

5.14 Floodplains and Drainage/Hydrology

This section discusses floodplain and drainage/hydrology resources and explains why they are important to the project. The impacts from the project alternatives on these resources also are evaluated, and proposed mitigation measures are discussed to minimize negative effects.

Since the Supplemental Draft EIS was published in August 2014, additional analyses and content review have been performed for many of the resources discussed in this document. These updates, along with changes resulting from the comments received on the Supplemental Draft EIS, have been incorporated into this Final EIS. In this section, the updates include the following items:

- Added in reasons for evaluation under NEPA.
- Included information on potential ponding areas north of I-70.
- Refined offsite flow summary.
- Revised onsite drainage alignment.

5.14.1 What are floodplains and ponding areas and why are they important to this project?

Floodplains typically are defined as areas adjacent to streams and rivers that periodically are flooded by water. The flood zones that are designated by the Federal Emergency Management Agency (FEMA) within the study area are located along the South Platte River and Sand Creek. Both of these areas are classified as having a 1-percent chance of flooding each year—also referred as a 100-year flood event. Potential ponding areas are developed areas with limited-capacity storm drain systems that result in periodic flooding during storm events. It is important to perform a detailed analysis of floodplains, ponding areas, and drainage to ensure that adequate drainage is designed for the project alternatives in case of a storm and that the project alternatives will not negatively impact the floodplains and ponding areas.

Reasons for evaluation of floodplains under NEPA

CDOT conducts floodplain assessments to:

- Ensure that floodplains are identified and their services and functions are protected to the maximum extent possible
- Comply with CDOT's Environmental Stewardship Policy, which ensures that the statewide transportation system is constructed and maintained in an environmentally responsible, sustainable, and compliant manner
- Comply with federal acts and executive orders

The regulations, advisories, and orders are directed toward the treatment of floodplains under NEPA. The intent of these regulations is to avoid or minimize highway encroachments within 100-year (base) floodplains, where practicable, and to avoid supporting land use development that is incompatible with floodplain services. Under the requirements of Executive Order 11988, "Floodplain Management" (Carter, 1977b), all federal-aid projects must make diligent efforts to:

- Avoid support of incompatible floodplain development
- Minimize the impact of highway actions that adversely affect the base floodplain
- Restore and preserve the natural and beneficial floodplain services
- Be consistent with the standards/criteria of the National Flood Insurance Program (NFIP) of FEMA

In addition to federal and state laws and regulations, local jurisdictions may have ordinances and regulations that must be followed. The CDOT Project Engineer must coordinate with counties, cities, and other jurisdictions in the study area to ensure any proposed encroachment or alteration of a floodplain meets their requirements.

Both Denver and Aurora have specific regulations and/or ordinances related to the proper management of floodplains. Denver's regulations are presented in the *Storm Drainage Design and Technical Criteria Manual* (Denver Wastewater Management, 2006) and a Floodplain Ordinance in the Revised Municipal Code. The general purpose of Denver's floodplain regulations includes:

- To reduce the hazards of floods to life and property
- To protect and preserve the hydraulic characteristics of water courses used for conveyance of flood waters
- To protect the public from extraordinary financial expenditures for flood control and relief

Aurora's policy for floodplains lists the major concerns as:

- Prevention of excessive erosion, flood heights, or flow velocities
- Protection of any use within or adjacent to a floodplain from damage
- Control or alteration of natural floodplains and channels
- Prevention of barriers which would divert flood waters and increase flood hazards in other areas

Analysis of drainage and floodplains seeks to encompass all of the policies and regulations to determine the best solution to drainage and floodplain issues.

5.14.2 What study area and process were used to analyze floodplains and drainage?

The study area for floodplains and drainage is the combined construction limits of the project alternatives. It includes bridge crossings at the South Platte River and Sand Creek, as seen in **Exhibit 5.14-1**. Both streams include a delineated 100-year floodplain. Due to the new smaller study area, Westerly Creek is no longer impacted by this project.

A review of the effective FEMA Flood Insurance Rate Maps (FIRMs) was completed for the study area. The South Platte River and Sand Creek both have detailed hydrologic and hydraulic studies and delineated floodplains.

