5.16 Water Quality

This section discusses the water quality in the study area and explains why water quality is important to the project. The impacts of the project alternatives on water quality also are evaluated and proposed mitigation measures are discussed to offset any potential adverse 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 list of potential contaminants from transportation projects.
- Included text on applicable regulations and guidance, impaired waters within the project, and other considerations for water quality.
- Added exhibit to show possible water quality pond locations.

5.16.1 What is water quality and why is it important to this project?

Water quality refers to the physical, chemical, and biological characteristics of aquatic systems. It is important to protect water quality for the intended uses of a water body that may include support of aquatic habitats, domestic water supply, contact recreation (such as swimming or other water sports), or agricultural irrigation. Transportation projects can impact water resources used for drinking, recreation, agriculture, and wildlife habitat. Any increase in impervious cover will lead to an increase in the amount of runoff and associated pollutants and cause a drop in water quality. Potential contaminants that may impact water resources from transportation projects are shown in **Exhibit 5.16-1**. It is important to determine the potential effects of the project on the water quality of the receiving water bodies and to mitigate any adverse effects.

Exhibit 5.16-1 Potential Contaminates from Transportation Projects That May Impact Water Resources

Source	Pollutant
Construction Phase	
Adhesives	Phenols, formaldehydes, asbestos, benzene, naphthalene
Cleaners	Metals, acidity, alkalinity, chromium
Plumbing	Lead, copper, zinc, tin
Painting	Volatile Organic Compounds (VOCs), metals, phenolics, mineral spirits
Wood	Biological Oxygen Demand (BOD), formaldehyde, copper, creosote
Masonry/concrete	Acidity, sediment, metals, asbestos
Demolition	Asbestos, aluminum, zinc, dusts, lead
Yard operation and maintenance	Oils, grease, coolants, benzene and derivatives, vinyl chloride, metals, BOD,sediment, disinfectants, sodium arsenate, dinitro compounds, rodenticides,insecticides
Landscaping and earthmoving	Pesticides, herbicides, fertilizers, BOD, alkalinity, metals, sulfur, aluminum sulfate
Materials storage	Spills, leaks, dust, sediment
Operation Phase	
Leaks, spills, accidents	Oil, gasoline, diesel, grease, VOCs, chemicals, other potentially hazardous materials
Vehicle traffic	Oils, grease, gasoline, diesel, benzene and derivatives, aromatic hydrocarbons, coolants, rust (iron), heavy metals (lead, zinc, iron, chromium, cadmium, nickel, copper), rubber, asbestos
Winter sanding	Sediment
Deicing	Calcium, sodium, magnesium, chloride
Landscape maintenance	Herbicides, pesticides, fertilizers, BOD, alkalinity, metals, sulfur, aluminum sulfate
Adhesives	Phenols, formaldehydes, asbestos, benzene, naphthalene
Cleaners	Metals, acidity, alkalinity, chromium
Painting	VOCs, metal, phenolics, mineral spirits

Source: CDOT NEPA Manual, October 2014

5.16.2 How is water quality regulated and assessed?

CDOT conducts water resource assessments to:

- 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, state laws, and FHWA technical guidance

Applicable regulations and guidance

The regulations and certifications applicable to water resource evaluations are summarized below.

Clean Water Act (Sections 401, 402)

The Clean Water Act established the basic structure for regulating discharges of pollutants into navigable waters. It provides the statutory basis for the National Pollutant Discharge Elimination System (NPDES) permit program and the basic structure for regulating the discharge of pollutants into waters of the U.S.

Safe Drinking Water Act (40 CFR Parts 141–143)

The Safe Drinking Water Act (SDWA) protects public health by regulating the nation's public drinking water supply and protecting drinking water and its sources. CDOT is a stakeholder in the Colorado Source Water Assessment and Protection (SWAP) program mandated by the SDWA.

Erosion and Sediment Control on Highway Construction Projects (23 CFR 650 Subpart B)

All highways funded in whole or in part by FHWA must be designed, constructed, and operated according to standards that will minimize erosion and sediment damage to the highway and adjacent properties and abate pollution of surface and groundwater resources.

