

September 18th, 2025



Memorandum

To: Christopher Engel, City of Merriam, City Administrator
From: Dan Ryan, P.E., HNTB, Project Manager

Re: Turkey Creek and Downtown Merriam Part 2 Hydraulic Analysis
City of Merriam

Turkey Creek and Downtown Merriam Part 2 Hydraulic Analysis Memo

Project Background

The purpose of this memo is to summarize conceptual hydraulic options for downtown Merriam, specifically the area east of Turkey Creek, north of Johnson Drive, and south of the Merriam Drive bridge over Turkey Creek (see Figure 1) based upon hydrologic and hydraulic site constraints. The scope of this phase of HNTB’s analysis does not include economic analysis, cost benefit analysis, or detailed roadway, geotechnical, structural, or geomorphological design.



Figure 1. Proposed Project Area

HNTB was requested by the City of Merriam to investigate the feasibility of raising this area out of the 100-yr floodplain. The project is intended to remove the project area from the floodplain by placing earth fill above the Base Flood Elevation to provide for re-developable area. In one option, the earth fill is combined with elements from the United States Army Corps of Engineers (USACE) proposed levee and floodwall improvements. USACE is proposing a project that encompasses this area as part of a slightly larger overall project. Their proposal includes the use of levees and floodwalls to provide surrounding ground with flood protection from frequent flooding for the 100-yr event (with 85% assurance). However, through the construction of walls and levees, the USACE project reduces access to Turkey Creek. This memo identifies what portion of the USACE flood protection is needed to mitigate the effects of fill downstream and determines what the estimated post-construction Base Flood Elevation would be in comparison to the USACE proposed design. This memo also determines what proposed grading conditions are needed to achieve no-rise conditions and maintain access to Turkey Creek, without incorporating the USACE levees and floodwalls system.

This analysis was done at a high level and was intended to determine if the project should move forward to the next phase. A conceptual, high-level opinion of probable cost including 2025 appraised property values and cut/fill quantities is shown in Tables 1 and 2 of this memo to help determine feasibility. Other costs such as roadway reconstruction, utility relocations, upstream levee/floodway improvements (if required), and engineering are included at a conceptual level. The two main, high-level alternatives HNTB investigated were:

- 1) The potential impacts of raising the entire project area out of the 100-yr floodplain (henceforth referred to as full-build option)
- 2) The potential improvements area within the project that would result in no-rise (no increase) in the 100-yr water surface elevation for Turkey Creek between existing and proposed outside of the project limits (henceforth referred to as no-rise option)

Both options used the Merriam Comprehensive Plan 2040 (adopted March 2021) as the basis for certain elements. These two options were modeled by developing proposed grading surfaces in AutoCAD Civil3D and importing them into the Turkey Creek 2D HEC-RAS (V 6.6) model from USACE. All references to water surface elevations in this memo unless stated otherwise refer to the base USACE model with updates from HNTB. The model received from USACE included an existing terrain that captures the current conditions of Turkey Creek around the project area as well as a proposed terrain that includes a levee system along Turkey Creek from W 63rd Street to the Merriam Drive bridge. The USACE model analyzes the 100-yr, 24-hr storm using Atlas 14 rainfall depths for all scenarios. This model has higher existing flowrate (17,511 cfs) than the Johnson County 2D model (12,200 cfs for 100-yr, 12-hr storm, Atlas 14 rainfall depths) and the effective FEMA model (15,007 cfs for 100-yr, 24-hr storm, TP-40 rainfall depths) at Johnson Drive.

To calculate cut and fill quantities, the terrain was raised approximately 2 feet above the 100-yr water surface elevation for both the full-build option and the no-rise option. The 2 foot height was based on the future APWA 5600 criteria and ASCE24-14, Flood Resistant Design and Construction elevations, conservatively assuming the project area may include essential facilities. Since the water surface varies along the length of the project, the elevation of the raised areas of both project options varies as well.

Full-Build Option

For the full-build option (see Figure 2), the proposed grading surface was created in Civil3D. The full-build project area is set approximately 2 feet above the 100-yr water surface elevations along Turkey Creek. That elevation tapers down to existing ground at a 6:1 slope at the north and west sides of the project area in order to maintain access to Turkey Creek. The full-build project area was raised to an elevation of approximately 920 feet on the south end near Johnson Drive and approximately 914 feet on the north end near the Merriam Drive bridge. It should be noted, in order to maintain vehicle access and maximize developable area there may need to be retaining walls in the vicinity of Johnson Drive.