Additionally, I-70 East crosses potential ponding areas identified in several locations. These are located in areas of the watershed that receive substantial surface flows or where water collects during extreme rainfall events.

Exhibit 5.14-1 Floodplains and Drainage Study Area

Smaller drainage crossings are not defined by FEMA; however, Denver has identified potential ponding areas within the study area. Potential ponding areas identified in the *Denver Storm Drainage Master Plan* (Denver Wastewater Management Division, 2014), *Park Hill (North of Smith Road) Drainage Outfall System Plan Conceptual Design Report* (Enginuity & Matrix Design Group, 2012), *Lower Montclair Street Flow Criteria Analysis Memorandum* (Enginuity, 2010), and the *Memorandum for I-70 Partial Cover Lowered Montclair Drainage Basin Hydrologic Analysis* (Enginuity, 2014a), and the *Memorandum for I-70 Partial Cover Lowered Park Hill Drainage Basin Hydrologic Analysis* (Enginuity, 2014b) were used to identify areas for additional drainage consideration and analysis.

5.14.3 What are the areas of floodplain and drainage interest that are being analyzed and what are their existing conditions?

The South Platte River is a confined urban floodplain that has been narrowed by previous development. The existing I-70 bridges and frontage road bridges cross the South Platte River. At this time, FEMA delineates the floodplain as Zone AE with calculated base flood elevations. A primary source of stream flow in the South Platte River is releases from upstream reservoirs, including Chatfield and Cherry Creek Reservoirs. Although waters in the reservoirs originate as groundwater, snowmelt, precipitation, effluent discharge, and stormwater runoff, instream flows are strongly influenced by releases from upstream reservoirs and, as a result, may not always reflect the timing of precipitation events.

The existing I-70 bridge crosses Sand Creek. FEMA currently delineates the floodplain as Zone AE with calculated base flood elevations.

Exhibit 5.14-2 shows the identified potential ponding areas along the I-70 corridor. These potential ponding areas represent flooding risks for the existing developed watershed, including flooded streets and structures.

FEMA floodplain zones

Floodplain zones are geographic areas that FEMA has defined according to varying levels of flood risk. These zones are shown in a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map.

Each zone reflects the severity or type of flooding in the area.

Cubic feet per second

Cubic feet per second (cfs) denotes the volume of water passing any given point in one second.

Exhibit 5.14-2 Potential Ponding Areas



Denver's *Storm Drain Master Plan* identified substantial offsite flows through the area, including surface overflows crossing I-70 between Brighton Boulevard and York Street, near Steele Street/Vasquez Boulevard, and between Colorado Boulevard and Dahlia Street. The Denver standard is to design local storm drain systems for a 20-percent annual chance (five-year) storm event.

Additional analysis of Montclair Basin and Park Hill Basin provided detailed information about the surface overflows impacting I-70. Because of the complexity of the project, local interest in the potential ponding areas, the fact that multiple projects would be impacted by the ponding areas, and the need for additional analysis of existing conditions, a Multi-Agency Technical Team (MATT) was developed. This MATT included CDOT, Denver, RTD, and the National Western Complex staff. Analysis of the existing ponding areas was developed through the MATT for use in this EIS and with future project planning. The I-70 Partial Cover Lowered Alternative Drainage Multi-Agency Technical Team Memo, dated August 1, 2014, provides peak discharges at I-70, which also are provided in **Exhibit 5.14-3**.

Exhibit 5.14-3 I-70 East Offsite Flow Summary Table

Location	1-Percent Annual Chance Peak Discharge (cfs)
I-70 at Race Street	2,649
I-70 at York Street	1,190
I-70 at Steele Street	1,120
I-70 at Colorado Boulevard	1,995

5.14.4 How do the project alternatives potentially affect floodplains and drainage?

The increased width of the viaduct for the No-Action Alternative and the Revised Viaduct Alternative could increase the amount of onsite water runoff from the I-70 viaduct. However, the additional runoff will follow existing flow patterns and the necessary drainage infrastructure will be in place to avoid an adverse impact to the surrounding areas.