Colorado Water Quality Control Act (Colorado Revised Statutes [CRS] Title 25, Article 8)

The Colorado Water Quality Control Act protects and maximizes the beneficial uses of state waters and regulates water quality. EPA has delegated authority for enforcement of the Clean Water Act and SDWA to the CDPHE. Under this authority, the Colorado Water Quality Control Act was passed and the Water Quality Control Commission (WQCC)

was created to provide regulations to be implemented by CDPHE to keep Colorado in compliance with the Clean Water Act.

Based on requirements promulgated under Section 402 of the Clean Water Act, the WQCC has implemented Regulation 61 identifying CDOT as a regulated Municipal Separate Storm Sewer System (MS4). By definition, a separate storm sewer system includes not only a storm drainage system but also ditches, gutters, or other similar means of collecting and conveying stormwater runoff that do not connect with a wastewater collection system or wastewater treatment facility.

Colorado Discharge Permit System

Section 402 of the Clean Water Act outlines the regulations for complying with the NPDES (implemented by Colorado as the Colorado Discharge Permit System or CDPS). Under NPDES, states were required to "phase in" EPA regulations that were aimed at reducing point source pollution to waters of the state. These regulations encouraged states to develop a variety of programs to reduce point source and stormwater runoff pollution from construction projects during both the construction and operation phases of those projects. In 1990, EPA issued the Phase I MS4 Permit. Under the Phase I regulations, an MS4 that served more than 100,000 people was required to obtain a permit. CDOT was included in Phase I as an MS4 permittee. The area covered by the Permit included the roadways owned and operated by CDOT located within the cities that served more than 100,000 people (i.e., Denver, Lakewood, Aurora, and Colorado Springs).

The CDOT New Development and Redevelopment Program provides direction, criteria, and procedures to ensure that permanent BMPs are incorporated, as appropriate, into CDOT projects. Projects that will fall within CDOT jurisdiction, but are initially constructed by others, such as local governmental entities, also must comply with BMP requirements. It should be noted that some construction projects may occur in areas where multiple MS4 Permits apply. If this is the case, the MS4 with the most stringent requirements applies.

In 1999, MS4s serving urbanized areas were required to obtain Phase II MS4 Permits that required them to develop a program to reduce point source pollution to waters of the state. CDOT's MS4 Permit area of coverage was expanded to

include Phase II permits. Phase II also reduced the minimum size of construction projects requiring a CDPS permit from five acres of disturbed area to one acre or more of disturbed area.

Construction projects that disturb one acre or greater or are part of a larger common plan of development require a CDPS Construction Stormwater Permit from the Water Quality Control Division (WQCD) and a Stormwater Management Plan (SWMP). The SWMP is prepared in the final design application submitted to the WQCD at least 30 days prior to construction.

Sites that must discharge groundwater from a construction site to a surface water body also require a CDPS Dewatering Permit. If a project feature will require permanent dewatering, the necessary permits should be coordinated through CDPHE's WQCD.

Colorado Regulation Number 31

Most recently renewed on January 31, 2013, the Basic Standards and Methodologies for Surface Water establishes "basic standards, an antidegradation rule, an implementation process, and establishes a system for classifying state surface waters" (5 Code of Colorado Regulations 1002-31) according to the uses for which they are presently suitable or intended to become suitable. Classifications may be established for any state surface waters, except water in ditches and other manmade conveyance structures. This regulation classifies waters based on suitability for use in recreation, agriculture, aquatic life, and water supply. While this regulation provides the basic standards by which state waters will be classified, additional regulations have been established to classify individual waters. Classifications and standards specific to the South Platte River and Sand Creek are set forth in Regulation 38 of the Clean Water Quality Control Act. **Exhibit 5.16-2** details the classifications for stream segments within the study area.

