INUNDATION TO DATE: FLOOD CHANGES OVER THE COURSE OF YEARS IN BARANGAY STA. MONICA, HAGONOY, BULACAN

A Case Study Presented to PAGASA-PRFFWC

San Fernando, Pampanga

In Partial Fulfillment of the Requirements for On-The-Job Training

of the Degree in Bachelor of Science in Environmental Science

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September 2021

INTRODUCTION

Background of the Study

Hagonoy is a 1st-class municipality on the coast of the province of Bulacan, island of Luzon. The municipality has a total land area of 103.10 square kilometers or 39.81 square miles subdivided into 26 barangays, accounting for 3.70% of the total area of Bulacan (PhilAtlas, 2021). Barangay Sta. Monica is one of the barangays in the municipality and is located at about 14.8393, 120.7368. At these coordinates, the elevation is found to be 7.4 meters or 24.3 feet above mean sea level (PhilAtlas, 2021).



Fig 1. Map of Hagonoy and Barangay Sta. Monica (OpenStreetMap)

With Hagonoy being deemed as a 1st class –municipality, it is safe to assume that Sta. Monica's socio-economic status is of 1st class as well. All barangays are also classified as urban by Philippine Statistics Authority (PSA, 2019). It has an estimated population of 8,168 people according to the 2020 Census. This represented 6.12% of Hagonoy's total population. In the 2015 Census, Sta. Monica's household population was 8,317, divided into 1,854 homes, with an average of 4.49 people per household. From the previous population of 8,317 in 2015, the newest census results in 2020 show a negative growth rate of 0.38 percent, or a reduction of 149 persons.

The municipality of Hagonoy is prone to floods as an effect from the overflow of water in Pampanga and Angat River, and Hagonoy River. Furthermore, due to high tide, many low-lying places in the municipality flood all year (Balgos, 2014). The classification of flooding susceptibility of each barangay varies depending on their geographical location, Barangay Sta. Monica was found to be one of the high-risk areas of the municipality based on the 2012 DENR-MGB study (DENR-MGB, 2012, as cited in Balgos, 2014).

Statement of the Problem

The main problem that the case study will be tackling is about the perceived flood changes in Barangay Sta. Monica by its residents over the course of years and how the facts align to these perceived flood changes.

Specifically, the case study is delving into;

- 1. What are the perceived flood changes in Barangay Sta. Monica by its residents over the course of five years from 2016 to 2020?
- 2. What are the perceived flood changes in Barangay Sta. Monica by its residents over the course of ten years from 2011 to 2020?
- 3. How to interpret the perceived flood changes using technical data gathered from various supporting sources?

These questions will be the guide into delving more about the flood changes case of Sta. Monica from then up to now.

Scope and Delimitations of the Study

The case study only tackles the flood changes of Barangay Sta. Monica over the course of years. This case study is done with an investigative approach, through gathering of perceived changes by the residents of Sta. Monica. In this paper, the term 'perceived changes' denotes to the perception of the flood experiences by the residents over the course of their residence in Sta. Monica, hence the usage of 'perceived'. While the perceived opinions are the key to this case study, this paper is by no means be focusing only in these perceptions. The researchers understand that perceived opinions vary widely from person-to-person and so their experiences were mostly highlighted than their opinion. The perceived changes and testimonial experiences were only used as a tool to have an understanding with the flood changes throughout Sta. Monica and will be further analysed and aligned to the technical data and archived facts that had happened across the years in Hagonoy, Bulacan.

Methods Used

With the study being conducted in a short time frame, the researchers utilized a combination of interview and survey of the residents of Barangay Sta. Monica. A small sample size were only utilized due to time and physical constraints. Four adult residents are interviewed for a much thorough and in-depth gathering of data. These four interviewees comprise of two adult males and two adult females to avoid gender bias. A survey in questionnaire form is also utilized in order to support the data gathered from the interviewees. A sample size of ten (10) respondents were gathered for the survey using random sampling. All of the data gathering methods were done through virtual means, with the interview being done through Messenger Call and Google Meet, and the survey being done through Google Forms.

BODY

The Case of Hagonoy's Growing Flood Concerns

The municipality of Hagonoy, alongside the municipality of Calumpit, has always been famous for being always flooded. If one would take notice to what the people of Bulacan say, Hagonoy has been humoured and colloquially dubbed as "The Land of the Rising Water", a humoured term for its consistently inundated town. Though the town is located in a flood-prone coastal area where tidal flooding is a regular occurrence, this hasn't always been the case.

Nanay Paning, a lifelong resident of San Nicolas, recalls a time when the Hagonoy River was larger, deeper, and cleaner. Hagonoy's lush mangroves, fireflies, and rice fields are now merely a memory of an elderly woman. The coastal communities of Hagonoy have become overcrowded. The streams have become settled upon by residents. The river has shrunk, the sea has become fish ponds, and wetlands have been reclaimed. Over the last four decades, the sea has steadily crept into the streets of coastal cities. Tidal flooding has made Hagonoy extremely vulnerable (Moya, 2014).

For four decades, the people of Hagonoy have learnt to deal with this daily reality of flooded streets and alleyways produced by surplus water from dams, rivers, or monsoon rain. Hagonoy, being a low-lying land and a coastal area, is located on the northern borders of Manila Bay, which are the key elements that cause the community to flood when it rains excessively. The Bustos Dam usually is unable to hold the water discharged from the nearby Angat and Ipo Dams, causing it to overflow. The rushing waves flow down the Pampanga River which serves as its catch basin and go through various barangays, including those in Hagonoy. With just a few drops of rain, the entire first-class municipality becomes a body of water (Mauricio & Aycocho, 2017).

