Chapter 12: Water Resources

12.1 Introduction

This chapter describes the existing conditions of surface water and groundwater in the water resources impact analysis area and the expected effects of the project alternatives on surface water and groundwater.

What is the water resources impact analysis area?

The water resources impact analysis area is the area within about 0.25 mile of S.R. 210 and also includes the Little Cottonwood Creek watershed.

This chapter focuses on the expected water quality impacts after the proposed improvements have been constructed. Water quality impacts during construction are addressed in Chapter 19, Construction Impacts. The existing conditions of riparian areas and wetlands and the expected effects of the project alternatives on these resources are discussed in Chapter 13, Ecosystem Resources. Floodplain impacts are discussed in Chapter 14, Floodplains.

Water Resources Impact Analysis Area. The water resources impact analysis area is the area within about 0.25 mile of State Route (S.R.) 210 and also includes the Little Cottonwood Creek watershed. The impact analysis area includes S.R. 210 from its intersection with S.R. 190/Fort Union Boulevard to its terminus in the town of Alta, including the Alta Bypass Road. Through the impact analysis area, S.R. 210 is designated with different street names: Wasatch Boulevard, North Little Cottonwood Road, and Little Cottonwood Canyon Road (see Figure 1.1.1, Transportation Needs Assessment Study Area, in Chapter 1, Purpose and Need).

12.2 Regulatory Setting

Several applicable water quality regulations, as well as watershed management objectives for entities with jurisdiction in the watersheds, apply within the water resources impact analysis area. These are summarized below.

12.2.1 Federal Guidance

The land managed by the U.S. Department of Agriculture (USDA) Forest Service in the water resources impact analysis area is under the guidance of the *Revised Forest Plan: Wasatch-Cache National Forest* (*Forest Plan*; USDA Forest Service 2003). The *Forest Plan*'s management prescriptions, desired future conditions, goals, subgoals and objectives, standards and guidelines, and specific Management Area directions for this land emphasize watershed health, which requires the USDA Forest Service to maintain and improve water quality and aquatic habitats. The *Forest Plan* articulates watershed health with three main requirements: (1) maintain the integrity of water system and soils, (2) meet the needs of thriving terrestrial and aquatic ecosystems, and (3) supply value for people—value such as drinking water, recreation, and commodity use—that does not compromise watershed health. In addition, Congress has directed the USDA Forest Service to administer designated watersheds in cooperation with Salt Lake City

for the purpose of storing, conserving, and protecting water from pollution (USDA Forest Service 2003). For more information, see Section 12.4.8, Forest Plan–related Management Objectives, which addresses watershed-related management objectives in the *Forest Plan*.

12.2.2 State Water Quality Regulations

The Utah Divisions of Water Quality and Drinking Water within the Utah Department of Environmental Quality (UDEQ) regulate the quality of Utah's water bodies. These agencies act pursuant to delegated authority to enforce the federal Clean Water Act and the federal Safe Drinking Water Act and also act pursuant to Utah's water quality laws and regulations. The water quality laws and regulations that apply to the S.R. 210 Project are summarized in Table 12.2-1 and discussed in the following sections.

Table 12.2-1. Laws and Regulations Related to Water Quality

Regulation	Regulating Agency and Requirement	Applicability
Clean Water Act Section 401 Utah Water Quality Certification (Utah Administrative Code [UAC] Rule [R] 317-15)	If a Clean Water Act Section 404 permit is needed for the S.R. 210 Project, the permit would require UDEQ to certify that the Selected Alternative would not cause Utah water quality standards to be exceeded. This certification is a Section 401 Water Quality Certification.	**Water Quality Certification** UDEQ provides this certification to the U.S. Army Corps of Engineers if a Section 404 permit is required.
Clean Water Act Section 402 (UAC R317-8) NPDES Permit (UPDES in Utah) (Limits discharges)	The U.S. Environmental Protection Agency has delegated authority for the National Pollutant Discharge Elimination System (NPDES) program in Utah to UDEQ. Construction projects that discharge stormwater to surface water and construction projects that disturb 1 or more acres of land must obtain a Utah Pollutant Discharge Elimination System (UPDES) permit to minimize impacts to water quality associated with construction activities. Operators of municipal separate storm sewer systems (MS4), such as the Utah Department of Transportation (UDOT), must comply with their UPDES permit to minimize water quality impacts associated with discharges from the project site.	**UPDES Permits** Required for roadway construction such as with the Selected Alternative. Compliance with the UDOT MS4 UPDES permit is required for all facilities.
UAC R317-2-7.2, *Narrative Water Quality Standards* (Limits discharges)	This regulation states that it is unlawful to discharge into surface waters substances that could cause undesirable effects on human health or aquatic life.	**Narrative Standards** Discharges must comply with narrative standards.
UAC R317-2-14, *Numeric Criteria* (In-stream standards)	Numeric standards for water quality are based on the water's designated beneficial uses, such as providing drinking water, supporting game fish, or supporting swimming. Projects cannot cause water quality standards to be exceeded. For surface waters exceeding water quality standards and identified on the state 303(d) list (of impaired waters), this regulation requires UDEQ to develop a total maximum daily load (TMDL) analysis to restore water quality standards and beneficial uses.	**Numeric Standards** Discharges cannot cause the numeric standards to be exceeded. Discharges to waters with approved TMDL analyses need to comply with pollutant load allocations defined in the TMDL analyses.

