

Colvin Run Stream Relocation

In order to accommodate an additional east-bound travel lane in the vicinity of the Difficult Run bridge crossing, approximately 1,600 feet of Colvin Run located adjacent to the south side of Route 7 from approximately 500 feet west of Carpers Farm Way east to Difficult Run, would have to be relocated. As part of the avoidance and minimization process, VDOT evaluated a range of options with consideration of various design elements to achieve the most practicable solution with the least amount of impacts. Following is a summary of the design elements that were considered in order to avoid and minimize impacts.

1. Use of retaining walls;
2. Location of pump station access road;
3. Location of equestrian bridle trail;
4. Location and width of Gerry Connolly Cross County Trail;
5. Median width;
6. Lane width;
7. Width of multi-use paths and safety buffer from back of curb on Route 7;
8. Typical section of stream channel (e.g., box culvert, riprap or equivalent-lined, concrete-lined, natural channel with wide meander and floodplain, natural channel with narrow meander and no floodplain, etc.);
9. Shift horizontal alignment of Route 7 further to the north;
10. Relocation of Colvin Run to the north of Route 7 versus to the south.

A total of 10 options (including three variations of Option 7, two variations of Option 9, and three variations of Option 10) were evaluated on the basis of construction cost, environmental impacts, and practicability (e.g., constructability, maintenance, etc.). All of the options were determined to be equally constructable; therefore, the selected option was chosen primarily based on cost and environmental impacts. Option 1 was the least expensive (\$859,100) but would have resulted in 3.45 acres of wetland impacts and was deemed not permissible by the USACE and VDEQ. Option 10C, while not the least expensive (\$3,757,061), was the least impactful (0.85 acres of wetlands) and was ultimately selected as the preferred design option. Option 10C, is depicted in **Figure 2-4**. A number of design elements were incorporated into the relocation of Colvin Run that reduced the total width of the project footprint as well as shifted the alignment away from wetlands to reduce wetland and stream impacts. Design options analyzed but not retained are depicted in **Figure 2-5 (Appendix A)**. The design elements considered as well as the decisions for each option are included in **Table 2-4**. By refining the design of the relocated Colvin Run, impacts to wetlands were reduced from 3.45 acres to 0.85 acres, a reduction of 2.6 acres. The impact acreages for the Colvin Run options also include some impacts attributed to roadway design as reported in **Table 2-5** below because the roadway design and Colvin Run relocation design are each affected by the other and could not be reasonably separated.

