

Section 8 Technical Reports

8.f Floodplain Hydraulic/Hydrologic Modeling Report

This section addresses *Larimer County Procedural Guide for 1041 Permits*, Item 8.f, and the criteria and standards described in LUC Sections 4.2.2, 14.10.D.3, 14.10.D.4, 14.10.D.6, 14.10.D.7, and 14.10.D.11.

The TWP corridor is 500-feet to ¼-mile wide to accommodate the water pipeline and appurtenances. The final water pipeline alignment will be developed during final design. Typically a 50-foot permanent easement for the water pipeline and a 40-foot temporary construction easement will be purchased from property owners. The TWP corridor width varies to allow for flexibility when developing the final water pipeline alignment as described in Section 2: Project Description. The TWP corridor crosses several designated 100-year floodplains as described herein and as shown on **Figure 8.f**, 100-Year Floodplains.

The TWP will not alter floodplains. The water pipeline will utilize trenchless construction methods under waterbody crossings such as Waters of the United States (jurisdictional waters), including streams, rivers, lakes, and wetland areas. Work conducted within the floodplain fringe areas will be restored to pre-construction conditions. Therefore, the TWP will mitigate impacts on the hydraulic and hydrology of the floodplain. Because impacts will be mitigated, no modeling has been conducted for this section. Thornton will obtain Floodplain Development permits and other approvals as required for floodplain crossings from Larimer County after design has progressed. Information will be provided to Larimer County as required to obtain permits.

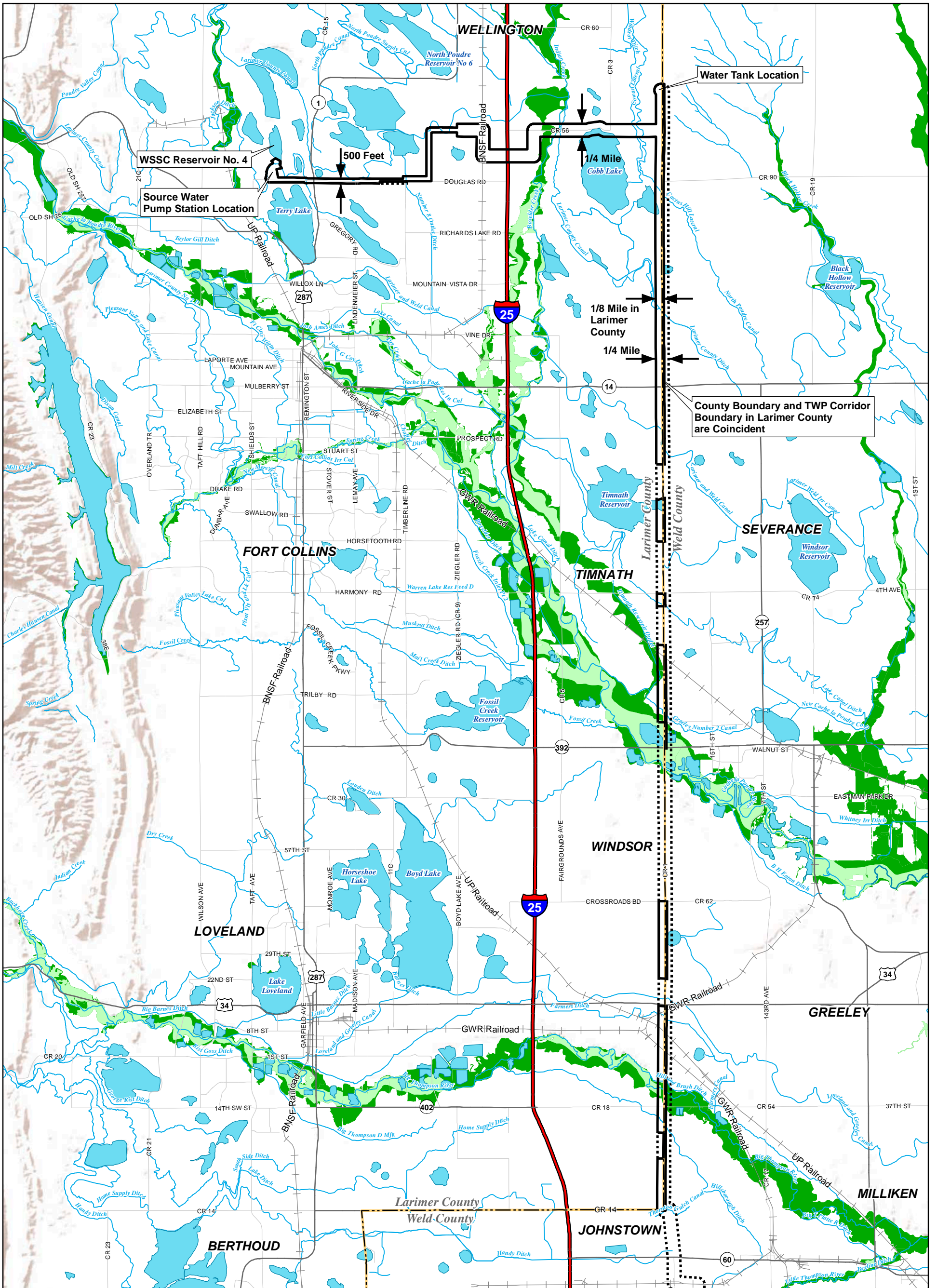
The TWP corridor crosses three designated 100-year floodplains in eastern Larimer County. Floodplain crossings information listed in this section were obtained from Larimer County and Weld County GIS data collected on July 18, 2016 from the online Larimer County Digital Data repository and November 2, 2016 from the online Weld County Downloadable Data repository. Floodplain crossings are shown on **Figure 8.f**, 100-Year Floodplains and identified below:

- Box Elder Creek east of I-25 near County Road 56
- Cache la Poudre River near Highway 392
- Big Thompson River near County Road 54

Floodplain crossings will utilize open-cut construction in the fringe area of the floodplain and trenchless construction methods under the ordinary high water mark and associated wetlands so that there will be no impact to jurisdictional waters. Spoils from trench excavations, construction-related equipment, materials, and supplies will be stored outside of the 100-year floodplain per local floodplain regulations. Fringe areas using open-cut construction will be restored to pre-construction grades and vegetation at the conclusion of construction.

Trenchless construction methods could include methods such as tunneling or auger boring techniques. Where trenchless construction methods are used, shafts will be located on either side of the water resource for launching and receiving the water pipeline and the fiber optic cable and will be located outside of the normal high water mark and associated wetlands. Shafts will be backfilled and compacted, and affected areas will be restored to pre-construction conditions. A geotechnical investigation of geologic conditions near crossing locations will be completed during design.

Thornton Water Project



**CITY OF THORNTON
COLORADO**

12450 WASHINGTON ST
THORNTON, CO 80241-2405

12/29/2017



0 0.9 1.8
Miles
1 in = 1.8 miles

- TWP Corridor in Unincorporated Larimer County
- TWP Corridor outside Unincorporated Larimer County
- County Boundary
- Railroad
- Lake/Reservoir
- River/Stream/Canal/Ditch
- 100-yr Flood Fringe
- 100-yr Floodway

**Figure 8.f
100-yr Floodplain**

Sources: NHD, USGS, CDWR, Larimer and Weld Counties, CDOT, FEMA

Currently, no areas have been identified that may pose a risk to trenchless construction methods; however, should any such locations be identified throughout the geotechnical investigation, Thornton will consult with applicable parties as required, including the affected property owners, Larimer County, and other agencies to develop an alternative approach that will minimize impacts.

The general standards required per LUC Section 4.2.2 that are applicable to the TWP will be met and include the following:

- *4.2.2.D.1.a - All new construction or substantial improvements shall be designed (or modified) and adequately anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.*

The water pipeline will be buried under floodplains. Buoyancy calculations will be conducted as part of design.