A proposed onsite drainage system (see **Exhibit 5.14-4**) is included for all alternatives to capture and convey the onsite stormwater and discharge it into the South Platte River. This outfall will not change the boundary of the existing South Platte floodplain.

The No-Action Alternative and the Revised Viaduct Alternative have a minimal impact to the potential ponding areas. However, the Partial Cover Lowered Alternative substantially impacts the potential ponding areas located between Brighton Boulevard and Dahlia Street. The lowering of I-70 will create a depression that captures and retains surface flows from the upstream basin before their discharge to the South Platte River.

The drainage system included with the Partial Cover Lowered Alternative will capture and convey offsite flows between Brighton Boulevard and Dahlia Street that currently drain north under the existing I-70 viaduct. The capture and conveyance of this offsite flow substantially reduces the ponding areas and existing flooding north of I-70. This drainage system (see **Exhibit 5.14-5**) starts at the Market Lead Railroad low point approximately 1,220 feet to the west of Colorado Boulevard and is located within the 46th Avenue right of way on the south side of I-70. The storm drain continues to the west looping around the south of the Denver Coliseum within McFarland Drive, through the parking lot of the Coliseum, and through Globeville Landing Park, ultimately discharging the offsite flow into the South Platte River. It will not change the boundary of the existing floodplain.

Proposed drainage

All the alternatives include drainage improvements on the north side of I-70 to capture and convey the onsite water runoff.

The Partial Cover Lowered Alternative also includes an offsite drainage system south of I-70 to capture surface water before it enters the lowered section of the highway.