(*continued on next page*)

Table 12.2-1. Laws and Regulations Related to Water Quality

Regulation	Regulating Agency and Requirement	Applicability
UAC R317-2-3, *Antidegradation Policy*	UDEQ assigns protection categories to manage the allowable level of degradation of water bodies in the state. Antidegradation procedures are applied to each protection category on a parameter-by-parameter basis. Antidegradation reviews are required for any action that requires a Section 401 Water Quality Certification or has the potential to significantly degrade water quality.	**Antidegradation Review** May be required to support the Section 401 Water Quality Certification required by the U.S. Army Corps of Engineers.
UAC R309-605, *Drinking Water Source Protection for Surface Waters* (Regulates activities near drinking water sources)	Owners of public water systems are responsible for protecting sources of drinking water and for submitting a drinking water source protection plan to the Utah Division of Drinking Water. Such plans must identify drinking water source protection zones around each drinking water source (such as a lake of river), existing sources of contamination, and the types of new construction projects that are restricted within each zone.	**Source Protection** Land uses and potential sources of contamination should be managed in compliance with the drinking water source protection plans.
UAC R317-6, *Ground Water Quality Protection*	UDEQ classifies aquifers and permits discharges to groundwater to protect and maintain groundwater quality.	**Groundwater Discharge Permits** Stormwater detention facilities are permitted by rule by the Utah Division of Water Quality.
National Forest Management Act, Forest Plan	The *Revised Forest Plan: Wasatch-Cache National Forest* guides all natural resource management activities and sets management direction for the Forest. The overarching objectives focus on ecosystem management and sustainability. The underlying premise of resource management of the Central Wasatch Management Area, which includes Little Cottonwood Canyon, is the need to provide long-term, high-quality culinary water to the urban population of the Salt Lake Valley. Therefore, protecting and enhancing water is the primary consideration for all management decisions.	**Watershed Health** Resource management is intended to maintain and improve water quality and aquatic habitats and protect culinary water supplies.
Salt Lake City Ordinance 17, *Watershed Areas*	A permit is required for new use of water within the Little Cottonwood Creek watershed. Fire protection is one acceptable use of surplus water.	**Water Supply Approval** A water connection is needed for the fire protection and life safety features of the proposed snow sheds and potential restrooms.
Salt Lake Valley Health Department, Health Regulation 14, *Watershed Protection*	Wastewater must be disposed of through a connection to a public sewage system. If vault toilets are used at trailheads in Little Cottonwood Canyon, they would need to be approved by the Director of the Salt Lake Valley Health Department and the Salt Lake City Department of Public Utilities.	**Wastewater Disposal** If not connected to a drinking water system, new vault toilets would need to be approved by the Salt Lake Valley Health Department and the Salt Lake City Department of Public Utilities.

MS4 = municipal separate storm sewer system; NPDES = National Pollutant Discharge Elimination System; R = rule; TMDL = total maximum daily load; UAC = Utah Administrative Code; UDEQ = Utah Department of Environmental Quality; UPDES = Utah Pollutant Discharge Elimination System

12.2.3 Watershed Protection

Big and Little Cottonwood Creeks serve as municipal watersheds and public drinking water sources and are managed to maintain or improve watershed conditions. The Salt Lake City Department of Public Utilities (SLCDPU), Sandy City, Murray City, Town of Alta, and Salt Lake County Service Area #3 are public water suppliers, as defined by the federal Safe Drinking Water Act, and are required by law to protect their source waters from contamination. SLCDPU is a cooperating agency, and Sandy City, Murray City, the Town of Alta, and Salt Lake County are participating agencies, for this Environmental Impact Statement (EIS). The Jordan Valley Water Conservancy District and the Granite Mountain Records Vault also have water interests in the water resources impact analysis area.

