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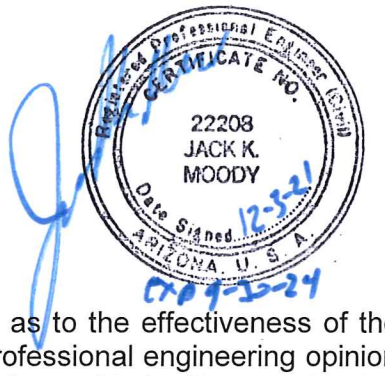
To: Tusayan Town Council

From: Jack K. Moody, P.E., CFM, Westwood Professional Services

Date: December 3, 2021

Re: Tusayan Proposed Stormwater Storage Basins



The purpose of this memo is to provide a detailed engineering opinion as to the effectiveness of the proposed detention basins on the tributaries to Coconino Wash. This professional engineering opinion utilizes information gathered from two studies identified as *Phase 1 Drainage Study, Tusayan East of Hwy 64* (2012) prepared by Peak Engineering, Inc. for the South Grand Canyon Sanitary District and the *State Route 64 Tusayan Street Improvements Final Drainage Report* (2010) prepared by Jacobs for the Arizona Department of Transportation (ADOT). The *Tusayan Forest Basins Construction Plans (30% Plans, 2020)* prepared by Woodson Engineering and Surveying were utilized as additional data, along with the *Decision Notice and Findings of No Significant Impact, Tusayan Flood Reduction Project* (2013) prepared by the Tusayan Ranger District, Kaibab National Forest (USFS).

The detention basins are proposed to be constructed on two unnamed tributaries to Coconino Wash, herein referred to as the Northeast Tributary and the Southeast Tributary. The Northeast Tributary has a watershed of approximately 1.4 square miles and impacts the Town of Tusayan north of Camper Village before the confluence with Coconino Wash. The Southeast Tributary has a watershed of approximately 1.3 square miles and impacts the Town south of Camper Village at the confluence with Coconino Wash.

The Peak Engineering (2012) study was contracted by the South Grand Canyon Sanitary District (SGCSD) to investigate nuisance flooding issues suspected to be caused by rainfall associated with flows coming off the watersheds to the northeast and southeast of the Town. Coconino Wash, situated between these two watersheds, was reportedly not suspected to be a contributing factor to these nuisance flood events, as there are many existing tanks and retention basins within Coconino Wash that are suspected to mitigate the small nuisance flooding events. Therefore, no development of detention basins was recommended in Coconino Wash. The Peak Engineering, Inc. (2012) study indicates that the proposed detention basins could reduce the peak flows from 30% to 60% for the frequent (2-year to 25-year) events. However, the report did not analyze the less frequent flooding events such as the 50-year or 100-year events. It also did not analyze the flow or major flooding events coming from the Coconino Wash. The Peak report indicated that Coconino Wash was not suspected to be a contributing factor to the nuisance flooding due to the ponds and tanks that exist upstream within the drainage area of Coconino Wash.

The basins are proposed to be detention basins meant to attenuate the peak flows by allowing the total volume to pass by slowly releasing the flow. The *Decision Notice and Findings of No Significant Impact, Tusayan Flood Reduction Project* prepared by the Kaibab National Forest indicates that the basins will be designed to pass the low flows and not retain water for an extended period of time. This is contrary to the *30% Design Plans* that show the basins incised below the natural flow line of the washes by seven to ten feet. A significant piping system or other low-flow conveyance system would be necessary to convey the low flow back into the wash and drain the basins. Whereas this is not an insurmountable

problem, it is illustrating that the 30% *Design Plans* are in conflict conceptually with the USFS Decision Document.

The Peak Engineering (2012) study references the Jacobs (2010) study, prepared for the ADOT improvements of State Route 64, for the peak flows in Coconino Wash. The Jacobs (2010) study prepared a HEC-1 model that identified the 100-year peak flow in Coconino Wash to be 8,020 cfs. The study then compared that flow with a Regional Regression Equation 100-year flow calculation of 7,216 cfs. The Jacobs (2010) study went on to indicate that at the time there were two 36-inch culverts under State Route 64 with a combined capacity of approximately 116 cfs. The report indicated that residents at public meetings and discussions with ADOT personnel confirmed the adequacy of the existing drainage facilities, noting that flow from Coconino Wash had not overtopped the roadway in the past 30 years. This data was used to support the decision not to put basins on the Coconino Wash watershed.

As indicated above, the Northeast Tributary has a watershed of approximately 1.4 square miles and the Southeast Tributary has a watershed of approximately 1.3 square miles. This is in contrast to the Coconino Wash watershed that is approximately 47 square miles upstream of the confluence with these two tributaries. Due to the size difference between these watersheds and the proximity of all three watersheds to the Town, the 100-year peak flows from the Northeast Tributary and the Southeast Tributary will impact the Town significantly prior to the 100-year peak flow from Coconino Wash. The runoff from these two smaller watersheds will have minimal impact on the peak flows from the Coconino Wash watershed, and therefore the proposed detention basins will have minimal impact on the 100-year flow in Coconino Wash.

Considering this information, it is unlikely that a significant reduction in the 100-year peak flow in Coconino Wash will be achieved by these proposed detention basins. They are estimated to only mitigate local storms and nuisance flooding in the smaller more frequent rainfall events. As a result, the Coconino County Flood Control District would not likely reduce the 100-year mitigation measures needed for development or re-development within the Town. In addition, these proposed basins would not have a significant impact on the existing or proposed FEMA floodplains or floodplain requirements within the Town. Therefore, these basins would not change any regulations to mitigate or floodproof to the 100-year water surface elevation, imposed upon the Town or developers by Coconino County or FEMA.

In conclusion, whereas these basins would mitigate the more frequent and smaller storm events that impact the Town from the Northeast and Southeast watersheds, they would not likely significantly mitigate the 100-year flows in Coconino Wash that are required by Coconino County and FEMA for engineering design.