Barangay Sta. Monica's Case

Sta. Monica is one of the barangay with high susceptibility to flooding in the municipality of Hagonoy. The term high susceptibility to flooding means flood heights of 1.0 to 2.0 meters and/or flood durations of more than 3 days are probable in the areas. These regions are quickly inundated after heavy rains that last several hours; they contain topographic low landforms such as active river channels, abandoned river channels, and areas along river banks; they are also prone to flashfloods (DENR-MGB Region III, 2012, as cited in Balgos, 2014). Since then, Sta. Monica has been experiencing flooding alongside with the other barangays in Hagonoy. They are soon entering the 5 decades history of flooding since the great 1972 flood that affected the island of Luzon.



Fig 2. Flood Marker in Sta. Monica

The Barangay Hall of Sta. Monica has these ruler-like markings in a post which serves as a gauge and warning about the river's water level which can also be called a flood marker. Though Barangay Sta. Monica is not close to the shores unlike other coastal barangays of Hagonoy as seen on the Fig 1, it remains susceptible to high risk of flooding. Figures 3 and 4 show that the risk of Barangay Sta. Monica in a 100-Year Flood Hazard and 5-Year Flood Hazard map.



Fig 3. 100-Year Flood Hazard Map, with red as 1.5 m above (NOAH)



Fig 4. 5-Year Flood Hazard Map with red as 1.5 m above (NOAH)

A "100-year flood" is an event or place where there is a 1% chance of a flood of a specific size occurring in any given year (Holmes & Dinicola, 2010). Thus, a 5-Year Flood Hazard is a

20% chance of flood. With Sta. Monica bearing red in both flood hazard maps, shows that the barangay is susceptible to high inundation.

The Resident's Point of View: Presentation of Data

To put a context as to what flood changes the residents of Barangay Sta. Monica experience, we conducted interview first and then created a survey to further support the testimonies in the interview. The interview and survey consisted of eight (8) questions, comprising of four (4) close-ended questions and (4) open-ended and opinion-based questions with more follow up questions for the interview session, unlike in the survey form.

Close-Ended Questions	Opinion-Based Questions			
1. How often do you experience flooding in	5. Have you experienced changes in flooding			
Sta. Monica in a yearly basis?	over the course of 5 years? (2016-2020)			
2. What is the usual height of the flood you	6. Have you experienced changes in flooding			
experience?	over the course of 10 years? (2011-2020)			
3. What year and month can you remember is	7. What do you think is the cause of the			
the highest flood height you experienced over	changes of flooding over the years in Sta.			
the course of 10 years (2011-2020)?	Monica?			
4. What is the height of the highest flood you	8. Are there changes in land use in Sta. Monica			
experienced?	over the course of years? Do you think this			
	affected the changes of flooding in your area?			

Table 1. Questionnaire

The questionnaire in the survey form consisted of both Tagalog and English versions of the question to ensure that the respondents will be able to understand the question in their own preferred language. With the more in-depth interview that has been conducted, the researchers were able to get a hold of the context of what the residents of Sta. Monica experiences when it comes to flooding situations. In order to understand the flood changes in Sta. Monica, the residents' usual experiences with inundation were first asked before delving into their perceived changes. The 1st Interviewee, which resides in Purok 2 of Sta. Monica, explained that he experiences usual flooding in the rainy season, particularly from July to December in a yearly basis. During January to May however, he experiences inundation due to high tide. These usual flood experiences are about knee-height. The month and year in which he experienced the highest flood was during October of 2015, with a flood that reached up to chest-height.

The 2nd Interviewee, which resides in Purok 8 of Sta. Monica, explained that he experiences usual flooding during typhoons and monsoons only. He explained that he never experiences tidal inundation anymore due to it being contained by the road heightening. These usual flood experiences are about knee-height as well. The month and year in which he experienced the highest flood was during August of 2012, with a flood that reached above human-height.

The 3rd Interviewee, which resides in Purok 7 of Sta. Monica, explained that she only experiences flooding during typhoons and monsoons only. She encounters tidal inundation almost every day nowadays but it doesn't reach her house that much, only in alleyways. These usual flood experiences are about mid-calf height. The month and year in which she experienced the highest flood was during September of 2011, with a flood that reached above human-height.

The 4th Interviewee, which resides in Purok 3 of Sta. Monica, explained that she experiences flooding every tidal inundation. These usual flood experiences are about mid-calf height as well. The month and year in which she experienced the highest flood was during October of 2015, with a flood that reached up to chest-height.

These claims about the usual flood experiences by the interviewees are also supported by the results in the survey.



Fig 5. Yearly Flood Experience

As shown in the Figure 5, respondents in the barangay Sta. Monica experienced flooding for two reasons: due to high tides, and due to typhoons and monsoon. Out of 10 respondents, 8 respondents experienced the flood every high tide and the other 2 respondents experienced floods during typhoons and monsoon.