SLCDPU has authority for watershed and water rights protection as granted by the Utah Constitution, Utah statutes, and U.S. statutes. To meet the requirements of the Drinking Water Source Protection rules, SLCDPU has prepared watershed management plans (SLCDPU 1999, 2013) to address existing sources of pollution. In addition, through cooperation with Salt Lake County, the USDA Forest Service, and the Salt Lake Valley Health Department, SLCDPU has adopted ordinances to protect water quality for various uses in Big and Little Cottonwood Canyons.

What are drinking water source protection rules?

Drinking water source protection rules require drinking water suppliers to prepare planning documents to control land uses and identify sources of pollution and controls to protect drinking water sources from contamination. For more information, see Section 12.2.7, Drinking Water Source Protection Plans and Protection Zones.

Sandy City has jurisdiction to protect the quality of its drinking water supplies. Sandy City prepared a watershed management plan to describe its management efforts for the seven watersheds it uses, which include Little Cottonwood Canyon (Sandy City 2002). Water from Little Cottonwood Creek is treated at the Little Cottonwood Water Treatment Plant that is owned and operated by the Metropolitan Water District of Salt Lake and Sandy (Metropolitan Water). Metropolitan Water prepared a drinking water source protection plan (Metropolitan Water 2013) to address the quality of its drinking water supply.

Salt Lake County is integral to managing the watersheds in the Wasatch Mountains. Section 208 of the federal Clean Water Act describes the chain of responsibility for local, area-wide water quality planning. Section 208 grants authority to the States to identify water quality planning areas and to identify a representative organization that will oversee water quality planning in those areas. The State of Utah delegated area-wide water quality planning authority for Salt Lake County to the Salt Lake County municipal government in 1978.

What are point and nonpoint sources?

A point source is any single, identifiable location, such as a pipe or ditch, from which effluents are discharged.
A nonpoint source is a source such as a highway or farm that does not discharge stormwater from a single, identifiable location.

This designation as the area-wide water quality planning agency authorizes Salt Lake County to plan water quality–related activities, provide for consistency of water quality–related activities, and enforce water quality–related ordinances. The County's Section 208–compliant plans, its *2009 Salt Lake Countywide Water Quality Stewardship Plan*, and its *2015 Salt Lake County Integrated Watershed Plan* (Salt Lake County 2015, as revised in 2017) describe and promote efficient and comprehensive programs for controlling water pollution from point and nonpoint sources. Salt Lake County has provided continuous water quality planning and monitoring since 1978.

12.2.4 Water Quality Standards

Under the Clean Water Act, every State must establish and maintain water quality standards designed to protect, restore, and preserve the quality of waters in the state. UDEQ oversees these water quality standards in Utah. Utah's water quality regulations broadly consist of three types of standards: an antidegradation policy, beneficial-use designations and their associated numeric water quality criteria, and narrative standards that apply to all waters within the state boundaries.

What are beneficial uses?

Lakes, rivers and other water bodies have uses to people and other forms of life called *beneficial uses*. Four beneficial-use designations apply to the water bodies in the water resources impact analysis area (see Table 12.2-2 below).

12.2.4.1 Antidegradation Policy and Reviews

Utah's antidegradation policy states that waters whose existing quality is better than the established standards for their designated uses should be maintained at high quality (Utah Administrative Code [UAC] Rule [R] 317-2-3.1). Discharges that could lower or degrade water quality are allowable if UDEQ determines that these discharges are necessary for important economic or social development. However, discharges must not impair the existing in-stream beneficial uses of these high-quality waters.

To facilitate this policy, all waters in the state of Utah are designated as Category 1, 2, or 3 waters. The surface waters in the water resources impact analysis area are designated as Category 1 or 3 waters (UAC R317-2-3.3).

What are examples of discharges from diffuse sources?

Two examples of discharges from diffuse sources are stormwater that runs off highway pavement and shoulders that is discharged directly to an adjacent water body, and runoff that is collected in a storm drain system and is discharged to a water body at one or multiple points.