Exhibit 5.14-4 Onsite Drainage System North of I-70

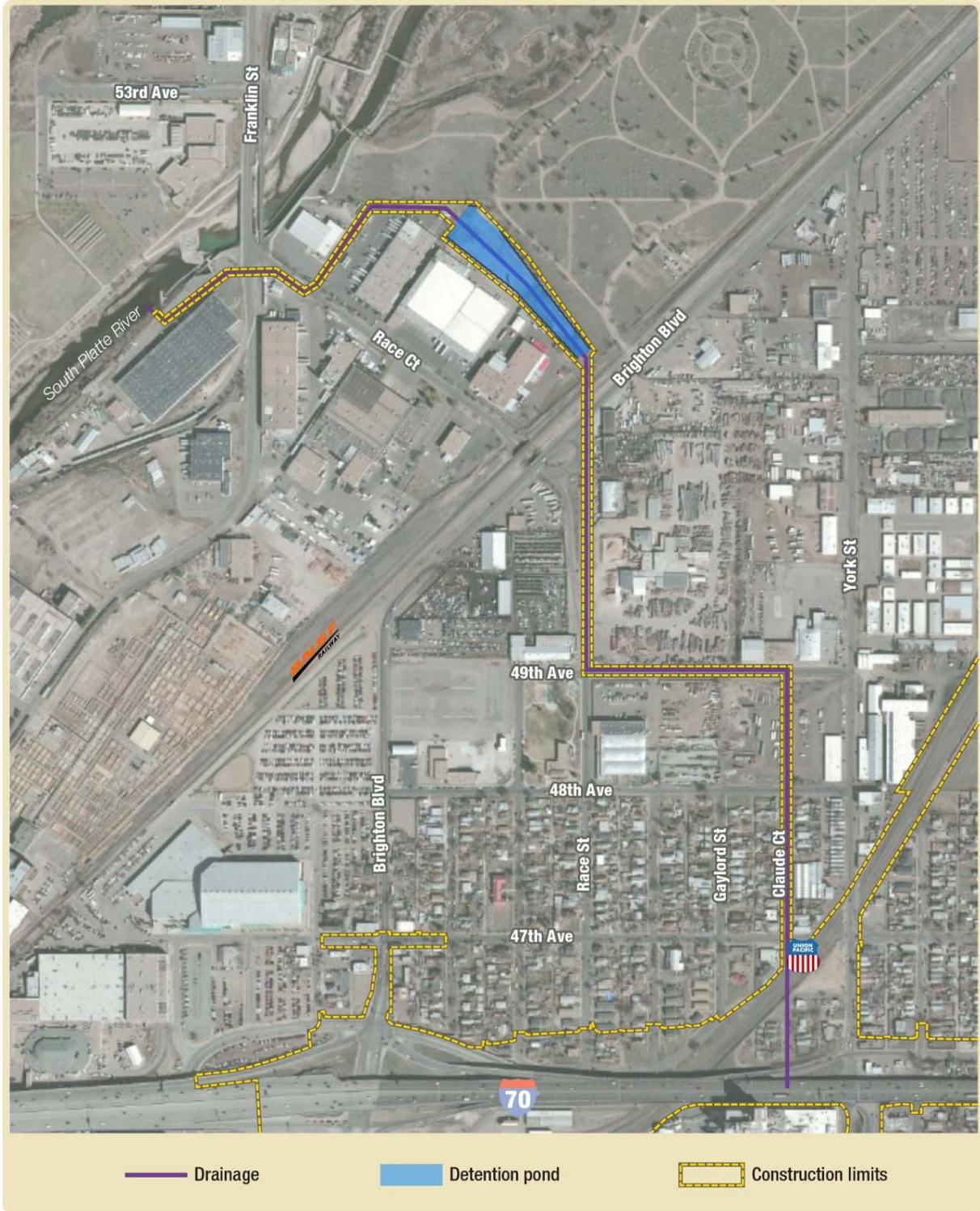
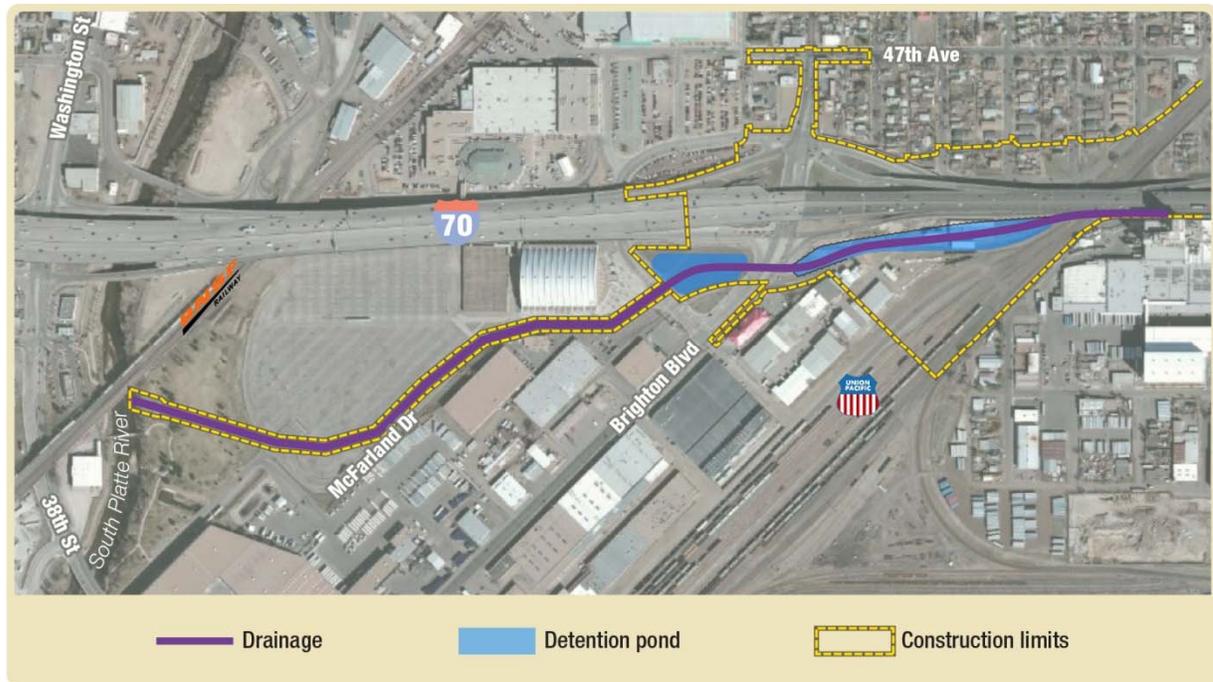


Exhibit 5.14-5 Offsite Drainage for the Partial Cover Lowered Alternative South of I-70



The Build Alternatives may impact the floodplain for Sand Creek, with bridge construction and new bridge structures crossing this waterway. Bridge piers are considered as a minimal floodplain encroachment; however, new bridge structures will be designed to have minimal effect on the existing regulatory base flood elevation and floodplain limits.