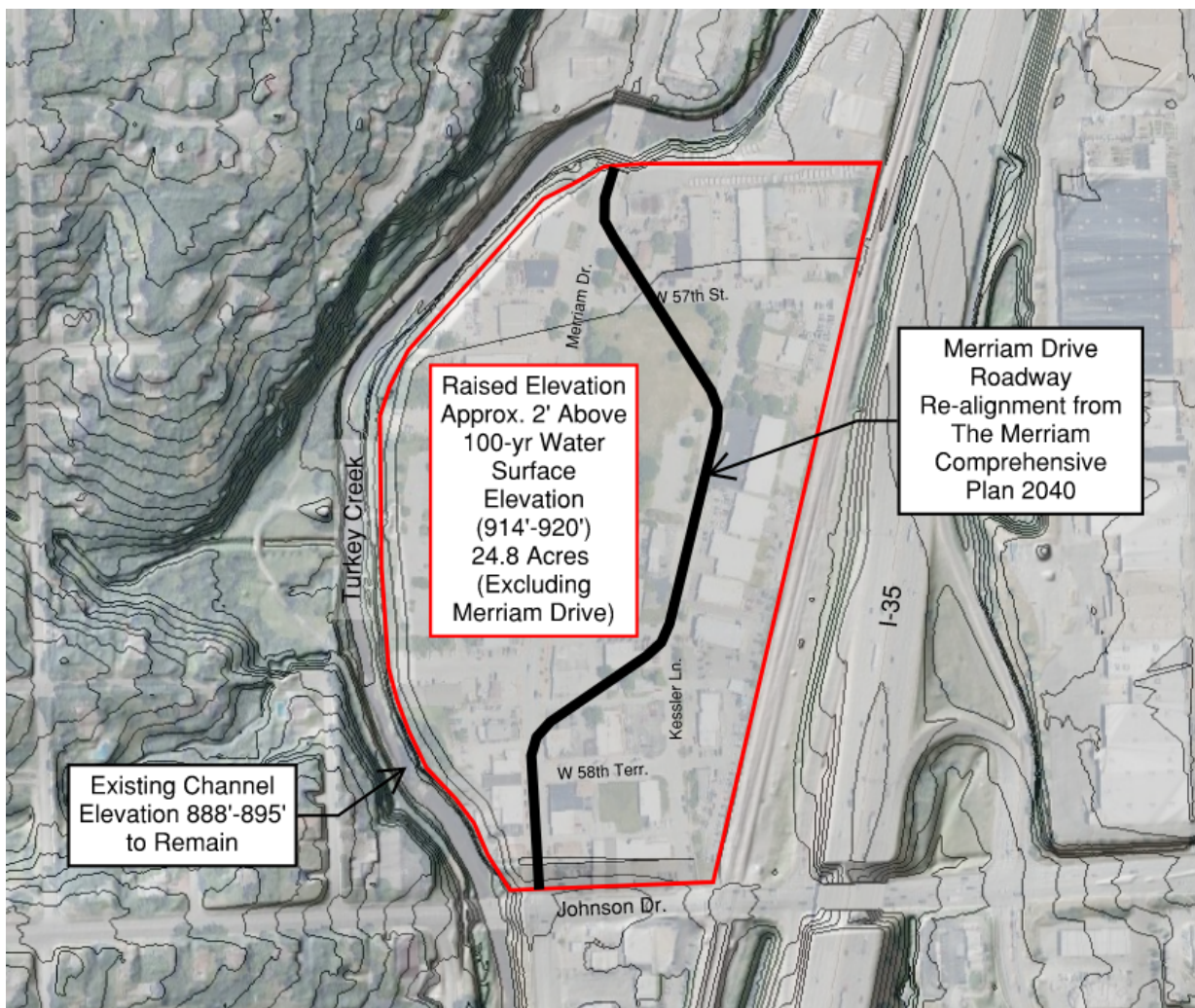


Figure 2. Proposed Full-Build Grading Footprint

After the proposed project area was modeled, it was then combined with a portion of the USACE levee system in order to mitigate the effects of the fill upstream. Only the levees and floodwalls outside of the project limits were used, which was approximately 78% of the total levee system proposed by USACE (see Figure 3) based on length. By incorporating a portion of the proposed USACE levee system, using slope transitions to tie into existing project limits, and maintaining a

general southeast to northwest drainage pattern within the project area, the proposed raised area in downtown Merriam can maintain pedestrian access to Turkey Creek, accommodate vehicle access through the realignment of Merriam Drive, avoid impact to the railroad east of the downtown area, and achieve no-rise conditions upstream and negligible rise downstream.