Category 1 Waters. The USDA Forest Service boundary parallels about 0.5 mile of the North Little Cottonwood Road segment of the impact analysis area and all of Little Cottonwood Canyon Road segment. Little Cottonwood Creek and its tributaries within this boundary are Category 1 waters. New discharges from diffuse sources are allowed in Category 1 waters provided that best management practices (BMPs) are used to the extent feasible to address the effects of pollution.

Category 3 Waters. The Big Cottonwood Creek and Deaf Smith Canyon Creek segments of the impact analysis area are outside the USDA Forest Service boundary and are Category 3 waters. A Level 1 antidegradation review may be conducted by UDEQ to ensure that existing beneficial uses will be maintained and protected. See Section 12.2.4.2 below for information regarding the designated beneficial uses of these waters. Antidegradation reviews are also required for any activity that requires a federal permit and/or water quality certification or projects which, as determined by the Director of the Utah Division of Water Quality, could have a major impact.

12.2.4.2 Beneficial-use Designations, Numeric Standards, and Narrative Standards

UDEQ designates all surface water bodies in the state according to how the water is used, and each use designation has associated standards. Table 12.2-2 lists the applicable beneficial uses of the surface waters in the water resources impact analysis area.

Table 12.2-2. Designated Beneficial Uses for Surface Waters in the Water Resources Impact Analysis Area

Class	Description
1C	Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.
2B	Protected for infrequent primary contact recreation and for secondary contact recreation (such as wading, hunting, and fishing) where there is a low likelihood of ingestion or bodily contact with the water.
3A	Protected for cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain.
4	Protected for agricultural uses including irrigation of crops and stock watering.

Source: UAC R317-2-6, *Use Designations*, updated October 1, 2018

Numeric standards for water quality are intended to protect the designated beneficial uses of the water, such as providing drinking water, supporting game fish and other wildlife, or protecting waders or swimmers (UAC R317-2-14). Numeric standards refer to pollutant concentration limits that are applied to each class of water to protect its beneficial uses.

Narrative standards, which are general policy statements that prohibit the discharge of waste or other substances that result in unacceptable water quality conditions such as visible pollution or undesirable aquatic life, also apply to waters in the impact analysis area.

When a lake, river, or stream fails to meet the water quality standards for its beneficial uses, the State places the water body on a list of "impaired" waters—also known as a 303(d) list, from Section 303(d) of the Clean Water Act—and prepares an analysis called a total maximum daily load (TMDL). The objective of a TMDL analysis is to determine the sources and allowable load of a given pollutant for that water body and to allocate that load among different pollutant sources so that the appropriate actions can be taken and controls implemented to maintain water quality standards. The TMDL process is important for improving water quality because it serves as a link in the chain between water quality standards and implementing control actions designed to attain those standards.

What are narrative standards?

Narrative standards are general policy statements that prohibit the discharge of waste or other substances that result in unacceptable water quality conditions such as visible pollution or that are undesirable to aquatic life.

What is a 303(d) list?

When a lake, river, or stream fails to meet the water quality standards for its designated beneficial use, Section 303(d) of the Clean Water Act requires that the State place the water body on a list of "impaired" waters, which is also known as a 303(d) list, and develop a plan to reduce pollution so that beneficial uses are met.

12.2.5 Stormwater Discharges

The State of Utah administers the Utah Pollutant Discharge Elimination System (UPDES) rules (UAC R317-8) under the Utah Water Quality Act. Under this program, industries and municipalities that could discharge wastewater, stormwater, or other pollutants into water bodies must obtain a UPDES permit to minimize impacts to water quality.

The Utah Department of Transportation (UDOT) has been issued a statewide municipal separate storm sewer system (MS4) permit (UTS 000003) that allows the discharge of stormwater from transportation facilities to waters of the state. In addition to managing stormwater runoff during construction, UDOT must address postconstruction stormwater runoff from new and redeveloped roads in accordance with its permit requirements. UDOT must, to the extent practical, evaluate stormwater BMPs that minimize impacts to water quality from the discharges of additional stormwater runoff from the S.R. 210 Project.

12.2.6 Groundwater Discharges

The Utah Water Quality Board classifies aquifers according to their quality and use (such as pristine, ecologically important, sole source, irreplaceable, drinking water quality, limited use, and saline). The Utah Division of Water Quality publishes numeric standards for each class of aquifer (UAC R317-6-3). Any person can petition the Board to classify an aquifer.