Exhibit 5.16-2 Colorado Regulation Number 38 Water Use Classifications

Stream Segment	Use Classification	Description
Segment 14 Main stem of the South Platte River from Bowles Avenue in Littleton, Colorado to the Burlington Ditch diversion in Denver, Colorado	Aquatic Life, Class 1 Warm Water Aquatic Life	Waters currently capable of sustaining a wide variety of warm water biota, including sensitive species. Waters will be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.
	Recreation, Class E Existing Primary Contact Use	Surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975.
	Domestic Water Supply	Suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent), these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto (CRS §25-8-101-703).
	Agriculture	Suitable or intended to become suitable for irrigation of crops usually grown in Colorado and not hazardous as drinking water for livestock (CRS §25-8-101-703).
Segment 15 Main stem of the South Platte River from the Burlington Ditch diversion in Denver, Colorado, to a point immediately below the confluence with Big Dry Creek	Aquatic Life, Class 2 Warm Water Aquatic Life	Waters could sustain a wide variety of warm water biota, including sensitive species, but for correctable water quality conditions. Waters will be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.
	Recreation, Class E Existing Primary Contact Use	Surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975.
	Domestic Water Supply	Suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent), these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto (CRS §25-8-101-703).
	Agriculture	Suitable or intended to become suitable for irrigation of crops usually grown in Colorado and not hazardous as drinking water for livestock (CRS §25-8-101-703).
Segment 16a Main stem of Sand Creek from the confluence of Murphy and Coal Creek in Arapahoe County to the confluence with the South Platte River	Aquatic Life, Class 2 Warm Water Aquatic Life	Waters could sustain a wide variety of warm water biota, including sensitive species, but for correctable water quality conditions. Waters will be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.
	Recreation, Class E Existing Primary Contact Use	Surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975.
	Agriculture	Suitable or intended to become suitable for irrigation of crops usually grown in Colorado and not hazardous as drinking water for livestock (CRS §25-8-101-703).

Regulation Number 93—Impaired Waters

Every two years, the Clean Water Act requires states to publish an updated list of water bodies that are not meeting their beneficial uses because of excess pollutants; these pollutants can be naturally occurring or a result of human activity. The list, known as the EPA Section 303(d) list, is based on violations of water quality standards and is organized by watersheds, which are further divided into stream segments. Regulation Number 93 satisfies the federal requirements of Section 303(d) reporting and the WQCC assigns total maximum daily loads to these impaired segments, which accelerates their clean-up.

What is a watershed?

"Per EPA, A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place."

Based on Regulation Number 93, WQCC has identified three stream segments within the study area as impaired—Segments 14 and 15 of the South Platte River and Segment 16a of Sand Creek. WQCC defines pollutants that are the main cause for impairment and describes the portion of the segment for which the impairment applies. Lastly, they assign a clean-up priority to each segment. The impaired waters are summarized in **Exhibit 5.16-3**, and their locations are shown on **Exhibit 5.16-4** in the following subsection.

Exhibit 5.16-3 Impaired Waters Identified on EPA Section 303(d) List

Stream Segment	Segment Description	Portion	Impairment	Priority
Segment 14	South Platte River, Bowles Avenue to Burlington Ditch	All	Arsenic	High
Segment 15	South Platte River, Burlington Ditch to Big Dry Creek	Clear Creek to Fulton Canal diversion and Burlington Canal headgate to Metro Wastewater Reclamation District	E. coli, Cadmium	High
Segment 16a	Sand Creek	All	Selenium, E. coli	Low to High

5.16.3 What study area and process was used to analyze water quality?

The study area for water quality matches the construction limits of the project alternatives. However, the impacts are applied to the overall watershed to determine if the impacts are significant (see **Exhibit 5.16-4**).

Exhibit 5.16-4 Water Quality Study Area

The study area is located within the Upper South Platte River watershed, which drains into the South Platte River. It can be characterized by high plains and rolling foothills with elevations ranging from approximately 4,800 feet to 8,300 feet above mean sea level. The watershed is highly urbanized within the study area with little natural groundcover. The average annual rainfall in the Denver metropolitan area is 15.4 inches and the average annual snowfall is 55.4 inches.

Surface water resources located within the study area include the South Platte River and Sand Creek. Each of these meets one or more of CDOT's "sensitive" criteria, due to their listing on the EPA Section 303(d) list, as described in the "New Development and Redevelopment Program."

Permanent BMPs are required by CDOT for projects that may affect "sensitive" waters.

The method of Driscoll analysis was prepared for FHWA in 1990 to help predict the effect of runoff to the water quality of a receiving water body through an estimation of the pollutant loading in the runoff.

