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Patuxent Greens
Overview of Floodplain Analysis & Project Design
May 2019

This document has been prepared to summarize and explain the planning, design, and analysis associated with the conversion of the Patuxent Greens golf course into a residential community, particularly with respect to flooding.

The 191+/- acre property, located within the City of Laurel adjacent to the Patuxent River, is entirely located within the 100-year floodplain, according to FEMA, MDE and our own analysis. According to FEMA mapping, numerous existing structures beyond the Patuxent Greens community are also within the 100-year floodplain. The 100-year floodplain is generally defined as the area of inundation associated with a storm that has a 1% chance of occurring each year, or a 100% chance of occurring once every 100 years. For this reason, additional consideration was given to the planning and engineering of this community, and possible effects to the surrounding communities, to account for flooding conditions associated with a 100-year storm event.

In order to significantly protect against increases to the floodplain due to the placement of fill within the floodplain, approximately 50 acres, referred to as compensatory storage, is proposed to be excavated within the project. In addition, approximately 700 linear feet of a structural levee will be installed. The combination of the compensatory storage, the proposed levee, and minor increases to the velocity of the flow, will result in a decrease overall in the floodplain elevation with minimal areas maintaining the same elevation.

In order to verify these results, further engineering modeling was performed using the industry standard floodplain management and modeling software known as *Hydrologic Engineering Center's River Analysis System (HEC-RAS)*, developed and maintained by the US Army Corps of Engineers. This is the modeling software that federal, state and local governments and engineering professionals utilize for mapping floodplains.

The HEC-RAS model and process typically includes the establishment of two models for comparison: the existing floodplain and the proposed floodplain. In this case of Patuxent Greens, two existing floodplain models were created and analyzed based on the presence of an existing levee-like berm that surrounds the Patuxent Greens Golf Course, which needed to be accounted for in two different ways – one model with it, and one model assuming it wasn't functioning. With the existing model, cross-sections are established at points along the river extending through and beyond the site, as well as upstream and downstream of the project. Ground surface, topography and flow characteristics are evaluated and established for each cross section. For Patuxent Greens, we started with the cross sections established by FEMA that were part of their current floodplain model for the Patuxent River. We then added more cross sections through the site in addition to FEMA's model to provide additional analysis and detailed

modeling for this project. Those same cross section locations were carried over to the proposed condition model, with updated ground surface and flow characteristics where changes are proposed due to the project.

The software, using engineering algorithms, computes water surface elevations for each cross-section associated with the 100-year storm event taking into consideration upstream flow characteristics, channel conditions, downstream constrictions, plus the myriad of other factors that affects the movement of water across the land. From there, the elevation of the floodplain at each cross section is plotted onto a topographic map, and the limits of the floodplain is delineated. When this is done for both the existing floodplain and the proposed floodplain, we are able to see the changes and how the proposed project is affecting the floodplain.

It is important to note that HEC-RAS has been for decades, and still is, the industry-standard for evaluating floodplains and, through the technology, eliminates computational mistakes that a human is more likely to make. The early model runs for Patuxent Greens showed a considerable reduction in the floodplain elevation across all cross sections, even after professional engineering judgment and review, including by third parties. Again, the hydraulic reason for the reduction is due to the excavation of a 50+ acre compensatory storage area, 700+ linear feet of new levee and minor flow rate increases. However, in order to provide an additional level of assurance and factors of safety, sensitivity analyses were run using even more conservative factors, primarily to determine their effect on the floodplain results. When using even more conservative factors, the model continued to result in no increases to the floodplain as a result of this project.

To protect against rises to the elevation of the floodplain during construction, the project is to be phased. The first step will be to construct a sediment control basin and excavation of the compensatory storage area, while leaving the existing berm in place. The existing berm will remain in place throughout the construction process and will be removed as a last order of business once all other measures are in place. Once the sediment basin has been constructed, the compensatory storage area has been excavated, and with the existing berm remaining, the mass grading and fill operation will take place. As soon as the site’s brought to grade and stabilized, the new levee will be constructed.

In closing, through a combination of factors – predominantly 50 acres of excavated compensatory storage, over 700 linear feet of a new structural levee, and minor flow increases – based on industry standard engineering modeling technology, the 100-year floodplain will not be increased by this project.