SFHA zone A for which no BFE is established by FEMA (Appendix A- Figure 1). However, the flood risk map (Appendix A- Figure 2) shows that the residence- living quarters- itself is not within the flood zone. Here is where the homeowner noticed conflicting data; i.e., the residence (living quarters) was not in the flood zone but a very small corner of a patio 60 feet from the residence indicated as being in the flood zone. The owner, recognizing this conflict, reached out to the surveying faculty to have students attempt to resolve the question of how equal elevations create a flood zone on only one portion of the residence.

Project Scope:

Two students from the Surveying Engineering department along with a faculty member participated in establishing the scope. The project scope entailed researching DOT data for a benchmark (BM) closest to the subject property, visiting the property location, performing leveling, and performing GNSS for contouring purposes together with elevation reduction considering orthometric height instead of geometric one:

Day1: Research FEMA map center information for the subject property – 2 hours (1 student)

Day 2: Visit subject property to locate the DOT Benchmark (Appendix A – Figure 3) and develop a plan to perform leveling from the DOT Benchmark to the entrance of the residence, and to designate the location of two Benchmarks for future field work – 4 hours (2 students and one faculty)

Day 3: Perform leveling, set the two benchmarks on property, and use GNSS Real-Time Kinematics (RTK) for data gathering for contouring purposes – 4 hours (1 student and one faculty)

Day 4: Perform post processing analysis of RTK dataset, and generate contour map of subject

property – 6 hours (2 students)

Day 5: Prepare a model elevation certificate client report, and plot contours - 4 hours (2 students).

Faculty field participation and oversight amounted to eight hours; review of the work performed by the students consisted of two hours.

Conclusion

This project provided students an opportunity to serve the local community using learned surveying skills applied to flooding. The project's overall scope enabled the homeowner to apply for a re-evaluation of the property's flood zone designation by filing a Letter of Map Change. Students having attended conference presentations on Base Flood Elevations always were under the understanding that elevations required for an elevation certificate were to be performed by a surveyor or engineer. However, students learned that FEMA forms allow homeowners can self-certify elevations. Although this project focused on one property it has provided an opportunity for follow-up student projects to review FEMA data for many flood-prone areas to identify properties which may be improperly designated thus eliminating the need for mandatory flood insurance. Base Flood Elevation projects can easily be incorporated in surveying courses and would provide an enormous benefit to students in preparing for their career. Overall, the students found this exercise to be meaningful due to its scope and impact. The students also expressed an appreciation of the project incorporating all aspects of surveying, from field work to processing of data to providing the client an opportunity to challenge a governmental action that at times has no basis in fact. BFE's are critical determinations that have high impact on homeowner finances and safety.

APPENDIX A

FIGURE 1- PROPERTY FLOOD INSURANCE RATE MAP (FIRM)

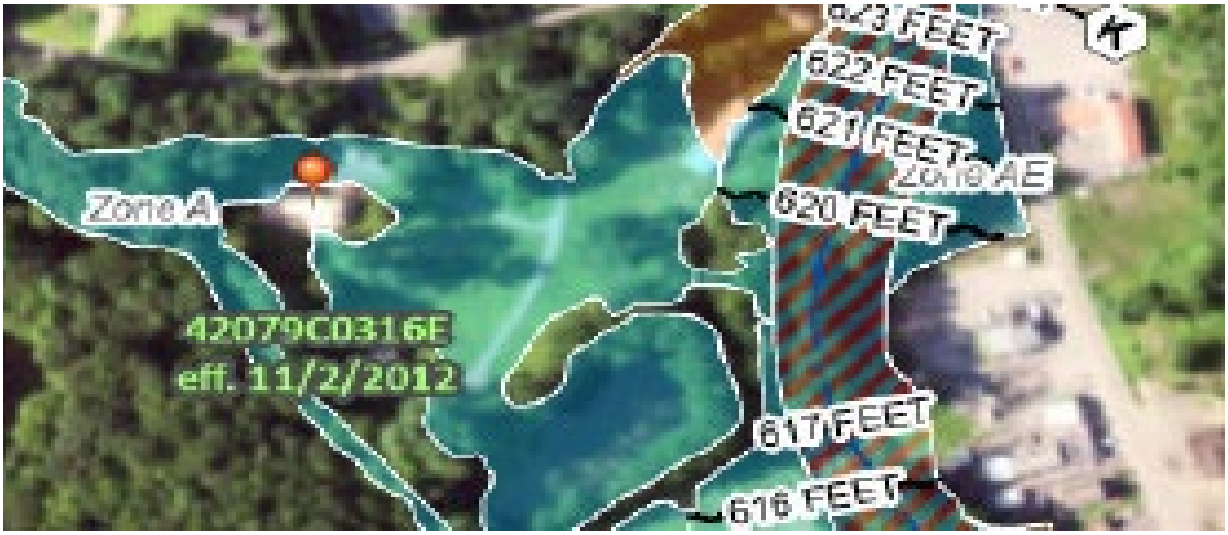

FIGURE 2- FLOOD RISK SUMMARY MAP

FIGURE 3 – SURVEYING BENCHMARKS

[1] FIRM zones: AE, AH, A1–A30, AR, AR/A, AR/AE, AR/A1– A30, AR/AH, AR/AO, V1–V30 and VE

[2] https://www.fema.gov/flood-maps

[3] https://www.fema.gov/flood-maps/tools-resources/risk-map/project-lifecycle

[4] FEMA. gov

[5] https://www.fema.gov/flood-maps/tools-resources/risk-map/project-lifecycle

[6] https://www.fema.gov/glossary/flood-zones

[7] A **LOMA** letter states that an existing structure or parcel of land *is on naturally high ground* that would not be inundated by flood; a **LOMR-F** refers to a structure or parcel *elevated by earthen fill* that would not be inundated by flood.

[8] https://www.fema.gov/flood-insurance/risk-rating

[9] Hill, Allison, "Do floodplain delineations decrease property values? Do floodplain delineations decrease property values?",(2015)

[10] https://www.fema.gov/sites/default/files/documents/fema_letter-map-amendment-out-shown.pdf

[11] https://msc.fema.gov/portal/home