Fig 6. Flood Height Experience

Figure 6 reveals the usual and severe flood experience of the respondents for over the years. For the usual experience, 5 out of 10 respondents experienced a knee height flood, 3 out of 10 respondents experienced a mid-calf height flood, and 2 out of 10 respondents, experienced a thigh height flood. These usual flood heights were experienced due to the rising of river water level during high tide seasons. For the severe experience, 3 out of 10 respondents experienced a chest height flood, 2 out of 10 respondents experienced waist height flood, 2 out of 10 respondents, experienced a chest height flood, 2 out of 10 respondents experienced waist height flood, 2 out of 10 respondents, experienced neck height flood, 2 out of 10 respondents experienced 2 meters above flood, and 1 out of 10 respondents a thigh height flood. These severe flood heights were experienced due to the rising of river water level



Fig 7. Year of Severe Flood Experienced

In Figure 7, it shows the year of when the respondents experienced severe flooding. 5 out of 10 respondents experienced severe flooding during the year of 2013, mostly on the month of November where Typhoon Yolanda strikes the country; 1 out of 10 respondents experienced severe flood during 2014; 1 out of 10 respondents experienced severe flood during 2015; 1 out of

10 respondents experienced severe flood during 2015, 1 out of 10 respondents experienced severe flood during 2016, and 1 out of 10 respondents experienced during last 2020 when continuous typhoons strikes the country.

For the residents' perceived flood changes over the course of five years (2016-2020) and ten years (2011-2020), all interviewees have pretty interesting answers, due to having disparate answers. When asked about the 5-year flood changes, the 1st Interviewee explained that five years ago, the main roads do not get flooded but as the years went by, almost the entirety of Hagonoy gets inundated. For the 10-year flood changes, he explained that though flooding has always been happening in this age, floods are now higher these days than a decade ago.

For the 2nd Interviewee when asked about the 5-year flood changes, he explained that he experiences fewer inundation now than 5 years ago. This is due to the road heightening being in favour to their house settlement. But he recognizes the fact that this road heightening did not favor those that are near the tributaries. For the 10-year flood changes, he explained that high inundation is much frequent than before.

For the 3rd Interviewee when asked about the 5-year flood changes, she explained that floods due to storms and monsoons are much lower due to road heightening but this made the tidal inundation much worse, especially those near the river tributaries. For the 10-year flood changes, she explained that before, only strong typhoons cause inundation but nowadays, even the trickle of rain already causes flooding in their area.

For the 4th Interviewee when asked about the 5-year flood changes, she explained that only the roads get flooded, especially during high tide but nowadays their home also gets flooded. For

the 10-year flood changes, she explained that the floods before are much lower and less frequent than what the floods are now.

These somewhat differences and disparity about the flood changes are supported in the survey results.



Fig 8. Flood Changes for 5-year span (2016-2020) and 10-year span (2011-2020)

Figure 8 shows whether the respondents notice flood changes in their area for the span of 5 years (2016-2020) and 10 years (2011-2020). For the 5-year span, 6 out of 10 respondents haven't noticed any flood changes, and 4 out of 10 respondents noticed some changes in flooding. For the 10-year span, 8 out of 10 respondents they noticed lot of changes in flood in their area, and 2 out of 10 respondents haven't noticed any changes at all. With these, it implies that in the past 5 years, flood changes in barangay Sta. Monica haven't changed that much where some minor changes weren't noticeable for the residents while in the past 10 years, the flood changes in the area were almost seen and noticed by the respondents as some changes in their area happened for this span of years.

And for the question of their perception as to what they think is the cause of these flood changes in Barangay Sta. Monica, all of the interviewees had similar perceptions. All of the interviewees claimed that road heightening, tide embankment and river pollution are the leading causes of the flood changes in Sta. Monica over the course of years. These claims are also backed in the survey results by the survey respondents.



Fig 9. Reasons of Flood in the Area

Barangay Sta. Monica lie near the coastal of Hagonoy River which mainly the one of the reasons for the flood occurrence in the area. In Figure 9, it shows other possible reasons why the area suffered for the severe flood changes as years passed. 8 out of 10 respondents said that the reason of flood changes for years is clogged canal which is caused by the improper waste disposal of some residents in the area, and 2 out of 10 respondents said that the reason of flood changes for years is the road heightening happened in their area where the flood didn't flow in naturally causing it to remain stocked in low areas.

How the Facts Come Into Play: Analysis of the Data

The first thing that the researchers have noticed is the pattern of similar answers from residents that reside within the same Purok.

Respondents	Purok	Usual Flood Experience		
1 st Interviewee	2	Every High Tide		
Survey Respondent 1	2	Every High Tide		
Survey Respondent 5	2	Every High Tide		
Survey Respondent 6	2	Every High Tide		
Survey Respondent 7	2	Every High Tide		
4 th Interviewee	3	Every High Tide		
Survey Respondent 4	3	Every High Tide		
Survey Respondent 9	3	Every High Tide		
Survey Respondent 10	3	Every High Tide		
3 rd Interviewee	7	Every Typhoon and Monsoons only		
Survey Respondent 3	7	Every Typhoon and Monsoons only		
2 nd Interviewee	8	Every Typhoon and Monsoons only		
Survey Respondent 2	8	Every Typhoon and Monsoons only		
Survey Respondent 8	6	Every High Tide		

Table 2. Pattern of Similar Answers by Purok

As shown in the Table 2, residents that reside in Puroks 2 and 3 usually experiences flooding every tidal inundation, while residents in Puroks 7 and 8 usually experiences flooding every typhoon and monsoons only. This suggests that Purok 2 and 3 residents are near a water body while the residents in Purok 7 and 8 may not. However, this is not always the case. As explained by the 2nd Interviewee, he resides near a river but a high road separates them. This high road contains the tidal inundation and therefore doesn't reach them. On the other hand as explained by the 1st Interviewee, he resides next to a tributary and so their usual flood experience is of tidal kind. This suggests that even though the respondents are located within the same barangay, there are still disparities with usual flood experience due to differences of the topography they reside.