The water quality analysis used a partial Driscoll model. The pollutants analyzed for included lead, copper, phosphorous, zinc, and total suspended solids.

The partial Driscoll analysis was performed for all of the alternatives for both water bodies: the South Platte River and Sand Creek.

What does a partial Driscoll analysis entail?

The Driscoll model is used to determine highway runoff pollutant loading impacts to receiving waters. This modeling approach identifies and quantifies the elements in highway runoff, identifies the sources and migration paths of these pollutants from the highways to the receiving waters, analyzes the effects of these pollutants on the receiving waters, and then develops the necessary abatement/ treatment methodology for objectionable pollutants.

5.16.4 What are the areas of water quality interest that are being analyzed and what is the existing water quality condition in the study area?

Several different areas of water quality interest are addressed within this Final EIS. These include specific interests within the study area and regulation requirements.

Since many surface water bodies span hundreds of miles, the WQCC has separated water bodies into segments with specific boundaries to identify the water body, and each segment is assigned its own set of water quality standards. These regulations include surface water standards, groundwater standards, and the Denver Metro Wastewater Reclamation District's (Metro District) role with wastewater treatment in the Denver metropolitan area.

Drinking Water Sources, Wellhead Protection Areas

These resources are not located within the study area and are not expected to be affected by this project.

Irrigation Ditches and Canals

Several irrigation ditches and canals are located in the study area, including the Farmers High Line Canal and Burlington Ditch. According to the Colorado Water Quality Control Act, water in ditches, canals, and other man-made conveyances is not subject to water quality standards, but can be used for the purposes of discharge permits.

Groundwater

Preliminary groundwater investigation has been performed and the results are briefly discussed in Section 5.18, Hazardous Materials. Additional investigation will be

performed as needed during final design of the project. Groundwater information related to site-specific standards and "Limited Use and Quality" areas was provided by the CDPHE.

WQCC Regulation Numbers 41 and 42 cover water quality standards and beneficial uses for groundwater. Regulation Number 42 further defines site-specific water quality standards for isolated areas within Colorado. These site-specific standards are primarily in place to protect groundwater drinking supplies (also known as wellhead protection areas or sole-source aquifers). Site-specific standards also are used by the WQCC for areas that encompass gas and oil fields. Groundwater in these locations is classified as "Limited Use and Quality," which alerts the public that groundwater may contain higher concentrations of organic chemicals. The WQCC has not placed any site-specific standards on groundwater within the study area, including special drinking supplies or "Limited Use and Quality" areas.

5.16.5 How do the project alternatives potentially affect water quality?

The partial Driscoll analysis involves the estimation of pollutant loads per mean storm event. The following list shows the polluting factors and the reason why they are analyzed:

- Lead, copper, and zinc are a concern because they dissolve in water and can have toxic effects when they build up in water plants and aquatic life.
- Total Suspended Solids (TSS) is a concern because it can increase the murkiness of water; as the floating particles in murky water settle, this can lead to loss of aquatic habitat and channel instability.
- Phosphorus is a concern because it can increase the production of algae in water, which can reduce oxygen levels in streams.

The existing loads of these factors in the South Platte River and Sand Creek were estimated using the partial Driscoll analysis and are presented in **Exhibit 5.16-5** and **Exhibit 5.16-6**, respectively, along with the load estimations for the alternatives.

Exhibit 5.16-5 South Platte River Water Quality Effect Summary

Alternative / Option	Water Quality Factor (pounds per mean storm event)						
	Percent impervious	Lead	Copper	Phosphorous	Zinc	TSS	Percentage TSS Increase
Existing Conditions	55%	2.20	0.30	2.20	1.81	781	N/A
No-Action Alternative, North Option	58%	2.29	0.31	2.29	1.88	811	4%
No-Action Alternative, South Option	51%	2.08	0.28	2.08	1.71	738	0%
Revised Viaduct Alternative, North Option	67%	2.58	0.35	2.58	2.12	915	17%
Revised Viaduct Alternative, South Option	60%	2.35	0.32	2.35	1.94	836	7%
Partial Cover Lowered Alternative	63%	2.44	0.33	2.44	2.01	866	11%

