WOOLPERT

Memo

To: Steve Kirk, PE

From: James Riddle, PE

Date: June 28, 2016

Subject: Church Creek ICPR Model Update – Logging Road

Introduction

At the request of the City of Charleston ("the City"), Woolpert created and has maintained an Interconnected Pond Routing (ICPR) hydrologic and hydraulic model ("the model") for the Church Creek drainage basin due to the history of flooding issues in the watershed. Prompted by recent citizen concerns, the City asked Woolpert to assess the hydraulic impacts of a logging road and its culvert on the main stem of Church Creek. Bowman Consulting completed the necessary survey work. Woolpert made appropriate adjustments to the model and reviewed the results.

The logging road culvert is located approximately 300 feet downstream of the railroad at the point where it crosses the main stem of Church Creek. It is unknown when the roadway/culverts were installed, but this structure was not previously included in the model. Citizens upstream of the culvert questioned if the structure was undersized and generally contributing to upstream flooding during large storm events. Of particular concern was an area adjacent to Church Creek approximately 400 feet downstream of the Bees Ferry Bridge (near ICPR node N-B010). "Figure 1: Logging Road" shows the location of the logging road and the ICPR nodes that were referenced to determine the impacts of the culverts.

Model Integration

The model was updated with survey data which indicated that the logging road culvert consisted of four (4) 36 inch diameter corrugated plastic pipes (CPP). The profile of the logging road was surveyed to determine the elevation at which the logging road would overtop (4.95 feet - NGVD '29). Channel cross sections upstream and downstream of the culvert were also obtained and used to update the cross section of the channels in the model. Two (2) new ICPR nodes were created upstream and downstream of the culvert and new ICPR links were created for each pipe. The channel and overtopping weir cross sections were also updated as necessary.

Model Results

The model results for the relevant ICPR nodes are included in "Table 1: Logging Road Results Summary Table". The table shows the maximum water surface elevation (WSE) at each node for the Existing Model (Existing) and Updated Model (Updated). The last column indicates the increase or decrease in WSE between the Existing and Updated models.

The nodes upstream of the logging road show a small increase (1.8 inches or less) during the 2-year and 10-year storm events. This increase was expected due to the construction of the road and addition of the culvert. The Existing Model did not include the four (4) culvert pipes or the weir representing the logging road, which allowed free flow through the open channel. The Updated Model added the culvert pipes and logging road weir, causing the small backwater condition in the aforementioned storm events. The larger storm events (25-, 50-, and 100-year) produced a negligible change in the maximum WSE.

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It is also important to note that the logging road will overtop when the water surface reaches an elevation of 4.95 feet. The smallest storm modeled (2-year) had a maximum WSE of 5.76' at the upstream side of the logging road. This would indicate that even smaller design storms should be overtopping the logging road. The changes in the maximum WSE downstream of the logging road were negligible for each design storm.

Conclusion

The model results demonstrate that the inclusion of the logging road had a minimal impact on the Church Creek drainage system. Although minimal water surface increases were observed during the smaller storm events, they were negligible during the larger storm events generally associate with flooding. The logging road overtops during any significant rain event and allows water to continue downstream without exacerbating flooding issues upstream of the logging road. The area of concern downstream of the Bees Ferry bridge had small increases in the 2- and 10-year storm events, but the changes were negligible in the larger storm events. The 2- and 10-year storm events are not significant enough to cause out-of-bank flooding in this area.