In addition, the Division requires groundwater permits for activities that discharge pollutants into groundwater. Flood-control facilities, such as the stormwater detention facilities, or BMPs that infiltrate stormwater, that might be constructed as part of the Selected Alternative are considered "permitted by rule" [UAC R317-6-6.2(A)(5) and R317-6-6.2(A)(7)]. Under permit by rule, UDOT is not required to obtain a groundwater discharge permit for these detention facilities.

What is a stormwater detention facility?

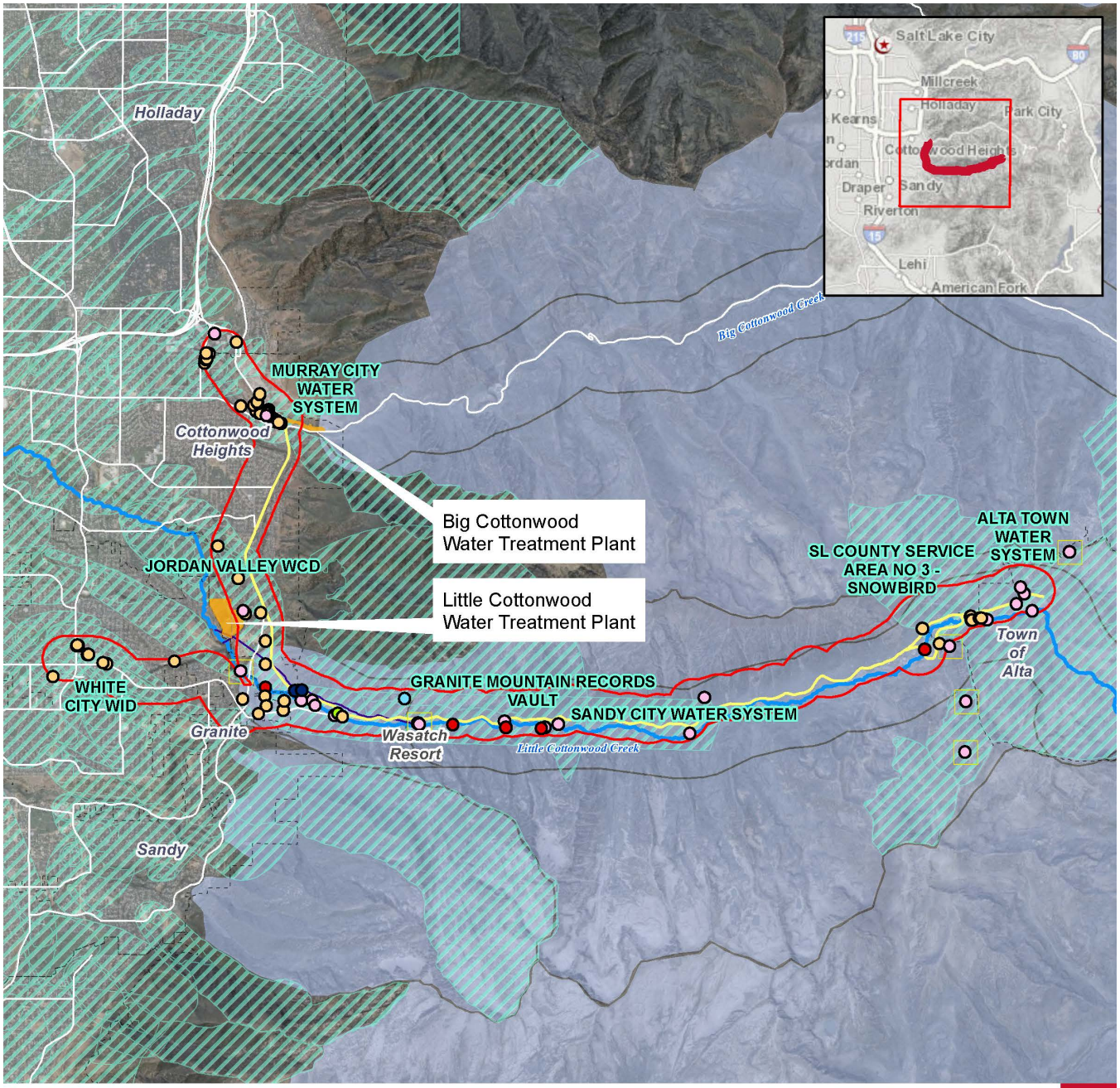
A stormwater detention facility is a pond that holds stormwater runoff temporarily before releasing it into a water body at an allowable release rate.