Exhibit 5.16-6 Sand Creek Water Quality Effect Summary

Alternative / Option	Water Quality Factor (pounds per mean storm event)						
	Percent impervious	Lead	Copper	Phosphorous	Zinc	TSS	Percentage TSS Increase
Existing Conditions	32%	5.31	0.72	5.31	4.37	1,886	N/A
Build Alternatives, General-Purpose Lanes Option	37%	6.46	0.87	6.46	5.31	2,292	22%
Build Alternatives, Managed Lanes Option	40%	7.26	0.98	7.26	5.97	2,576	37%

As shown in **Exhibit 5.16-5**, the No-Action Alternative will have slight adverse effects on water quality in the South Platte River. Results in **Exhibit 5.16-6** show an overall increase in pollutant and TSS loads, which generally includes phosphorous and heavy metals such as lead, copper, and zinc. The percentage increase in factor loads in runoff will require permanent BMPs to mitigate the effects of the proposed alternatives back to the existing conditions.

Exhibit 5.16-7 summarizes the comparison of the traffic volumes, total project impervious areas, and impervious area over streams. The analysis shows that traffic volumes can increase while minimal change will occur in impervious surface area. The exhibit also shows an increase in impervious area for the Build Alternatives up to 22 percent.

Exhibit 5.16-7 Water Quality Factor Summary

Alternative/Option	Water Quality Factor			
	Percent Increase in Impervious Surface	Daily Traffic Volume (vehicles per day)	Number of Stream Crossings	New Impervious Surface Over Streams (acres)
South Platte River				
Existing Conditions	N/A	143,800	1	0
No-Action Alternative, North Option	0%	191,700	1	0
No-Action Alternative, South Option	22%	191,700	1	0
Revised Viaduct Alternative, North Option	9%	214,600	1	0
Revised Viaduct Alternative, South Option	14%	214,600	1	0
Partial Cover Lowered Alternative	14%	214,600	1	0
Sand Creek				
Existing Conditions	N/A	132,300	1	0
No-Action Alternative	N/A	174,300	1	0
Build Alternatives, General-Purpose Lanes Option	13%	229,100	1	1.08
Build Alternatives, Managed Lanes Option	25%	174,500	1	3.15

Increased impervious area over streams also is shown in **Exhibit 5.16-7** for each of the alternatives ranging from 0 acres to 3.15 acres. The amount of surface area at stream crossings is important due to difficulty in capturing constituents at the crossing. During snow events, plowing may push sand, gravel, and de-icing agents off the highway and outside the drainage system, making it inaccessible for treatment by the permanent BMPs before discharge into the receiving water bodies.

5.16.6 How are the negative effects from the project alternatives mitigated for water quality?

The runoff from I-70 will be captured and conveyed in a storm drain system that discharges to the South Platte River or to Sand Creek. Prior to discharging to the receiving streams, the system will discharge to a water quality pond to provide water quality treatment. The outlet of the pond is smaller than the inlet of the pond, so runoff is temporarily stored in the pond and releases over a period of a few days. During this time (CDOT requires a minimum drain time of 40 hours), sediment settles out of the runoff and is stored in the pond and the runoff, with reduced sediments, discharges to the South Platte River. Preliminary locations of permanent water quality ponds are shown on **Exhibit 5.16-8**.

Exhibit 5.16-8 Preliminary Water Quality Pond Locations

Permitting

CDOT will take maintenance responsibility for any MS4 improvements constructed as part of this project or document operation and maintenance by others for improvements constructed as part of this project and maintained by others. CDOT also will obtain the CDPS permit that covers stormwater discharges during construction. Additionally, CDOT requires that construction contractors secure dewatering permits for construction activities, if necessary.

Permanent BMPs

For each alternative option, these BMPs will be implemented to comply with CDOT's MS4 permit, which will ultimately have a beneficial effect on water quality. A variety of BMPs could be implemented at the site to remove the particulate pollutants from the stormwater with practical ranges from 10 percent to 90 percent. Removal of soluble pollutants and oil and grease by typical BMPs is less effective. Most notably and widely used in the Denver metropolitan area are extended detention basins with typical removal rates ranging from 50 percent to 80 percent for a well-designed basin. These basins increase retention times, allowing sediment and other suspended solid pollutants, such as metals that are carried with sediment, to settle to the bottom. Then, other pollutants, such as oils and greases, can partially volatilize before the stormwater runoff enters receiving waters.