For the perceived flood changes in a 5-year course and a 10-year course, there are differences in opinion regardless of the Purok they reside in. This suggests that their perceived flood changes do not depend entirely around their immediate location. And while there are differences in opinion, the majority of respondents does agree that there are apparent changes in both 5-year course and 10-year course. Interestingly enough, majority claims that the flooding situations have always been there from 2011, the situation just got apparently worse as the years went by. This finding also shows that there aren't much of a difference between the 5-year course and 10-year course of flooding.

The Notable Typhoon Experiences

Accounts of the worst flooded situation by the respondents were also gathered in order to gain contextual understanding as to what the residents have experienced. These accounts of severe flood experiences are cross-examined with technical data and information that can be gathered across the web.

The respondent aged 21-years-old from Purok 5, shared that she experienced the worst flood from September 2009 during the Typhoon Ondoy. She labelled the floodwaters as neck-high deep. Typhoon Ondoy dumped a month's worth of rain in just 24 hours. Hagonoy, along with other municipalities, was left severely flooded and damaged after the heavy rainfall brought by this 2009 typhoon. 22-year-old 3rd interviewee from Purok 7, stated that the flooding made by Typhoon Pedring from September 2011 left a great impact to her. She described it as "Lagpas tao na baha" at about 2 meters deep.

Narratives of other residents are stated from the study of Balgos (2014). Barangay Sta. Monica resident, 45-year-old Nilo Clemente, described the water level during Typhoon Pedring as "Deeper than a man's height." He stated, "...for two weeks, we had no business operation. We simply relied on the supply of relief goods. Because of the typhoon, the roof of our garage was blown off. We did not flee since our house is sufficiently tall."

Barangay Captain Leopoldo Medina of Sta. Monica, Hagonoy, said that the water was deep and that it lasted approximately a month. He further stated that the local and national roadways were inaccessible and impassable. As a result, they had to rely on boats to transport relief goods. According to Kapitan Leopoldo's accounts, crops were also harmed, and skin illness was widespread. He also recalled his house being buried in water for 14 days when Typhoon Pedring struck. According to him, the water was neck-deep, and the fishpond owners lost money were badly impacted (Balgos, 2014).

Purok 8's 21-year-old 2nd interviewee answered that the 2012 Habagat floods was the one that left the most memory to him. The 2012 Habagat rains was brought by Typhoon Gener and further enhanced by Typhoon Haikui. He experienced a height of 1-2 meters floodwaters which left them to evacuate to higher elevation. In 2012, the increased southwest monsoon or Habagat rains caused flooding in Sta. Monica experiencing 1-2 meters of water and other neighboring municipalities and towns (Gamos, 2012, as cited in Balgos, 2014).

Male respondents aged, 22 and 24, and female respondent aged 20 from Purok 2; 2 female respondents from Purok 3, aged 18 and 19; and 20-year-old male respondent from Purok 7; all stated that the November 2013 or from Typhoon Yolanda flood was the one that they have experienced the hardest. But upon checking, Typhoon Yolanda has made a landfall in Central Visayas and some part of Southern Luzon (see *Fig 10*). The typhoon has no big effect on Central Luzon, therefore also in municipality of Hagonoy.



Fig 10. Track of Typhoon Yolanda (PAGASA, as cited in GMA News Online, 2013)

The correct typhoon that must have hit the majority of Luzon is the Typhoon Santi that happened last October 2013 (see *Fig 11*).



Fig 11. Track of Typhoon Santi (PAGASA, as cited from Rappler, 2013)

They all have different accounts on the flood water level that they experienced. All interviewees in Purok 2 stated that they have 2 meters high flood except with one who said a neck-high flood. Purok 3 interviewees have different opinion, one have chest-high while the other was neck-high flood. Interviewee from Purok 7 said to also have chest-high flood experience. These differences must be because of their closeness to river and belongingness to diverse Puroks.

Typhoon Santi poured enough rainfall that caused greater water elevations at the Candaba and Sulipan stations, causing the backfloods to Calumpit and Hagonoy. Given the region's topography, backfloods are a natural occurrence (Balabo, 2013).

Purok 8's 23-year-old female respondent and Purok 3's 19-year-old female respondent both answered year 2014, specifically month of December. They described the flood as thigh-high and chest high deep. During this time, Typhoon Ruby entered the Philippine Area of Responsibility (PAR). 22-year-old 1st interviewee from Purok 2 and 18-year-old 4th female interviewee from Purok 3 and both claimed that October 2015 floods greatly affected them. Both of them described that the flood is chest-high deep. The October 2015 flood is brought by Typhoon Lando, which also left a hefty damage to properties and agriculture.

Purok 6's 22-year-old female respondent shared that the 2016 floods are notable for her. She described the level of floodwaters as high as waist height. Among the Typhoon that entered the country during that year, Typhoon Karen from October 2016 and Typhoon Nina from December 2016, mostly strucked the island of Luzon.

The last female respondent, 18-year-old, answered year 2020 as the time where the highest flood she observed. She described the flood to be as high as waist height of a man. During this year, Typhoon Rolly and Ulysses drenched and damaged the majority of Luzon.

Yolanda False Memory

Due to the popularity of Typhoon Yolanda as the most destructive typhoon in year 2013, the respondents maybe have had a false memory of these rain and flooding situations. Upon checking, Typhoon Santi was the one that struck the island of Luzon around the same time as Typhoon Yolanda. This is in line with the trajectory of both typhoons that hit the country. The researchers wanted to highlight this possible misinformation to give light to the true happenings during this year.