12.2.7 Drinking Water Source Protection Plans and Protection Zones

Owners of public water systems are responsible for protecting sources of drinking water and for submitting a drinking water source protection plan to the Utah Division of Drinking Water. Such plans must identify drinking water source protection zones around each drinking water source (such as a lake, river, spring, or groundwater well), identify existing and potential sources of contamination, and propose methods to control sources of pollution within each zone.

The public water suppliers with source water protection zones in the water resources impact analysis area are Metropolitan Water (which is jointly owned by Sandy City and SLCDPU), Sandy City, Murray City, the Town of Alta, Salt Lake County Service Area #3, the White City Water Improvement District, and the Jordan Valley Water Conservancy District. The Granite Mountain Records Vault is a private company with water rights and a protection zone in the impact analysis area. For more information, see Section 12.3.4, Surface Water and Groundwater Water Rights, and Figure 12.2-1.

Figure 12.2-1. Water Rights and Points of Diversion



WCD = Water Conservancy District; WID = Water Improvement District

For groundwater sources, the Utah Division of Drinking Water requires the drinking water source protection plan to identify four distinct drinking water source protection zones for each well.

- **Zone 1** is the area within a 100-foot radius of the wellhead.
- **Zone 2** is the area within a 250-day groundwater time of travel to the wellhead.
- **Zone 3** is the area within a 3-year groundwater time of travel to the wellhead.
- **Zone 4** is the area within a 15-year groundwater time of travel to the wellhead.

Land managers, usually Cities, are responsible for protecting drinking water sources from contamination in coordination with the public water system owners. Cities, through zoning and land use, control whether roads and associated safety features are an allowable form of development within each of the various drinking water protection zones. In general, if transportation development within source protection Zone 1 is determined by the owner to have a negative impact to the function of the well, methods to reduce and/or eliminate the negative impact may be proposed. See Section 12.3.4, Surface Water and Groundwater Water Rights, for a description of groundwater rights points of diversion in the impact analysis area.

For surface water sources, the watershed management plans, antidegradation reviews, source water protection zones, and quality standards for beneficial uses provide many drinking water source protection mechanisms. As described in Section 12.2.3, Watershed Protection, SLCDPU and Salt Lake County have watershed management authority. Salt Lake City Ordinance 17, *Watershed Areas*, sets conditions for water use, establishes unlawful acts in the watershed (such as bathing and littering), and establishes a permit application procedure for certain activities in the canyons, activities including sewage handling, waste disposal, and dog ownership. The Salt Lake Valley Health Department's Health Regulation 14, *Watershed Regulation*, regulates the use and occupancy of the watersheds in Salt Lake County in a manner that will protect and promote public health, safety, and welfare and preserve and protect drinking water supplies. The Director of the Salt Lake Valley Health Department and the Director of SLCDPU have joint authority to approve any water-using facilities proposed as part of this project.