Figure 1: Logging Road

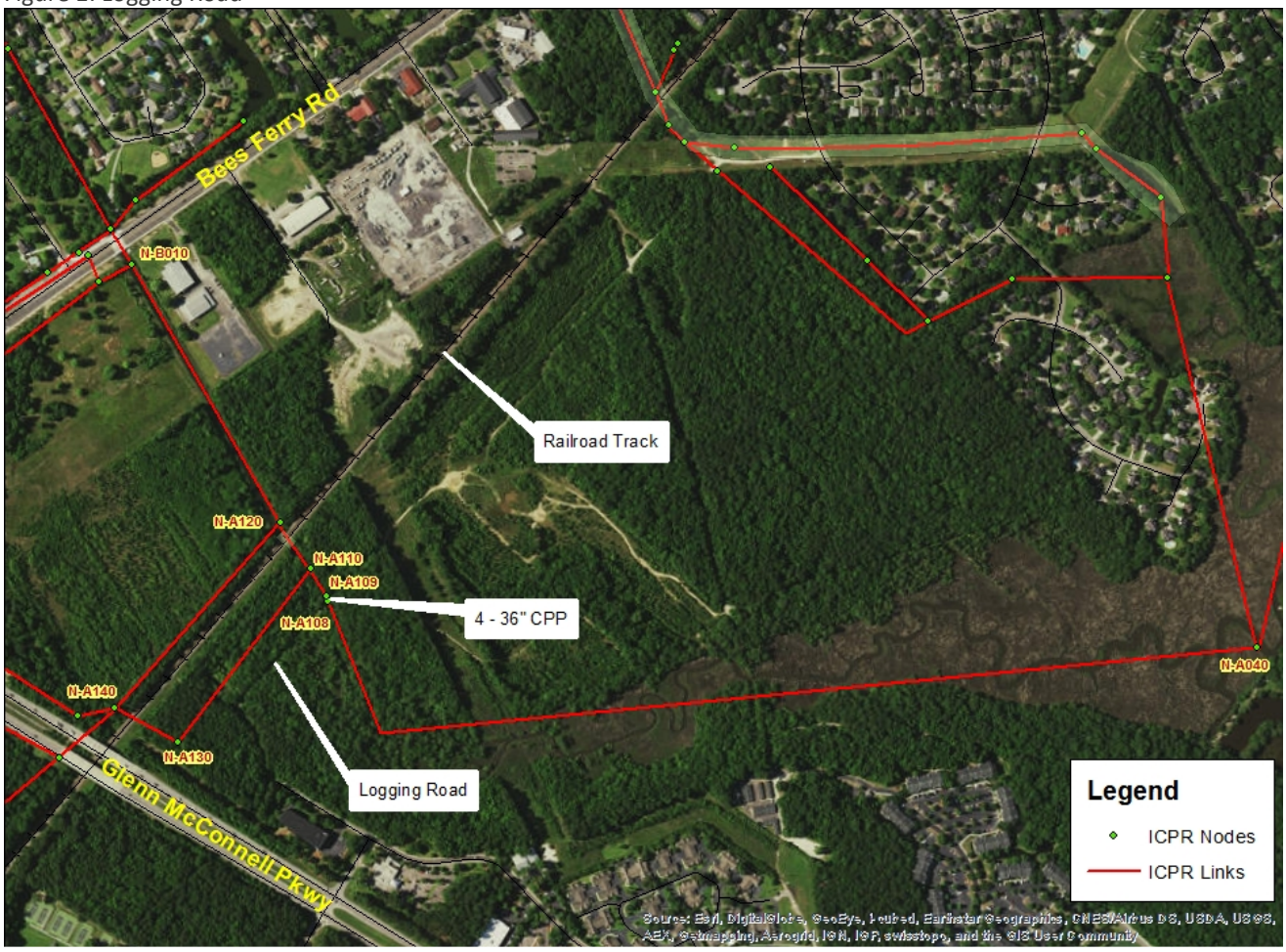

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Table 1: Logging Road Results Summary Table

Name	Location	Storm	Existing Model Max WSE (ft)	Updated Model Max WSE (ft)	Difference (ft)
N-A040	DS Church Creek	002YR	5.24	5.23	-0.01
		010YR	6.21	6.18	-0.03
		025YR	6.61	6.54	-0.06
		050YR	6.92	6.87	-0.04
		100YR	7.25	7.22	-0.03
N-A108	DS End of Culverts Under Logging Rd	002YR	-	5.76	-
		010YR	-	6.64	-
		025YR	-	7.02	-
		050YR	-	7.35	-
		100YR	-	7.71	-
N-A109	US End of Culverts Under Logging Rd	002YR	-	5.78	-
		010YR	-	6.64	-
		025YR	-	7.02	-
		050YR	-	7.36	-
		100YR	-	7.71	-
N-A110	DS End of Culvert Under RR	002YR	5.73	5.88	0.14
		010YR	6.59	6.66	0.07
		025YR	7.04	7.04	0.00
		050YR	7.38	7.37	-0.01
		100YR	7.73	7.73	-0.01
N-A120	US End of Culvert Under RR	002YR	5.86	6.01	0.15
		010YR	6.78	6.90	0.12
		025YR	7.31	7.33	0.02
		050YR	7.74	7.74	0.00
		100YR	8.25	8.24	0.00
N-B010	DS End of Bees Ferry Bridge	002YR	6.08	6.23	0.15
		010YR	6.99	7.14	0.15
		025YR	7.53	7.56	0.03
		050YR	7.94	7.95	0.01
		100YR	8.43	8.43	0.00

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