The Flip Side of the Coin: Possible Technical Truth of the Case

While it is a general accepted and regarded truth that the road heightening, clogged canals and river pollution are the cause of flood changes in Sta. Monica, Hagonoy, especially as this is claimed first-hand by the residents themselves, there might be deeper underlying truth to this case.

Surely, the provincial and municipal government of Bulacan must have done several projects in order to ease the flooding situations in Hagonoy. One of these is to raise the roadways to make them passable, but residents who are unable to raise their homes to match them suffer. For one account, the Bulacan provincial administration and the Department of Public Works and Highways have begun significant dredging of major rivers and canals in the province to alleviate the province's perennial flood problem, particularly in Hagonoy and Calumpit (The Manila Times, 2016). But river dredging have been debated to have large disadvantages. In relation to the catchment from which it takes its water, a river's capacity is minimal. Dredging can boost a river's flow, but this will likely result in faster and more dangerous floods downstream (Monbiot, 2014). In order to understand why flooding in Hagonoy has been the normal way of things, one must look at the area as to what it really is.

With how Barangay Sta. Monica is located, it's safe to assume that the town is situated in the flood plains of Pampanga River. As shown in the Figures 3 and 4 above, Sta. Monica and its adjacent barangays are near the path of Pampanga River. This may also mean why these areas are of higher risk in flood hazard than their neighboring barangays. In one statement by Hilton Hernando, head of Pampanga River Flood Forecasting and Warning Center (PRFFWC), flanked by mountain ranges in the east and west, Central Luzon at the middle is floodplains with river tributaries draining into Manila Bay (Balabo, 2013).



Fig 12. Illustration of Encroachment of Flood Plains (Lagmay, 2021)

This encroachment of floodplains would explain the apparent frequent flooding in Barangay Sta. Monica and the entirety of Hagonoy. Dr. Mahar Lagmay, who teaches at the National Institute of Geological Sciences wrote, "This is what happens when we settle on floodplains and claim that piece of land which is a natural part of the river or stream." Dr. Lagmay also showed the top 10 affected population by province in the Philippines due to encroachment of floodplains.



Fig 13. Encroachment of Floodplains Affected Population by Province (Lagmay, 2021)

The figures shown in Figure 11 are from the fruits of labor from the extensive work of University of the Philippines' Project Nationwide Operational Assessment of Hazard or Project NOAH. This figure just shows the truth behind the never-ending flood situations in the municipality of Hagonoy.

CONCLUSION

Summary and Conclusion

With the discussions stated above, the researchers therefore conclude that the perceived flood changes by the residents of Barangay Sta. Monica varies from person-to-person and from where they are particularly located in the barangay. Usual flood experiences are of the tidal nature and the typhoon and monsoon instances. Flood changes in the 5-year course and 10-year course are apparent among the residents but show no significant difference, owing to the fact that the town already experiences frequent flooding over the course of years. And though there are disparities from person-to-person point of view, the general respondents agree that the road elevation, clogged canals and river pollution are the leading cause of the flood changes. When technical information comes into play, several factors do not align with the respondents' testimonies, like in the case of Typhoon Yolanda. However, these accounts do not change the fact that flood situations in Sta. Monica steadily worsens as the years go by.

Recommendation

With a 10-year span used in the study, flood changes in the barangay Sta. Monica, Hagonoy wasn't seen that much by the residents, and only minor flood changes have been noticed by them. Based on the survey results, the only changes that the respondents noticed was the rising of flood due to the road heightening happened in the area within the span of 10 years. Since only 10-year time frame were used for this study, the results weren't enough to determine the flood changes. The researchers recommend to do the study for 40 years to 50 years, if data is available to better frame the flood changes in Hagonoy. This span of years are recommended due to accounts of Hagonoy experiencing frequent inundation for about 4 decades and nearly 5 decades already.

One account of flood events spanning nearly 5 decades is the narrative by siblings Ildefonso and Bienvenido Villanueva during the 1972 flooding in Sta. Monica. According to the two, it was also the most devastating flooding event in their community. They vividly remembered that they rely mostly on relief supplies, and that many people contracted ailments such as cough and flu as a result of the flooding (Balgos, 2014). This just proves that, in order to see the bigger picture of the flood changes in Sta. Monica, one must set the frame wider.

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Annex

Flood Survey Form for Sta. Monica, Hagonoy Residents					
Ang sarbey na ito ay para sa mag-aaral ng Bulacan State University na kasalukuyang nag- aaral ng BS Environmental Science, at kasalukuyang nag-iintern sa PAGASA-PRFFWC.					
Walo (8) lamang ang mga tanong na iyong sasagutan. Ang mga impormasyon na aming makakalap mula sa iyo ay gagamitin lamang para sa case study at wala nang iba pa. Ang iyong kooperasyon ay malugod naming pinapasalamatan.					
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Annex A. Flood Survey form for Sta. Monica in Google Forms

Appendices

Appendix A. Interview Transcript conducted using Tagalog Language

Interview #1

Interviewer: Magandang tanghali po! So start po tayo sa kung saang purok kayo nakatira at saan malapit na landmark, particularly kung sa ilog o sa kalsada. Ganun po.

Interviewee: Sta Monica Purok 2 Malapit kami sa bayan tabi kami ng sapa.

Interviewer: Ah so malapit po kayo sa may bandang sapa?

Interviewee: Oo. Dito sa pagitan ng Barangay Sta. Monica tyaka ng Barangay Santo Niño, pahaba na yun. Tatawid lang ng kalsada dito na yung bandang ilog

Interviewer: Ayun po ano, so bale gaano po kadalas ninyo nararanasan ang pagbaha kada taon?

