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Franny Henty
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Charleston, South Carolina 29412
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Dear Franny,

I am writing to address the following questions:

- 1) Are the stormwater plans for the proposed Central Park development consistent with the 2013 City of Charleston Stormwater Design Standards Manual?
- 2) Will the stormwater improvements recommended by the AECOM study adequately prevent flooding by the proposed Central Park development?
- 3) What was my take away from my September 3, 2020, meeting with Matt Fountain, Director of the Department of Stormwater Management for the City of Charleston, regarding the stormwater permitting for the proposed Central Park development?

Please see my responses below.

Are the stormwater plans for the proposed Central Park development consistent with the 2013 City of Charleston Stormwater Design Standards Manual?

No, the stormwater plans for the proposed Central Park development are not consistent with the 2013 City of Charleston Stormwater Design Standards Manual. For reference, the manual is available at the following link:

<https://www.charleston-sc.gov/DocumentCenter/View/5972/Stormwater-Design-Standards-Manual-August-2014-Updates?bidId=>

The critical passage in the 2013 stormwater manual is the following:

“Flooding exists in many locations around the City where development densities have increased to the point that stormwater controls have become overwhelmed... The following design criteria shall be used for projects discharging to receiving waters within these areas: The post-development, peak discharge rates are restricted to ½ the pre-development rates for the 2 and 10-year 24-hour storm event **or to the downstream system capacity, whichever is less...**”
(emphasis added)



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The downstream system capacity sets a lower bound on the permissible post-development peak discharge rate. That is, it does not matter whether the projected post-development peak discharge rate is one-half or one-third or one-tenth of the pre-development peak discharge rate. If the post-development peak discharge rate would exceed the ability of the downstream stormwater infrastructure to carry away stormwater, the development should not be approved.

The City of Charleston has not required the proponents of the Central Park development to calculate or to take into account the downstream system capacity.

According to Matt Fountain, Director of the Department of Stormwater Management for the City of Charleston, the system capacity is assessed by comparing the water-surface elevation during a 100-year storm between the pre-development and the post-development states. The water-surface elevations are compared for both the upstream and the downstream neighborhoods. If the changes in water-surface elevations during a 100-year storm can be shown to be negligible, it is said that the system capacity has not been exceeded.

Mr. Fountain's interpretation is not correct. The passage from the stormwater manual requires the comparison of three quantities:

- (1) post-development peak discharge rate
- (2) pre-development peak discharge rate
- (3) downstream system capacity

The above quantities can be compared only if they are all discharge rates, that is, only if they all have the units of volume per time, for example, cubic feet per second.

The fact that "downstream system capacity" is a discharge rate (with units like cubic feet per second) is further clarified with the expression "whichever is less." The determination as to which is the larger quantity (pre-development peak discharge rate or downstream system capacity) can be made only if the two quantities have the same units, that is, only if "downstream system capacity" is a discharge rate with units like cubic feet per second.

The fact that "water-surface elevation" and "system capacity" are different concepts is further clarified in the following passage from the 2013 stormwater manual:

"All construction, development and redevelopment activities which disturb one (1) acre or more shall perform an hydraulic analysis to determine the impacts of the proposed development during 100-year 24-hour storm event (precipitation only). The project shall not... Increase water surface elevations **or** reduce system capacity in stormwater system and facilities upstream or downstream of the project" (emphasis added).



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The above passage refers to all developments and not just to developments within the Special Protection Areas (which would include the Central Park development). Therefore, the requirement of no increase in water-surface elevation (which applies to all developments) cannot be equivalent to the requirement of no exceedance of the downstream system capacity by the post-development peak discharge rate (which applies only to the Special Protection Areas).

In summary, while the Department of Stormwater Management has insisted on a legitimate requirement (no increase in water-surface elevation during a 100-year storm), it is not the requirement that is specified in the stormwater manual (no exceedance of the downstream system capacity by the post-development peak discharge rate).

The additional inconsistency with the 2013 stormwater manual is the inaccuracy in the stormwater model used by the consultants for the Central Park developers. Nowhere does the City of Charleston Stormwater Design Standards Manual state that stormwater models must be accurate and up-to-date. However, that assumption is implicit throughout the stormwater manual because, without accurate stormwater models, nothing in the manual makes any sense.

Accurate stormwater models should begin with the most recent existing hydrological information. In the case of the Central Park development, the most recent information would be a joint study between the South Carolina Department of Transportation and the U.S. Geological Survey South Atlantic Water Science Center that was carried out between 2014-2018 and entitled “StreamStats for South Carolina: A Multipurpose Water-Resources Web Application.” The corresponding StreamStats tool is freely available online and can be used to delineate the watershed and calculate the flow statistics for the stream that drains the Central Park watershed.