Figure 2-4: Colvin Run Options – Stream Relocation Option 10C

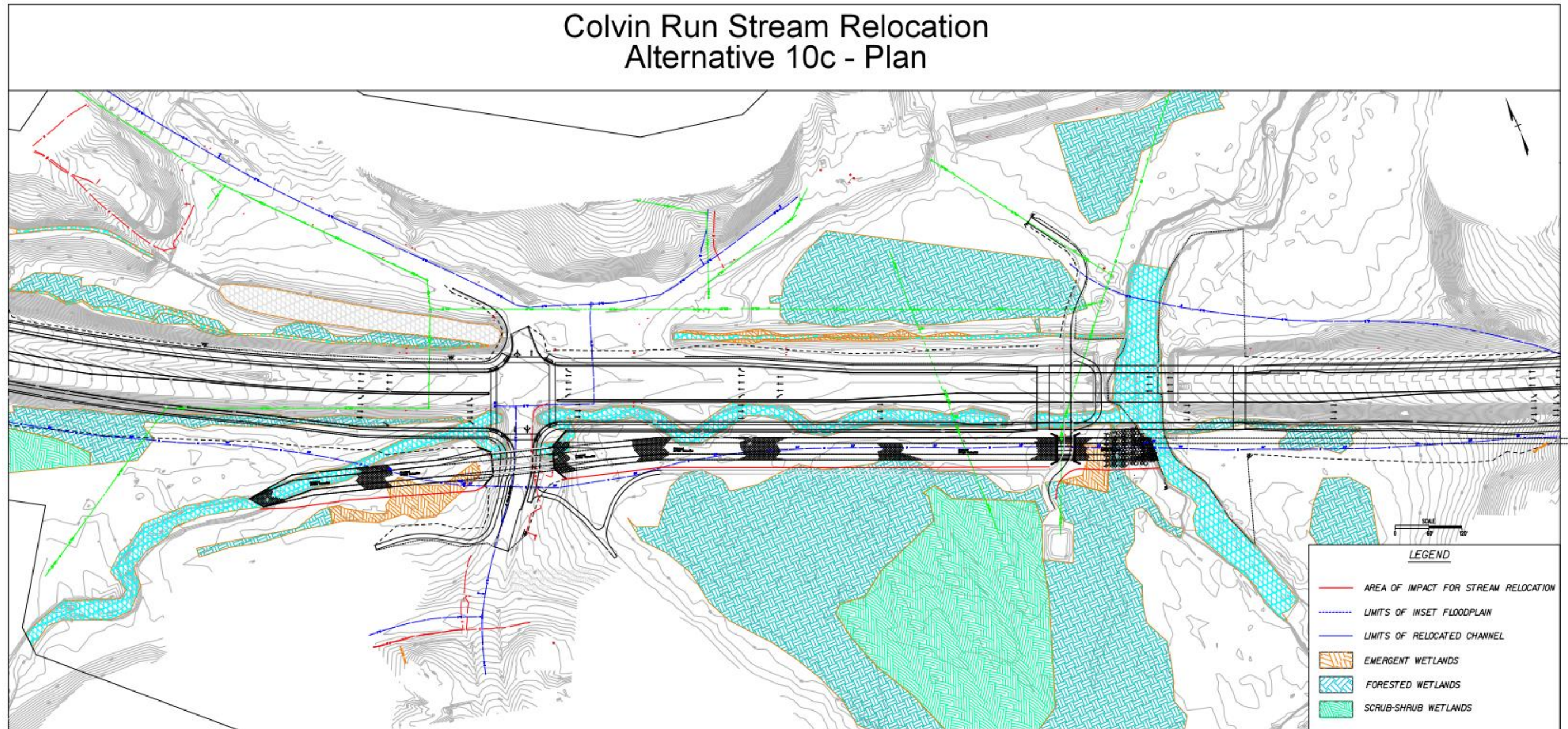


Table 2-5: Colvin Run Options

	Option 1 - "Wide Floodplain"			Option 2 - "Reduced Floodplain"			Option 3 - "No Floodplain"		
Design Elements	Natural channel design, wide meander, wide constructed floodplain, CCT/bridle trail between Route 7 and Colvin Run			Natural channel design with narrow meander, step pools, rock vanes, narrow floodplain, CCT/bridle trail between Route 7 and Colvin Run			Natural channel design with narrow meander, step pools, rock vanes, no floodplain, CCT/bridle trail between Route 7 and Colvin Run		
Estimated Construction Cost	\$859,100			\$1,441,000			\$2,305,800		
Wetland Impacts (AC)	PEM	PSS	PFO	PEM	PSS	PFO	PEM	PSS	PFO
	0.34	0.47	2.15	0.34	0.23	1.41	0.33	0.2	1.24
Total Wetland Impacts (AC)	3.45			1.98			1.77		
Stream Impacts (LF)	1,660			1,660			1,660		
Decision	Not chosen. High wetland impacts. Not permissible.			Not chosen. High wetland impacts. Not permissible.			Not chosen. High wetland impacts. Not permissible.		
	Option 4- Concrete Channel			Option 5 - Culvert Enclosure			Option 6 - Splitting Flow to Colvin Mill and Reduced Floodplain		
Design Elements	Colvin Run conveyed through a concrete-lined channel, CCT between Route 7 and Colvin Run			Colvin Run conveyed through triple 12' X 12' box culverts, CCT/bridle trail located south of relocated Colvin Run through wetlands.			Option 1 stream design plus impound Colvin Run and reconstruct head race to Colvin Mill to return flowing water to the Colvin Mill water wheel		
Estimated Construction Cost	\$3,272,300			\$7,145,800			\$7,500,000		
Wetland Impacts (AC)	PEM	PSS	PFO	PEM	PSS	PFO	PEM	PSS	PFO
	0.34	0.11	1.15	0.16	0.01	0.59	0.34	0.47	2.15
Total Wetland Impacts (AC)	1.6			0.76			2.96 (+26.62 AC for dam)		
Stream Impacts (LF)	1,660			1,660			7,921		
Decision	Not selected. High wetland impacts. High cost. Not permissible.			Not chosen. Cost prohibitive.			Not chosen. Cost prohibitive. High wetland and stream impacts. Not permissible.		
	Option 7 - Box Culvert under Route 7 to Discharge to Mill Tail Race			Option 7a - Box Culvert under Route 7 Discharge to Improved Mill Race Channel			Option 7b - Box Culvert under Route 7 Discharge to Improved Mill Race Channel with Retaining Wall to Reduce impacts		
Design Elements	Convey Colvin Run north through box culvert under Route 7 and tie into Mill Tail Race which will be conveyed through a box culvert to discharge into Difficult Run			Convey Colvin Run north through box culvert under Route 7 and tie into Mill Tail Race which will be conveyed through an improved "Option 3" type channel with a narrow meander, step pools, rock vanes and no floodplain			Option 7a but with retaining wall on north side of Route 7		
Estimated Construction Cost	\$6,261,700			\$5,682,866			\$6,217,166		
Wetland Impacts (AC)	PEM	PSS	PFO	PEM	PSS	PFO	PEM	PSS	PFO
	0.12	0	0.56	0.12	0	0.68	0.12	0	0.32
Total Wetland Impacts (AC)	0.68			0.8			0.44		
Stream Impacts (LF)	2,386			2,386			2,386		
Decision	Not chosen. Cost too high. High stream impacts.			Not chosen. High cost. High stream impacts.			Not chosen. High cost. High stream impacts.		