Attachment M, *Hydrology and Hydraulics Technical Report Addendum*, includes additional detail on the hydrologic and hydraulic analysis of the offsite and onsite drainage. A preliminary onsite hydrological analysis was done to estimate flows and size the drainage system to route the onsite flows to the South Platte River. Additional design and analysis for the proposed drainage facilities, including pipe and pond sizes, will be conducted as part of the final design.

5.14.5 How are the negative effects from the project alternatives mitigated for floodplains and drainage?

The No-Action Alternative and the Build Alternatives will not negatively impact the floodplain resources for the South Platte River and Sand Creek. The effects to human safety, health, and welfare will be minimized and the beneficial values of the floodplains will be preserved. Any encroachment into the Sand Creek floodplain or floodway will require compliance with FEMA, NFIP, and Denver local floodplain permitting requirements.

The potential ponding areas between Brighton Boulevard and Dahlia Street will be minimally impacted by the No-Action Alternative and Viaduct Alternatives. On-site detention, to reduce possible increases in runoff from the widened I-70 will be implemented to match pre-existing runoff rates from I-70 and runoff will follow historical flow paths.

The potential ponding areas between Brighton Boulevard and Dahlia Street will be substantially impacted by the Partial Cover Lowered Alternative. To mitigate the risk to human safety, an offsite drainage system is required to capture and convey the offsite surface runoff before reaching the lowered section of I-70 between Brighton Boulevard and Colorado Boulevard and to discharge the stormwater runoff to the South Platte River. An additional offsite system is required to capture the offsite flows between Colorado Boulevard and Dahlia Street, reduce the discharges in a regional detention pond, and convey the flows north of I-70 to an existing storm drain system.

The runoff from I-70 will be captured and conveyed in a storm drain system that discharges to the South Platte River. Prior to discharging to the South Platte River, the system will discharge to a water quality pond to provide water quality treatment. Additional detail on water quality is discussed in Section 5.16, Water Quality. **Exhibit 5.14-6** lists the impacts and mitigations associated with floodplains and drainage/hydrology.

Exhibit 5.14-6 Summary of Floodplains and Drainage/Hydrology Impacts and Mitigations

Alternative	Impacts and/or Benefits	Mitigation Measures Specific to Alternatives
No-Action Alternative	Minimal impact to potential ponding areas due to the increased width of the viaduct, which may increase runoff from I-70	<ul style="list-style-type: none"> • Create detention ponds and implement storm drainage for onsite drainage system improvements • Design proposed bridge structures to cause no adverse impact to the Sand Creek floodplain
Revised Viaduct Alternative	<ul style="list-style-type: none"> • May impact the floodplain for Sand Creek since bridge construction and new bridge structures will cross this waterway • Minimal impact to potential ponding areas due to the increased width of the viaduct, which may increase runoff from I-70 	
Partial Cover Lowered Alternative	<ul style="list-style-type: none"> • Impact to the Sand Creek floodplain with the proposed bridge construction and new bridge structures will cross this waterway • Impact to potential ponding areas due to the increased width of the highway, which may increase runoff from I-70 • The potential ponding areas between Brighton Boulevard and Dahlia Street will be substantially impacted due to lowered profile of the highway 	<ul style="list-style-type: none"> • Create detention ponds and implement storm drainage for onsite drainage system improvements • Build an offsite drainage system to reduce the risk of flooding within the lowered section of I-70, as well as the portion of the watershed between I-70 and the South Platte River • Design proposed bridge structures to cause no adverse impact to the Sand Creek floodplain

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