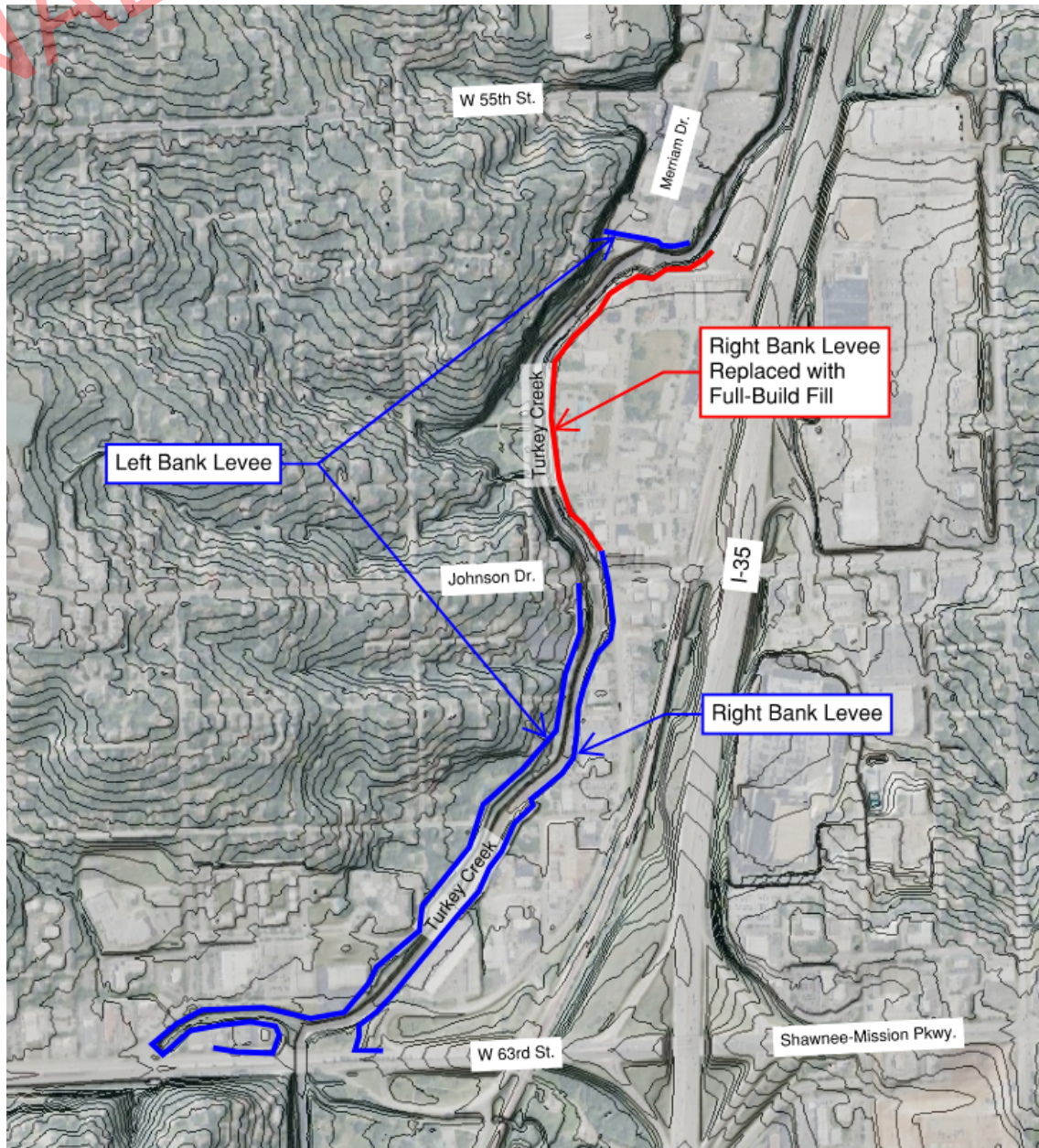


Figure 3. Extents of USACE Levee Improvements for Full-Build Option

The results of this run showed a maximum increase in the 100-yr water surface elevation of approximately 3.4 feet upstream of Johnson Drive and an increase of approximately 1.03 feet downstream of the project. A 3.4-foot rise in a FEMA Zone AE mapped floodplain is not permissible by federal law and would require mitigation. The levee and floodwall infrastructure plan proposed by USACE outside of the proposed project limits would provide the mitigation needed for the 100-yr water surface increase with the full-build grading option.