	Option 8 - Raise Stream Bed of Relocated Colvin Stream/Step-Pool Transition at Difficult Run			Option 9a - Wide Floodplain with Retaining Wall for Reduced Impacts			Option 9b - No Floodplain with Retaining Wall for Reduced Impacts		
Design Elements	Option 1 stream design, but with raised stream bed of relocated Colvin Run and step pool transition and rock vanes at discharge into Difficult Run			Option 1 stream design with a retaining wall on south side of Route 7.			Option 3 stream design with retaining wall on south side of Route 7.		
Estimated Construction Cost	\$1,253,159			\$1,896,423			\$2,497,353		
Wetland Impacts (AC)	PEM	PSS	PFO	PEM	PSS	PFO	PEM	PSS	PFO
	0.34	0.47	2.15	0.33	0.22	1.76	0.27	0.09	1.06
Total Wetland Impacts (AC)	2.96			2.31			1.42		
Stream Impacts (LF)	1,660			1,660			1,660		
Decision	Not chosen. High wetland impacts. Not permissible.			Not chosen. High wetland impacts. Not permissible.			Not chosen. High wetland impacts. Not permissible.		
	Option 10a -			Option 10b -			Option 10c -		
Design Elements	Colvin Run conveyed through straight riprap or equivalent-lined channel, no meander, no floodplain; retaining wall on south side of Route 7; box culvert under Carpers Farm Way skewed to direct Colvin Run closer to Route 7; Route 7 shifted 20 feet to north; bridle trail between Route 7 and Colvin Run; pump station access road coming from north under Difficult Run bridge			Same as Option 10a, except bridle trail traversing wetlands to south of Colvin Run			Same as Option 10a, except bridle trail between Colvin Run and wetlands		
Estimated Construction Cost	\$3,765,861			\$3,757,941			\$3,757,061		
Wetland Impacts (AC)	PEM	PSS	PFO	PEM	PSS	PFO	PEM	PSS	PFO
	0.14	0	0.15	0.17	0	0.12	0.17	0	0.06
Total Wetland Impacts (AC)	0.90			1.1			0.85		
Stream Impacts (LF)	1,660			1,660			1,660		
Decision	Not chosen. Not least impactful option.			Not chosen. Not least impactful option.			Selected option. Least impactful option.		

*Impact acreages for Options 1 and 10C include a 20-foot buffer from construction limits to allow for installation of erosion and sediment control measures. Impact acreages for Options 2 through 10B do not include a 20-foot buffer from the limits of construction.

The key design refinements incorporated into Option 10C are provided below:

- Colvin Run would be conveyed through a straight, riprap or equivalent-lined channel with no meander and no constructed floodplain. This design would greatly reduce the lateral footprint and would minimize encroachment into the adjacent wetland. The channel would be designed to allow adequate energy dissipation to minimize effects to downstream hydrodynamics.
- The relocated 54-inch water main would be collocated under the equestrian bridle trail to minimize land disturbance and impacts. The design currently allows for a 28-foot-wide permanent utility easement for the collocated trail and water main, of which the CCT would occupy 12 feet. Fairfax Water typically prefers a 40-foot wide permanent easement; however, during a meeting with VDOT on August 16, 2017, Fairfax Water tentatively agreed to a narrower easement in this location to avoid impacts to wetlands. The width of the permanent easement may increase pending final decision from Fairfax Water.
- The pump station access road would cross under the Difficult Run bridge from the north side of Route 7 eliminating the need to place the road between Route 7 and Colvin Run further reducing encroachment into the wetlands to the south.
- The road tangent was shifted to the east shifting the horizontal road alignment 20 feet to the north.
- A retaining wall would be constructed on the south side of Route 7 to further reduce the road typical section.
- The CCT would cross at the signalized intersection between Route 7 and Carpers Farm Way rather than travel between Route 7 and Colvin Run east to cross under the Difficult Run bridge.
- The box culvert under Carpers Farm Way was skewed to direct Colvin Run closer to Route 7.
- The equestrian bridle trail width was reduced from 10 feet to 7 feet.
- The width of the shared use path on Route 7 was reduced from 10 feet to 8 feet at Difficult Run crossing.

Compensation for Lost Wetland Functions

Banks within the same HUC are restoring and preserving similar systems with similar geomorphic setting, hydrology, and hydrodynamics; therefore, it is reasonable to assume that these banks would provide suitable, “in-kind” compensation that would replace the lost functions of the wetlands being impacted by the Project.