12.3 Affected Environment

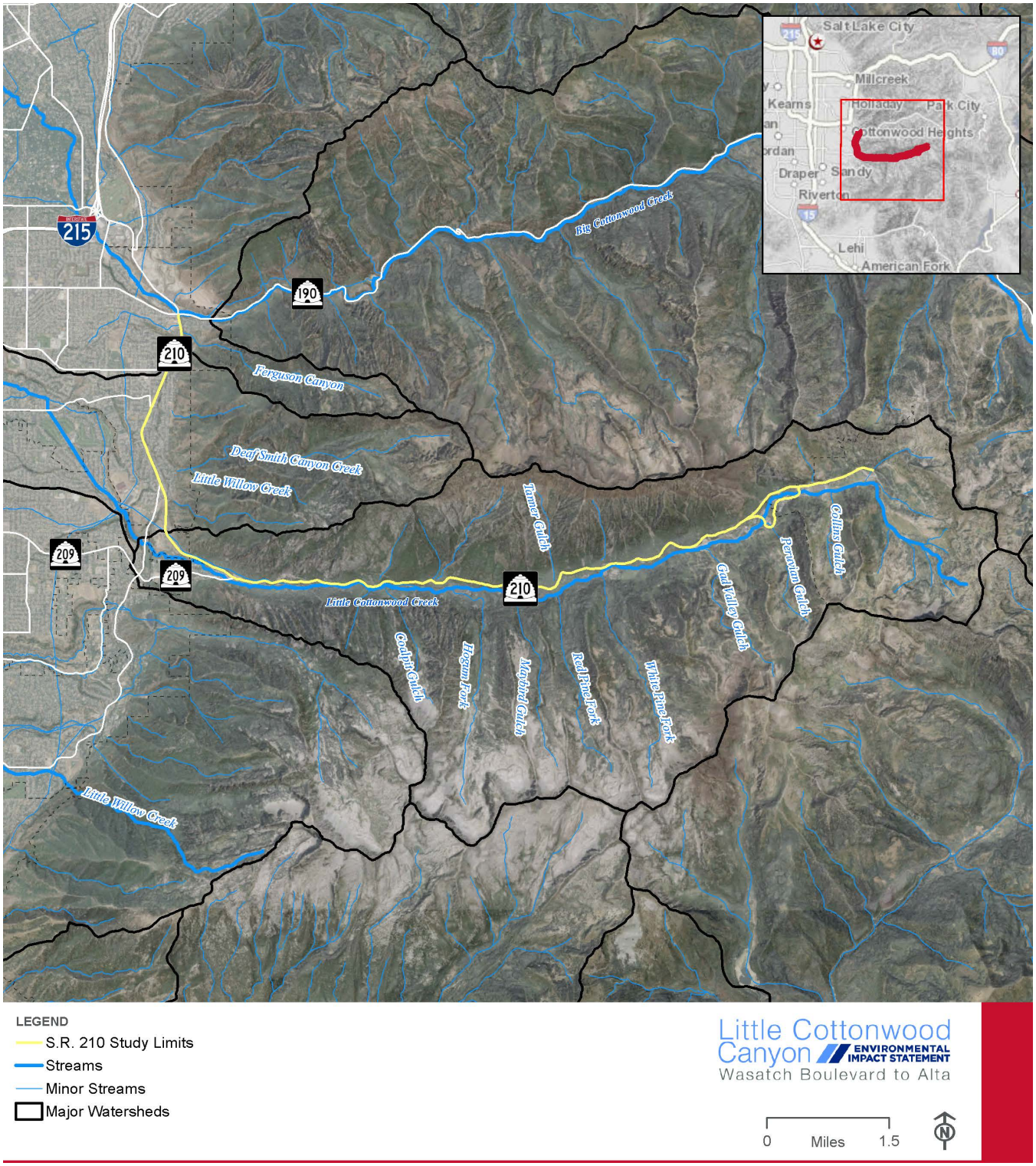
The main surface water bodies in the water resources impact analysis area are Big Cottonwood Creek, Deaf Smith Canyon Creek (also known as Little Willow Creek or Deaf Smith Fork), and Little Cottonwood Creek. Smaller drainages, which are perennial, intermittent, or ephemeral and which originate along the Wasatch Mountains foothills (including Ferguson Canyon) or are tributaries to Little Cottonwood Creek (Tanner Gulch and Peruvian Gulch, for example), also cross the impact analysis area (Figure 12.3-1). In total, about 12 intermittent streams and 15 ephemeral streams cross under S.R. 210 between Fort Union Boulevard and the town of Alta (for more information, see Section 13.3.2.3.2, Streams, in Chapter 13, Ecosystem Resources).

There are no sole-source aquifers in the impact analysis area (EPA, no date); therefore, impacts to sole-source aquifers are not evaluated further in this chapter.

What is a sole-source aquifer?

A sole-source aquifer is an aquifer that is the only source of drinking water for a community.

Figure 12.3-1. Watersheds



12.3.1 Surface Waters and Beneficial-use Classifications

Big Cottonwood Creek, Deaf Smith Canyon Creek, and Little Cottonwood Creek are the three main surface waters in the water resources impact analysis area. The smaller tributaries shown above in Figure 12.3-1 (Ferguson Canyon Creek and the gulches in Little Cottonwood Canyon) have similar beneficial uses as the main surface waters described in this section.

Table 12.3-1 summarizes the surface waters in the impact analysis area and their beneficial-use classifications. These waters are discussed in more detail after the table.