The opinion of probable construction cost of bringing the full project area 2 feet above the proposed 100-yr water surface elevation is shown in Table 1. Full-Build Opinion of Probable Cost. This alternative results in 24.8 acres of area raised above the floodplain that could be redeveloped, excluding the conceptual footprint of Merriam Drive. This alternative allows the entire 2040 plan to be implemented in this area if desired.

Table 1. Full-Build Opinion of Probable Cost

| Line | Description | Units | Qty. | Unit Cost | Total Cost |
|--------------------------------------|---|-------|---------|-----------------|-------------------------|
| Land Acquisition | | | | | |
| 1 | 2025 Appraised Property Value* | LSUM | 1 | \$37,825,925.00 | \$37,825,925.00 |
| Land Acquisition Subtotal | | | | | \$37,825,925.00 |
| Construction Costs | | | | | |
| 2 | Fill | CY | 298,741 | \$50.00 | \$14,937,050.00 |
| 3 | Cut | CY | 5,389 | \$20.00 | \$107,780.00 |
| 4 | Bridge Reconstruction (Merriam Dr. and Johnson Dr.) | LSUM | 1 | \$10,787,367.00 | \$10,787,367.00 |
| 5 | Realignment of Merriam Dr. | MI | 0.36 | \$8,453,280.00 | \$3,043,180.80 |
| 6 | Levee/Floodwall Improvements | LSUM | 1 | \$22,503,094.00 | \$22,503,094.00 |
| 7 | Downstream Impact Mitigation† | TBD | TBD | TBD | TBD |
| Construction Costs Subtotal | | | | | \$51,378,471.80 |
| Contingency (30%) | | | | | \$15,413,541.54 |
| 2025 Construction Costs Total | | | | | \$66,792,013.34 |
| Permitting | | | | | \$50,000.00 |
| Utility Relocation (6%) | | | | | \$4,007,520.80 |
| JCW Utility Relocation | | | | | \$10,000,000.00 |
| Engineering (15%) | | | | | \$10,018,802.00 |
| Construction Inspection (6%) | | | | | \$4,007,520.80 |
| Total (2025 Costs) | | | | | \$132,701,781.94 |

*Appraised Property Values were obtained from Johnson County Automated Information Mapping System (AIMS). Values were increased by 150% of the cost of appraised values to account for market value, demo, adjustments, and relocations.

† This alternative results in induced impacts downstream that will need to be mitigated.

Note: All Unit Prices based on 2025 values. The costs shown in this estimate represent an estimate of probable costs prepared in good faith and with reasonable care. HNTB has no control over the costs of construction labor, materials, or equipment, nor over competitive bidding or negotiating methods and does not make any commitment or assume any duty to assure that bids or negotiated prices will not vary from this estimate.

No-Rise Option

The other option considered is a no-rise option. Multiple grading configurations were modeled to contain a rise within the project area resulting in this conceptual alternative. In general, opening the channel too much without a hydraulic constriction removed floodplain storage and caused a rise downstream, while constricting the channel too much caused a rise upstream. A balance is required when laying out the configuration of cut and fill to reduce the risk of a rise both upstream and downstream of the project area. It was determined that the project area east of Merriam Dr. could be raised in addition to the small area north of 57th St. as shown in red in Figure 3 to achieve no rise.