The above study and the StreamStats tool are available at these links:

<https://pubs.er.usgs.gov/publication/fs20183070>

<https://streamstats.usgs.gov/ss/>

The above study is not mentioned anywhere in the application for the Central Park development. By contrast, the development of the stormwater model for the Central Park development involved only Lidar elevation data, historic stormwater infrastructure descriptions that were available from the City, and a limited amount of fieldwork. That fieldwork has not been documented anywhere, but it was so cursory that it was not able to detect that a 42” outfall pipe was completely sealed. That discovery was only made by a local resident, Jimmy Mazyck.

The foundational element of any stormwater model would be the watershed boundary. According to the report by the consultants for the developers, “the City also required the



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expansion of the downstream analysis to incorporate all the contributing watershed from upstream of the site all the way to James Island Creek.” However, there is no map in the report that actually shows the watershed boundary. The only explanation as to the extent of the watershed is the phrasing “DRAINAGE SYSTEM DESCRIPTION A. System Description 1. Watershed (shown on USGS Quad Map—Appendix A).” There is an Appendix A, but it does not include the USGS topographic map.

It would make no sense to develop the watershed boundary from the USGS topographic map. In the first place, in areas with stormwater infrastructure, watersheds do not depend on topography alone. This is especially true in urban areas with extensive culverts, in which roads can block stormwater runoff, but culverts can convey the stormwater flow under the roads. It is just as important that the contour interval for the USGS topographic map is 10 feet, so that it would be worthless for developing a watershed boundary.

The correct procedure would have been to begin with the watershed boundary that could be created using the StreamStats tool, and then modify that boundary as indicated by additional fieldwork. Without even knowing the watershed boundary that was used by the consultants for the developers, it is impossible to evaluate whether the stormwater model is correct.

In summary, the City of Charleston has used a very low standard in evaluating the stormwater plans for the proposed Central Park development.

Will the implementation of the stormwater improvements that were recommended by the AECOM study mitigate any possible flooding due to the Central Park development?

For reference, the AECOM study is entitled “Technical Memorandum Subject: Evaluations and Recommendations for Central Park Project Area” and is available at this link:

<https://www.charleston-sc.gov/DocumentCenter/View/27211/Central-Park-Tech-Memo---Compiled---Final---08072020?bidId=>

The AECOM stormwater model was based upon historic stormwater infrastructure descriptions available from the City, Lidar elevation data, engineering drawings from various developments (including the Central Park development), and a limited amount of fieldwork. The AECOM study did not take into account or even mention the 2014-2018 joint study by the South Carolina Department of Transportation and the U.S. Geological Survey South Atlantic Water Science Center.

The watershed boundary assumed by the AECOM study is very different from the watershed boundary that could be created using the StreamStats tool. As a consequence, some of the



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stormwater improvements recommended by the AECOM study are not even in the Central Park watershed. Figure 1 at the end of this memo shows the watershed boundary from the USGS/SCDOT StreamStats model (amethyst line) superimposed on the stormwater infrastructure improvements that were recommended by the AECOM study. To the west of the watershed boundary are three proposed pipe improvements and part of a channel improvement that are outside of the watershed. To the southeast of the watershed boundary are two proposed pipe improvements and part of a channel improvement that are outside of the Central Park watershed. These particular stormwater improvements cannot possibly have any effect on stormwater drainage in the Central Park watershed.

In summary, I would not assume that implementation of the stormwater improvements that were recommended by the AECOM study would mitigate flooding due to the Central Park development.

What was my take away from my September 3, 2020, meeting with Matt Fountain, Director of the Department of Stormwater Management for the City of Charleston, regarding the stormwater permitting for the proposed Central Park development?

This is the beginning of a memo that I sent to Mayor John Tecklenburg on September 6, 2020:

“I am writing to thank you again for arranging the meeting between me and Matt Fountain, Director of the Department of Stormwater Management. I have the greatest respect for Mr. Fountain. We listened to each other and I think that we came to understand one another’s point of view. I still do not believe that the City of Charleston has acted in compliance with the 2013 Stormwater Design Standards Manual in its evaluation of the stormwater application for the proposed Central Park development.”

The meeting between me and Matt Fountain was not recorded, so that all quotes are from a five-page memo that I sent to South Carolina Coastal Conservation League on September 4, 2020.

Matt Fountain and I discussed our conflicting interpretations of the stormwater manual. This was my summary of Matt’s response:

“Matt said that he could see how I was interpreting the stormwater manual in this way. He said that he wished that I had been around when they were rewriting the stormwater manual. I understood Matt to be saying that the stormwater manual should have been rewritten in such a way as to reflect the actual practice within the Department of Stormwater Management.”