Interviewee: More than a half year siguro. Mas madalas siya pag ganto.

Interviewer: Kalahating taon po? Paano pong kalahating taon?

Interviewee: Ah ganto July August September Hanggang December

Interviewer: Ah bandang rainy season po ano? Latter half ng year. July to December. So pag January to June, wala po?

Interviewee: Basta tuwing January to May yun yung puro high tide lang. Pero sa Totoo lang halos araw araw na.

Interviewer: Ah ngayon po, halos araw araw na?

Interviewee: Ngayon, oo. Kagaya ngayon. Ngayon high tide meron sa kalsada

Interviewer: Umaabot po yung high tide sa bahay ninyo?

Interviewee: Hindi naman pero minsan pag sobrang laki ng high tide umaabot sa bahay. Lalo pagka sumabay siya sa ulan o kaya sa bagyo tapos malaki yung high tide.

Interviewer: Ah so pag hindi po malaki high tide, sa kalsada lang po?

Interviewee: Oo. Sa kalsada kasi mataas na yun pero hanggang tuhod pa rin yung tubig dun. Pero pag sa looban hanggang bewang hanggang bewang na yung tubig sa mga looban ng mga street.

Interviewer: Street? Ah ibig sabihin nyo po sa kalsada yung main road?

Interviewee: Opo

Interviewer: Tapos yung street yung sa alleyways?

Interviewee: Oo. Marami na rin kasing nasirang palaisdaan dito. Mga bahay na Nasisira dahil sa paglubog ng tubig

Interviewer: Sige po. So next question po ay may napansin po ba kayong pagbabago sa pagbaha sa Sta. Monica, over the course of 5 years? Let's say po na 2016-2020.

Interviewee: Oo mas tumaas, dati kasi 2016 dating di pa talaga nilulubog ang mga kalsada dito sa Hagonoy pero habang tumatagal halos buong Hagonoy lumulubog na yun yung napansin kong pagbabago.

Interviewer: I see po. How about po sa course of 10 years? May nakita po ba kayong pagbabago sa pagbaha sa loob ng sampung taon? Sabihin po natin na 2011-2020.

Interviewee: Oo mas lalong dumumi ang tubig baha mas lumalim mas malawak yung baha. Parehas yung lang din naman, mas maano yung 2011 mas mababa sa kaysa ngayon siguro. Di naman inaabot yung kalsada noon sa mga looban mga hanggang tuhod lang ganun.

Interviewer: Ano po yung Natatandaan pinaka mataas na pagbaha sa naranasan nyo sa inyo, ano po kaya ung taon?

Interviewee: Natatandaan ko po 2015 po.

Interviewer: Ano po ng buwan? Natatandaan niyo po ba kung anong buwan?

Interviewee: 2015 nga ba iyon? Yung panahon po ng Ondoy. Basta 2015, yun po yung pinakamataas na lagay ng tubig.

Interviewer: Hanggang saan po naranasan nyo tubig sa loob ng bahay?

Interviewee: Sa bahay namin hanggang dibdib yung tubig.

Interviewer: Edi mas mas mataas po dun sa ibang lugar sa Sta Monica?

Interviewee: Marami lalo na doon sa mga bukid sa fishpond mataas yung tubig halos halos nasira lahat halos magmukha ng dagat talaga.

Interviewer: Meron po ba sainyong nagbabalita sa pagtaas ng high tide sa inyo or may material or gadget na malalaman kung kailan yung high tide?

Interviewee: Sa kalendaryo mo makikita yung kung gaano ka taas ng tubig

Interviewer: Sa tingin niyo po, kung meron po kaya kayong idea or sariling opinyon niyo po ang dahilan kung bakit nagkaroon ng pagbabago sa baha kagaya po nung nabanggit nung ng 2016

hindi kataasan pero ngayon mas mataas na at mas madumi. Ano po kaya sa tingin niyo ang dahilan sa Sta. Monica lang po mismo?

Interviewee: Para saakin nasa tao din naman yung problema para sa akin kasi sa problema sa pagtapon ng basura sa pagiging walang disiplina sa sa pagtapon ng basura kung saan-saan lang tinatapo. Ayun yun lang talaga.

Interviewer: Ah sa tingin niyo po na parang mas dumami po yung basura sa Santa Monica?

Interviewee: Oo ganun na nga po

Interviewer: May napansin po ba kayo ng pagbabago sa for example na may mga bagong establishment nadating naka dulot din po ng pagbaha ganun po? May napansin din po ba kayo? Ano po ito?

Interviewee: Ano po yung pagtaas din po ng kalsada dito sa amin

Interviewer: Yung main road po ba?

Interviewee: Oo halos lahat kasi lahat ng Barangay dito tinaasan lahat ng kalsada yung mga dating binabaha sa Santa Monica.

Interview #2

Interviewer: So ayan, good afternoon po ulit. Start po tayo, Ready na po ba kayo? Interviewee: Yes, okay.

Interviewer: Okay ready na po. So start po tayo sa paki-describe po kung sa kayo malapit lalo na po kung malapit sa ilog or san po kayo nakatira?

Interviewee: Taga- Sta. Monica po ako, purok 8. Um medyo malayo kami sa ilog. Kunware eto yung ilog tas bahayan tapos kalsada tapos bahayan. Dito kami sa bahayan malapit sa kalsada kung saan kabila pa namin yung ilog

Interviewer: So next question po tayo. Gaano nyo po kadalas naee-experience yung pagbaha sa isang buong taon po

Interviewee: Ngayon kassi kung sa isang buong taon siguro kapag bumabagyo na lang and bumabagyo naman every year. Yung pagbaha kasi diba magkaiba ang pagbaha sa high tide Interviewer: Yes po pero okay din naman po sa tuwing pag-high tide po ba nakakaranapo ba kayo ng pagbaha

Interviewee: Yung pagbaha saamin umaabot pero kapag high tide naman hindi na masyado Interviewer: Kung high tide naman po saan po banda bumabaha, bandang kalsada po ba or somewhere?