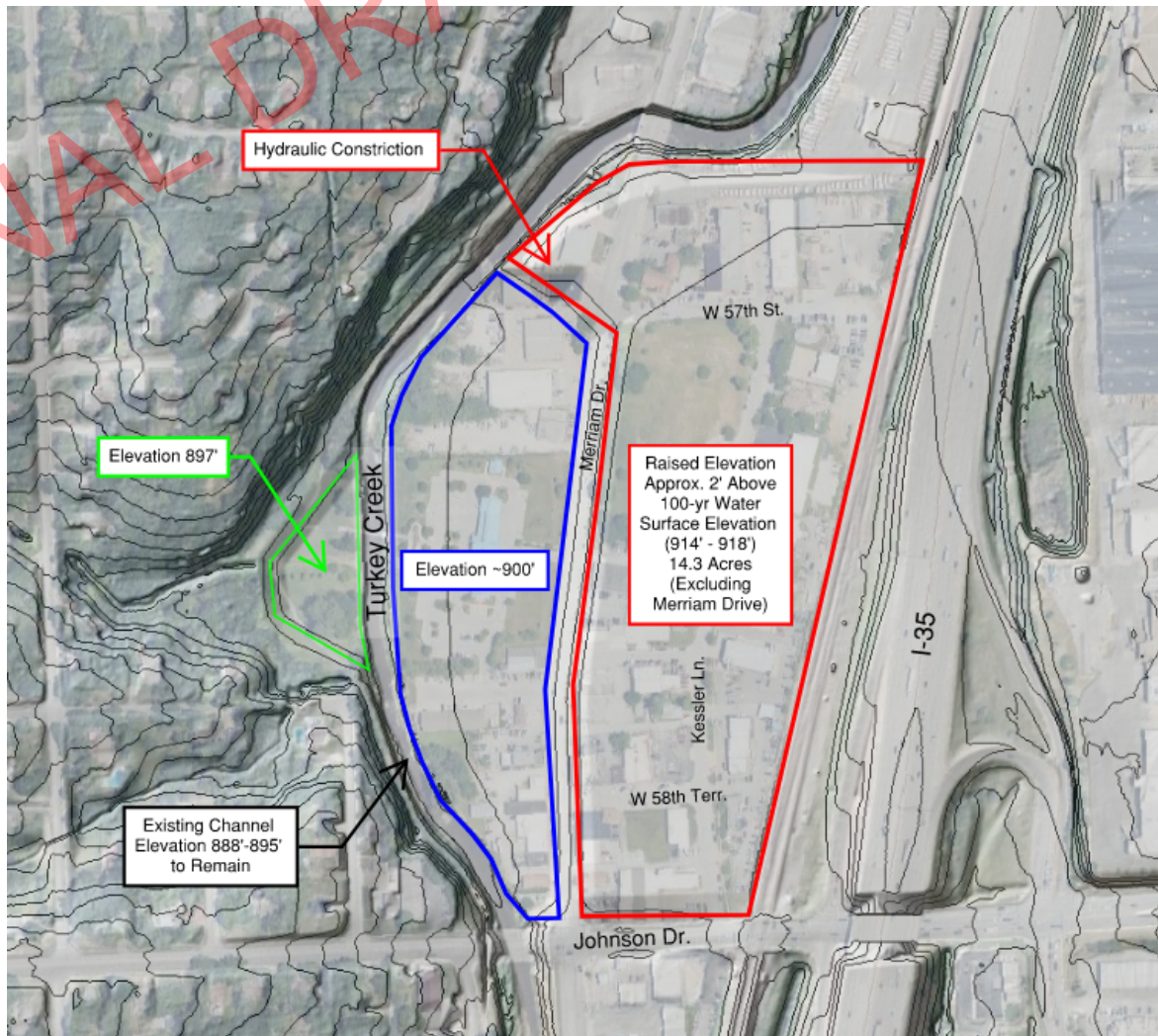


Figure 4. Proposed No-Rise Grading

For the no-rise option, the proposed grading surface was modeling using Civil3D. The fill area for the no-rise option is set approximately 2 feet (+/-) above the 100-yr water surface elevations along Turkey Creek. That elevation tapers down to existing ground at 6:1 slope at the north side of the project as well as to the west side of the raised fill area in order to maintain access to Turkey Creek. The fill area was raised to approximately 918-foot elevation on the south end near Johnson Drive and approximately 914-foot elevation on the north end near the Merriam Drive bridge. The fill requirements decrease to the east as the existing ground is higher on the east side. It should be noted, in order to maintain vehicle access and maximize developable area there may need to be retaining walls in the vicinity of Johnson Drive.