CDOT also will consider the use of green infrastructure techniques to provide water quality treatment. Green infrastructure is a general term applied to an approach using environmentally friendly techniques to manage stormwater.

Possible locations of permanent water quality BMPs are shown on **Exhibit 5.16-8**. Water quality mitigation will be provided as required by CDOT's MS4 Permit and their New Development and Redevelopment Program. Draft versions of both the CDOT MS4 Permit and the New Development and Redevelopment Program are currently being reviewed and have yet to be approved. This project will conform to the requirements of the approved CDOT MS4 Permit and the New Development and Redevelopment Program.

Winter maintenance

CDOT implements "non-structural" BMPs in its winter maintenance practices, including policies and common sense practices that ensure the agency is meeting or exceeding the water quality standards of its MS4 Permit. Based on CDOT standards obtained by personal interview, current non-structural practices include:

- Prevent over-treating by commencing liquid de-icer application at the beginning of snowfall and no longer pre-treating roads.
- Apply sand/salt mixtures (30 percent/70 percent, respectively) at rates of 105 pounds to 115 pounds per lane mile, which is roughly one-third of the maximum allowable amount of 300 pounds per lane mile.
- Use liquid de-icer products, such as magnesium chloride and Caliber (a mixture of magnesium chloride, cornstarch, alcohol, and tree sap); apply these products at rates of 40 pounds to 80 pounds per lane mile.
- Completely remove sand/salt within the "core" sweeping area within four days of snow events, as per DRCOG and CDOT regulations. Only 35 percent removal outside the "core" areas is required. For the past two years, it has been CDOT practice to remove all remaining sand/salt from the study area even though it is not in the "core" sweeping area—and CDOT will continue to do so.
- Perform fleet upgrades that include on-board computers to track the amount of mixture being applied, as well as rates of application of de-icing materials. This technology prevents over-treating; the majority of the CDOT Region 1 fleet is currently equipped with these computers.
- Use Ice Slicer, another solid mixture; this product is a sand/salt mixture with anti-corrosive additives and is applied at a rate of 100 pounds to 150 pounds per lane mile. This product is preferred over regular sand/salt mixtures because it produces less fugitive dust.
- Stockpile solid mixtures at the I-70 and Havana Street CDOT maintenance facility; the mixtures are kept under domes to protect them from precipitation, which prevents water high in salts from running off into receiving waters.

- Perform quality assurance audits on de-icing mixtures several times per year to ensure elevated levels of harmful anti-caking compounds are not found in the mixtures.
- Train snowplow drivers annually, stressing the importance of meeting or exceeding water quality and air quality permit requirements.
- Use temperature gauges built into trucks and roadway surfaces to assist with making decisions related to de-icing application rates and mixes.
- Use vacuum sweepers, not side-cast sweepers, as part of ongoing fleet upgrades; trash within the right of way is picked up prior to each sweeping.
- Rely on cameras/ITS systems to determine problem areas during each storm event.

Construction BMPs

During construction, as soils are disturbed, storm runoff may create erosion and degradation of water quality if proper BMPs are not employed. Alternative implementation will be done in accordance with the programs established under CDOT's MS4 Permit. Site-specific engineering design studies will be performed during final design, and care will be exercised during construction to prevent problems of stability and erosion during and after construction. To mitigate these effects, BMPs for erosion and sediment control, dust control, stormwater control, and expansive soils will be implemented during construction. BMPs for erosion and blowing dust during construction include the use of silt fences, erosion control blankets, sediment traps, sediment basins, soil stockpile management, temporary diversion structures, and spill prevention and control measures.

After construction, other BMPs will be followed for permanent erosion control. These include regrading as necessary, seeding and revegetating soils and slopes, mulch protection for new plantings, and stormwater control channels. These BMPs are described in numerous standard publications, including the *Erosion Control and Stormwater Quality Pocketbook* (CDOT, 2002b), *Best Management Practices for Erosion and Sediment Control* (U.S. Department of Transportation, 1995), and *Erosion and Sediment Control Handbook* (Goldman, Jackson & Bursztynsky, 1986).