Interviewee: Bandang, diba nga ilog tapos bahay tapos kalsada tapos sabahayan ulit. Normally dun na lang sa tabing ilog na bahayan yung binabaha hindi na umaabot sa kalsada pero before talaga kapag bumaha or high tide inaabot talaga kami

Interviewer: Natatandaaan nyo po ba kung anong time po kayo inaabot ng baha?

Interviewee: 2013-2014 po siguro

Interviewer: Ahm mga 2013-2014 po pala, ganun taon po ba nagkaroon ng pagtaas ng kalsada? Interviewee: Ahm opo Interviewer: So yun sakto po, yun din po kasi sinabi saamin nung unang na-interview namin. So ano po yung usual height ng baha nararanasan nyo po.

Interviewee: Ano pabinaha. Last na baha dito october last year. May bagyo din nun hanggang tuhod.

Interviewer: Every year may bagyo po ba nakakaranas po kayo ng pagbaha?

Interviewee: May mga bagyong hindi namn kami binabaha.

Interviewer: May natatandaan po ba kayong noteable na bagyong nabaha kayo? Or hindi na po?

Interviewee: Last time na pinaka mataas lagpas tao sya nung habagat yung nakaraan lang. Anong grade ba ako nun garde 9 ako nun. Yung time na yun lagpas tao yun

Interviewee: Grade 8 po yata. Di pa po mataas yung kalsada nun dito.

Interviewer: May pagbabago ng pagbaha sa over the course of 2016-2020. Meron po ba?

Interviewee: Meron naman in the span of 5 years mas hindi na kami binabaha. Ngayon hindi na sya inaabot. Pero yung mga mas malapit sa ilog mas malala. Tapos maginhawa na saamin Interviewer: Sa 10 years naman po? Ano po napansin n'yo?

Interviewee: Mas tumataas na rin po yung pagtaas ng baha. Dahil rin po sa pagtapon ng basura mas tumaas yung baha kasi hindi naman po nililinis at tumaas din po yung bilang ng nakatira dun ngayon

Interviewer: In terms po sa frequency may napansin po ba kayo ngayon kunware mas naging bahain po in 10 years

Interviewee: Mas madalas ngayon kasi mas madalas ngayon na tumaas. Dati kasi hindi naman umaabot eh ngayon kasi mas tumaas tyaka everyday na sya nakikita ko.

Interviewer: Ano po yung taon naalala nyo po na mataas talaga yung pagbaha sa inyo

Interviewee: Ano 10 years lang? 2012 ayun yung umabot ng 1st floor namin tapos nasa 2nd floor lang kami as in umaabot ng kisame.

Interviewer: Grabe po pala, Natatandaan nyo po kung gaano katagal yung pagbaha na yun? Interviewee: Nako matagal yun, siguro halos 1 week pero hindi namana ganun kataas,siguro 1 week pero bumababa naman sya.

Interviewer: So dito naman po tayo sa opinion based question naman po tayo. So tingin nyo po anong dahilan ng pagkakabago ng pagbaha

Interviewee: Ano dahil sa population and mas accumalated yung basura sa ilog then pataas ng kalsada. Hindi din maganda yung sewage system sa Santa Monica kasi nakikita ko talaga na bumabara sila sa drainage

Interviewer: May changes po ba paggamit sa lupa, or pagbabago sa land use na sa tingin nyo po nakaapekto

Interviewee: Wala naman halos tinatayo dito sa Santa Monica.

Interview # 3

Interviewer: Ayan so good evening po, Ano po tayo sa pag gusto ko na kung saan po part ng Santa Monica nakatira? Interviewee: Ayan so sa Sta Monica Purok 7 ako tapos kung describe ko yung lugar namin eh mismong bahay likod namin ilog tyaka malapit na rin kami sa ilog ng san Agustin pero dito ngayon, may ilog sa likod namin then dito kasi sa Sta. Monica may ilog sya so malapit din kami sa dike

Interviewer: Ipapasharescreen ko rin yung map para mapaano namin, mavisualize tapos turo nyo po kung saan banda.

Interviewee: Eto lang po yung Sta. Monica Ayan. Diba po, San agustin tapos Tampok tapos Sto. Nino

Interviewer: Ah ganun po ba, proceed na po tayo dun sa mga tanong ko na inihanda naming, Gaano kadalas kayo makaexperience ng pagbaha sa isang buong taon?

Interviewee: Depende sa kung madalas umuulan mas madalas din yung baha kung iyong average sa isang taong minsan dalawang beses bumabaha tapos kasi ngayon araw-araw na yung high tide na halos kasing taas na rin ng baha.

Interviewer: Kapag po ba umaabot sa bahay ninyo hanggang saan po kaya yun? Pwede nyo po ba sabihin kung hanggang saan kung umaabot po ba sa bewang, tuhod or kung saan?

Interviewee: Kapag high tide ano lang siguro binti pero kapag baha sa labas lagpas tuhod so siguro mga hita ganun

Interviewer: Ayun po no, so over the course of five years 2016-2020, Meron po ba kayong napansin sa pagbago sa pagbaha sa sta. Monica mismo?