Matt and I also discussed the stormwater model that was created by the consultants for the Central Park developers. This was my summary of Matt’s description:



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“Matt said that there were three sources of inputs. The first was the publicly available Lidar (elevation) data that were collected by the County in 2017. The second was the description of the stormwater infrastructure that is available on the Stormwater Management website as ArcGIS files. Matt described these descriptions as ‘historical’ and said that the City makes no guarantee as to the accuracy of this information. The third source was some ground-checking that was carried out by Crescent Homes. There is no document that describes this ground-checking.”

My interpretation of the conversation between me and Matt Fountain is largely contained in my response to the first question in this memo.

Please let me know if I can help with anything else.

Best wishes,

A handwritten signature in black ink that reads "Steven H. Emerman".

Steven Emerman

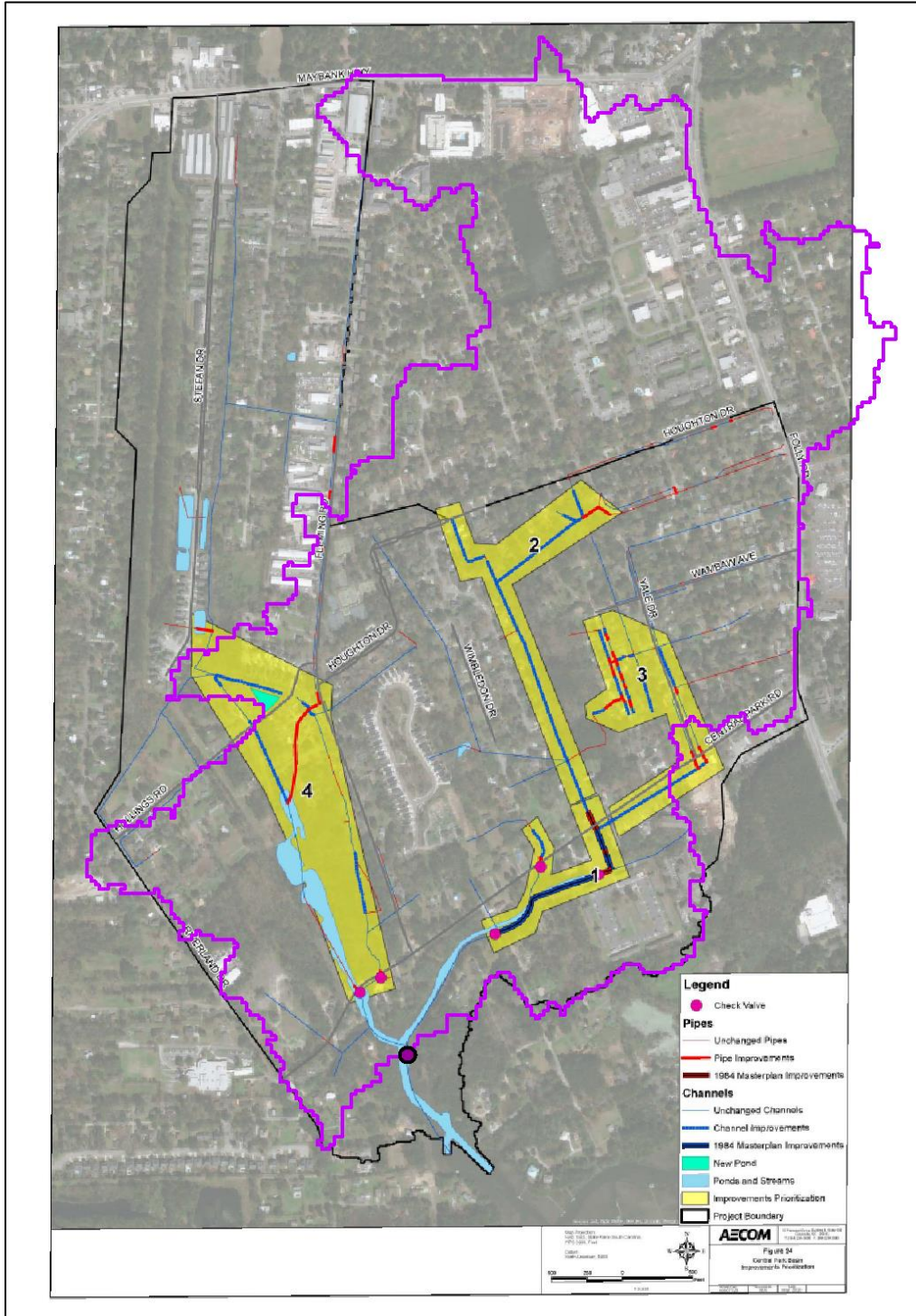


Figure 1. Comparison of AECOM stormwater improvements with SCDOT/USGS watershed (amethyst line)