Exhibit 5.16-9 lists the impacts and mitigations associated with water quality.

Exhibit 5.16-9 Summary of Water Quality Impacts and Mitigations

Alternative / Option	Permanent Impacts and/or Benefits	Mitigation Measures Applicable to All Alternatives
All Alternatives	• Stormwater runoff can create erosion and degradation of water quality during and after construction • Winter maintenance activities use solutions and compounds that could lead to water quality issues from runoff	• Provide permanent water quality control features (i.e., extended detention pond) as part of the project to treat stormwater runoff from the highway • Consider environmentally friendly techniques to provide water quality treatment • Treat runoff entering the South Platte River and Sand Creek in conformance with CDOT's MS4 Permit and New Development and Redevelopment Program Implement the following BMPs for erosion and sediment control, dust control, stormwater control, and expansive during and after construction: • Silt fences, erosion control blankets • Sediment traps, sediment basins • Soil stockpile management • Temporary diversion structures • Spill prevention and control measures • Regrading • Seeding and revegetating soils and slopes • Mulch protection for new plantings • Stormwater control channels Use the following winter maintenance BMPs to meet or exceed the water quality standards of CDOT's MS4 permit: • Prevent over-treating by commencing liquid de-icer application at the beginning of snowfall and no longer pre-treating roads • Apply sand/salt mixtures (30 percent/70 percent, respectively) at rates of 105 pounds to 115 pounds per lane mile, which is roughly one-third of the maximum allowable amount of 300 pounds per lane mile • Use liquid de-icer products, such as magnesium chloride and Caliber (a mixture of magnesium chloride, cornstarch, alcohol, and tree sap); apply these products at rates of 40 pounds to 80 pounds per lane mile • Completely remove sand/salt within the "core" sweeping area within four days of snow events, as per DRCOG and CDOT regulations; only 35 percent removal outside the "core" areas is required; for the past two years, it has been CDOT practice to remove all remaining sand/salt from the study area even though it is not in the "core" sweeping area—and CDOT will continue to do so • Perform fleet upgrades that include on-board computers to track the amount of mixture being applied, as well as rates of application of de-icing materials; this technology prevents over-treating; the majority of the CDOT Region 1 fleet is currently equipped with these computers
No-Action Alternative	• Increase in runoff TSS loads of up to 4 percent to the South Platte River	
Revised Viaduct Alternative	• Increase in runoff TSS loads of 7 percent to 17 percent to the South Platte River • Increase in runoff TSS loads of 22 percent to Sand Creek	
Partial Cover Lowered Alternative	• Increase in runoff TSS loads of 11 percent to the South Platte River • Increase in runoff TSS loads of 22 percent to Sand Creek	

Exhibit 5.16-9 Summary of Water Quality Impacts and Mitigations

Alternative/ Option	Permanent Impacts and/or Benefits	Mitigation Measures Applicable to All Alternatives
Managed Lanes Option (option to Build Alternatives)	• Increase in runoff TSS loads of 15 percent (for a total of 37 percent) to Sand Creek	• Use Ice Slicer, another solid mixture; this product is a sand/salt mixture with anti-corrosive additives and is applied at a rate of 100 pounds to 150 pounds per lane mile; this product is preferred over regular sand/salt mixtures because it produces less fugitive dust • Stockpile solid mixtures at the I-70 and Havana Street CDOT maintenance facility; the mixtures are kept under domes to protect them from precipitation, which prevents water high in salts from running off into receiving waters • Perform quality assurance audits on de-icing mixtures several times per year to ensure elevated levels of harmful anti-caking compounds are not found in the mixtures • Train snowplow drivers annually, stressing the importance of meeting or exceeding water quality and air quality permit requirements • Use temperature gauges built into trucks and roadway surfaces to assist with making decisions related to de-icing application rates and mixes • Use vacuum sweepers, not side-cast sweepers, as part of ongoing fleet upgrades; trash within the right of way is picked up prior to each sweeping • Rely on cameras/ITS systems to determine problem areas during each storm event