- *4.2.2.D.1.b - All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damage.*

Floodplain crossings will utilize open-cut construction in the fringe area of the floodplain and trenchless construction methods under the ordinary high water mark and associated wetlands. Spoils from trench excavations, construction-related equipment, materials, and supplies will be stored outside of the 100-year floodplain per local floodplain regulations. Fringe areas using open-cut construction will be restored to pre-construction grades and vegetation at the conclusion of construction.

- *4.2.2.D.1.c - All new construction or substantial improvements shall be constructed with materials resistant to flood damage.*

Within areas designated as 100-year floodplains, the water pipeline will be constructed with materials resistant to flood damage, such as welded steel pipe or ductile iron pipe. Materials for appurtenances will include concrete, steel, cast iron, and ductile iron. Valves in manholes will include equipment capable of withstanding some water submersion.

- *4.2.2.D.3 All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.*

Within areas designated as 100-year floodplains, the TWP will be designed to minimize or eliminate infiltration of flood waters into the system through the use of watertight joints; manholes, and vaults will include watertight joints and waterproofing coatings.

- *4.2.2.D.5 - With the exception of critical facilities, outlined in subsection 4.2.2.E, new construction and substantial improvements of any commercial, industrial, or other nonresidential structure shall either have the lowest floor (including basement) elevated to the regulatory flood protection elevation or, together with attendant utility and sanitary facilities, be designed so that at the applicable flood protection elevation the structure is watertight with walls and openings substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. A registered Colorado Professional Engineer shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice. Such certification shall be submitted to the floodplain administrator before a building permit will be issued.*

The water pipeline and appurtenances will be designed and constructed in accordance with accepted standards of practice. The water pipeline will be buried under floodplains. Buoyancy calculations will be conducted as part of design. Manholes and vaults located within areas designated as 100-year floodplains will include watertight joints and waterproofing coatings. Design and specifications will be completed by a registered Colorado Professional Engineer. Thornton will obtain Floodplain Development permits and other approvals as required for floodplain crossings from Larimer County after design has progressed. Information will be provided to Larimer County as required to obtain approvals.

- *4.2.2.D.9.c - All proposed development shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize or eliminate flood damage.*

Within areas designated as 100-year floodplains, the water pipeline will be constructed with materials resistant to flood damage, such as welded steel pipe or ductile iron pipe. Manhole and vaults located within areas designated as 100-year floodplains will include watertight joints and waterproofing coatings.

- *4.2.2.D.9.d - All proposed development shall meet the floodplain development permit requirements of subsection 4.2.2.H.*

Thornton will obtain Floodplain Development permits and other approvals as required for floodplain crossings from Larimer County after design has progressed and information will be provided as required to obtain approvals.

- *4.2.2.D.14 - All activities shall meet all applicable federal, state and local floodplain requirements and regulations.*

Thornton will obtain Floodplain Development permits and other approvals as required for floodplain crossings from Larimer County as applicable after design has progressed and information will be provided to Larimer County as required to obtain approvals. Other applicable federal, state, and local floodplain requirements and regulations will be met.

- *4.2.2.D.19 - Outdoor storage or processing of materials that in time of flooding are buoyant, flammable, explosive, or could be injurious to human, plant or animal life is prohibited.*

Spoils from trench excavations, construction-related equipment, materials, and supplies will be stored outside of the 100-year floodplain per local floodplain regulations.

- *4.2.2.D.21 - Railroads, streets, roads, bridges, flood and water control structures, above and below ground utilities (excluding service connections), pipelines, marinas, boat rentals, docks, piers, and wharves, if allowed by underlying zoning shall be processed as a floodplain special review.*

Thornton will obtain Floodplain Development permits and other approvals as required for floodplain crossings from Larimer County after design has progressed and information will be provided to Larimer County as required to obtain approvals.