Interviewee: So ano kasi yung mga kalsada kasi dito nagsitaasan na kung 2016 malalalim yung mga na-expierence namin na pagbaha, Ngayon di na sya ganun kalalim kasi nga nataasan na ung mga kalsada.

Interviewer: So mas bumaba na yung pagbaha dahil sa pagtaas ng kalsada?

Interviewee: Ayun mas bumaba yung pagbaha pero yung high tide mas kumbaga mas lumala Interviewer: How about the over the course of 10 years 2011-2020 ano po yung napansin nyo time frame na yun about sa pagbaha

Interviewee: Ano kahit konting pag ulan na lang bumabaha na , di sya tulad dati na dapat halos a month long para bumaha, Eh ngayon konting pag ulan lang bumabaha na.

Interviewer: Sa konting ulan lang yun gaano na po agad kataas ang pagbaha?

Interviewee: Tuhod

Interviewer: So sa mga pagbaha yung naranasan nyo, ano po yung taon at buwan na pinaka mataas na naranasan nyo yung pagbaha?

Interviewee: Tandang tanda ko yun, Yun yung Pedring kasi lumubog yung second floor namin Interviewer: Pedring?

Interviewee: Oo

Interviewer: Hanggang second floor yung baha?

Interviewee: Oo, hanggang second floor merong tubig sa taas namin, Lagpas tao sya.

Interviewer: Grabe po pala nung bagyong pedring. Inonote po namin yan. Thank you po sa detail na yun

Interviewer: Ahm, Dito po tayo sa bandang opinion-based questions. So sa tingin nyo po ano po kaya ang dahilan ng pagbabagong pagtaas, tulad po ng sabi nyong pagbabagong naganap over 5 years tyaka 10 years. Ano po sa tingin nyo yung dahilan kung bakit nagkaroon ng pagbabago sa pagbaha sa sta. Monica?

Interviewee: Ahm siguro yung pinaka main factor yung pagtaas ng kalsada. Ang ginagawang solusyon kasi ng gobyerno is taas lang ng taas ng kalsada. Dapat kasi yung ginagawa nila yung mismong excavation ng mga ilog. Masyadong ng mababaw yung mga ilog konti ano lang napupuno agad tapos kakataas ng kalsada na iiwanan yung mga bahay so yung tubig hindi sya nagfflow sa kalsada so instead nadidistribute sya sa mga bahay.

Interviewer: So masasabi nyo po bang yung pagtaas ng kalsada is nakatulong or mas nakadulot ng perwisyo kesa gumihawa

Interviewee: Mas naging perwisyo.

Interview #4

Interviewer: So ayun po good evening po! Start po tayo sa tanong na saang purok po kayo nakatira?

Interviewee: Sa Purok 3 po ako nakatira.

Interviewer: Sa isang buong taon po, gaano kadalas po kayo nakakaranas ng pagbaha dyan sa Sta. Monica?

Interviewee: Tuwing may bagyo po pero kadalasan po tuwing high tide binabaha na po kami eh.

Interviewer: Ah so it's safe to say po na tuwing high tide, talaga pong binabaha na kayo?

Interviewee: Opo.

Interviewer: Gaano kataas po yung nararanasan nyong pagbaha na ito?

Interviewee: Ano po, hanggang tuhod ganon.

Interviewer: Ah hanggang tuhod. So natatandaan nyo po ba kung anong taon at buwan yung pinaka mataas na pagbaha na naranasan ninyo?

Interviewee: Ah noong 2015.

Interviewer: Naaalala nyo po kung anong buwan?

Interviewee: Hmmm, hindi na po eh. Basta natatandaan ko na 2015 yon.

Interviewer: Gaano po kataas yung baha na naranasan nyo na iyon noong 2015?

Interviewee: Hanggang ano sya, hanggang dibdib sa bahay namin.

Interviewer: Ah hanggang dibdib po. So dito naman po tayo sa tanong na, mayroon po ba kayong napansin na pagbabago sa pagbaha over the course of 5 years. Sa 2016-2020 po?

Interviewee: Meron, way back 2016 sa lugar namin di kami ganoong binabaha, lalo na kapag high tide, kalsada lang yung madalas na binabaha.

Interviewer: Ah. How about po sa over the course of 10 years. Sa 2011-2020, may napansin po ba kayong pagbabago sa pagbaha?

Interviewee: Meron, compared sa ngayon, yung baha dati mas maliit lang at tumaas lang yung baha kapag may malakas na bagyo na talaga or habagat

Interviewer: So dito naman po tayo sa isang opinion-based question. Ano po sa tingin nyo ang dahilan ng pagbabago ng pagbaha sa pagdaan ng mga taon sa Sta. Monica?

Interviewee: Siguro yung ginawang pagpapataas ng kalsada dito samin.

Interviewer: May pagbabago po ba sa land use ng Sta. Monica sa mga nagdaan na taon? Halimbawa po, bagong establisyimento, ganun po. Or pagpapataas lang po talaga ng kalsada? At sa tingin mo ba ay naka apekto po ito sa pagbabago ng pagbaha sa iyong lugar?

Interviewee: Meron, yung pagpapataas ng kalsada talaga. At syempre nakaapekto yon lalo na nawalan ng ibang daluyan ang tubig kaya naiipon sila sa mga kabahayan ba bumaba simula nung tumaas yung kalsada.

Appendix B. Flood Survey Form Responses

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To see full responses, see:

https://docs.google.com/spreadsheets/d/1K2QOECRSGbSnWjNYB4UtWOvnyY2ZLaiv/edit?us

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