West of Turkey Creek in Werner Park, the terrain was lowered to an elevation of 897 feet, approximately 5 feet above the existing channel bottom to provide floodplain storage. This area is shown in green in Figure 3. East of Turkey Creek, storage was provided by lowering the area west of Merriam Dr. to an elevation of ~900 feet as shown in blue in Figure 3. Both the blue and green area would be inundated more often than the 2-yr event. The raised area west of Merriam Dr. (labeled as “Hydraulic Constriction” in Figure 4) was necessary to constrict the channel and force water to back up and expand into the additional storage areas shown in blue and green in Figure 4. As this alternative achieves no-rise, it was not necessary to include any of the proposed

USACE Levee improvements. This alternative would likely require a revision to the Merriam Comprehensive Plan 2040.

The opinion of probable cost of the cut and fill associated with the no-rise option is shown in Table 2. No-Rise Opinion of Probable Cost. This alternative results in 14.3 acres of areas raised above the floodplain that could be redeveloped, excluding the conceptual footprint of Merriam Drive.

Table 2. No-Rise Opinion of Probable Cost

| Line | Description | Units | Qty. | Unit Cost | Total Cost |
|--------------------------------------|---|-------|---------|-----------------|------------------------|
| Land Acquisition | | | | | |
| 1 | 2025 Appraised Property Value* | LSUM | 1 | \$15,130,370.00 | \$15,130,370.00 |
| Land Acquisition Subtotal | | | | | \$37,825,925.00 |
| Construction Costs | | | | | |
| 2 | Fill | CY | 140,823 | \$50.00 | \$7,041,150.00 |
| 3 | Cut | CY | 162,433 | \$20.00 | \$3,248,660.00 |
| 4 | Bridge Reconstruction (Merriam Dr. and Johnson Dr.) | LSUM | 1 | \$10,787,367.00 | \$10,787,367.00 |
| 5 | Realignment of Merriam Dr. | MI | 0.36 | \$8,453,280.00 | \$3,043,180.80 |
| 6 | Levee/Floodwall Improvements | N/A | N/A | N/A | N/A |
| Construction Costs Subtotal | | | | | \$24,120,357.80 |
| Contingency (30%) | | | | | \$7,236,107.34 |
| 2025 Construction Costs Total | | | | | \$31,356,465.14 |
| Permitting | | | | | \$50,000.00 |
| Utility Relocation (6%) | | | | | \$1,881,387.91 |
| JCW Utility Relocation | | | | | \$6,000,000.00 |
| Engineering (15%) | | | | | \$4,703,469.77 |
| Construction Inspection (6%) | | | | | \$1,881,387.91 |
| Total (2025 Costs) | | | | | \$83,698,635.73 |

*Appraised Property Values were obtained from Johnson County Automated Information Mapping System (AIMS). Values were increased by 150% of the cost of appraised values to account for market value, demo, adjustments, and relocations.

Note: All Unit Prices based on 2025 values. The costs shown in this estimate represent an estimate of probable costs prepared in good faith and with reasonable care. HNTB has no control over the costs of construction labor, materials, or equipment, nor over competitive bidding or negotiating methods and does not make any commitment or assume any duty to assure that bids or negotiated prices will not vary from this estimate.

Conclusion and Future Considerations

These alternatives were modeled as part of a high-level analysis. The full-build scenario results in approximately 3.4 feet of rise which is mitigated using a portion of the proposed USACE levee system and the no-rise scenario has the potential to meet FEMA no-rise criteria. Special consideration should be given to ensure no additional water is drained onto the railroad right-of-way located at the eastern edge of the project. While the full-build is more costly, there would be full access unimpeded by flood waters on either side of the redeveloped area. As for the no-rise option, there would be remnant flooding on Merriam Drive north of the project and Johnson Drive which could restrict access during a flood event.

Additionally, because velocities are generally increased for both the full-build and no-rise conditions, it will be important to examine the duration at which the velocity is increased to check for erosion potential. Also, a shear stress analysis should be completed to ensure the long-term stability of Turkey Creek.

As part of Phase 2 of this project, grading changes for the full-build were combined with the USACE 2D model that includes levees and floodwalls south of Johnson Drive and north of the Merriam Drive bridge. Approximately 78% of the USACE flood protection by length would be needed upstream to mitigate the effects of this project. Additionally, both the full-build and no-rise scenarios were analyzed and then refined using the USACE 100-yr, 24-hr rainfall event. If the City deems this overall approach to flood damage reduction in Downtown Merriam to be desirable and financially feasible, it is recommended to move forward with more detailed analysis and design of these improvements.