Table 12.3-1. Surface Waters and Beneficial Uses in the Water Resources Impact Analysis Area

Water Body	Reach Description	Beneficial Uses
Big Cottonwood Creek	From Big Cottonwood Water Treatment Plant to confluence with the Jordan River	2B – Infrequent primary-contact recreation 3A – Cold-water fishery/aquatic life 4 – Agricultural uses including irrigation of crops and stock watering
Deaf Smith Canyon Creek	Entire stream, which is a tributary of Little Cottonwood Creek	1C – Domestic/drinking water with prior treatment 2B – Infrequent primary-contact recreation 3A – Cold-water fishery/aquatic life 4 – Agricultural uses including irrigation of crops and stock watering
Little Cottonwood Creek	From Metropolitan Water treatment plant to headwaters	1C – Domestic/drinking water with prior treatment 2B – Infrequent primary-contact recreation 3A – Cold-water fishery/aquatic life

Source: UAC R317-2-13, *Classification of Waters of the State*, as in effect January 1, 2020

Big Cottonwood Creek. The Big Cottonwood Creek watershed comprises about 50 square miles of drainage area. Elevations range from about 5,000 to 10,500 feet. Big Cottonwood Creek yields about 51,000 acre-feet of water supply annually. Downstream of the Big Cottonwood Water Treatment Plant, which is about 0.25 mile east of Wasatch Boulevard, Big Cottonwood Creek has beneficial-use classifications of 2B, 3A, and 4.

Deaf Smith Canyon Creek. The Deaf Smith Canyon Creek watershed lies between Big Cottonwood and Little Cottonwood Canyons. Deaf Smith Canyon Creek crosses Wasatch Boulevard near Golden Hills Avenue. The creek water is conveyed under Wasatch Boulevard in a 72-inch-diameter metal culvert. Water rights from this creek are held by the Big Willow Irrigation Company and consist of about 2,500 acre-feet of water, which is used for irrigation, stock watering, and domestic purposes. This creek has beneficial-use classifications of 1C, 2B, 3A, and 4.

Little Cottonwood Creek. The Little Cottonwood Creek watershed comprises about 27.5 square miles (17,600 acres) and ranges in elevation from about 5,200 to 11,200 feet. It is a source of drinking water and yields about 46,000 acre-feet of water supply annually. For this reason, Little Cottonwood Creek and its tributaries have a Class 1C (protected for drinking with prior treatment) designation from the Metropolitan Water treatment plant to their headwaters. Little Cottonwood Creek and other streams and gulches in the watershed have beneficial-use classifications of 1C, 2B, and 3A.

12.3.2 Impaired Surface Waters

If the water quality of a surface water or segment exceeds the quality standards for its beneficial uses, the water or segment is listed in the State of Utah's *2016 Integrated Report* [commonly referred to as the 303(d) list] as impaired, and the Utah Division of Water Quality must develop a TMDL analysis to address pollutant sources and take measures to restore its beneficial uses.

Table 12.3-2 lists the impaired surface waters in the water resources impact analysis area. These impaired surface waters are discussed in more detail after the table. Deaf Smith Canyon Creek is not mentioned on the State's 303(d) list as impaired. UDOT therefore assumes that the creek's water quality meets the standards for its beneficial-use designations.

Table 12.3-2. Impaired Surface Waters in the Water Resources Impact Analysis Area

Impaired Water Body	Reach	Constituents or Measurement	Description of Impairment	TMDL Development Priority
Big Cottonwood Creek	Jordan River to Big Cottonwood Water Treatment Plant	Temperatures OE biosassessment[a]	Does not meet water quality standards for beneficial use 3A (cold-water fishery/aquatic life) because elevated temperatures have been recorded and because of the low health of the aquatic organisms.	Low
		Escherichia coli (*E. coli*)	Does not meet water quality standards for beneficial use 2B (infrequent primary contact recreation) because of high levels of *E. coli*.	High
Little Cottonwood Creek	Metropolitan Water treatment plant to headwaters	Heavy metals (cadmium, copper, and zinc)	Does not meet water quality standards for beneficial use 3A (cold-water fishery/aquatic life) because of elevated concentrations of dissolved copper and dissolved cadmium. In addition, elevated concentrations of zinc have been recorded in water from the creek.	Low
		Physical parameters	pH has been recorded outside the established standards for water bodies with Class 1C, 2B, and 3A designations.	Low

Source: Utah Division of Water Quality 2016

[a] An OE bioassessment is a bioassay to determine the ratio of observed to expected aquatic organisms.

Big Cottonwood Creek. The Big Cottonwood Creek segment from the Jordan River to the Big Cottonwood Water Treatment Plant does not support its Class 3A designation (cold-water fishery/aquatic life) because of monitored elevated temperatures and because some other factors, which are currently unidentified, are harming the health of the aquatic organisms in the creek. Big Cottonwood Creek is also listed as on the State's 303(d) list for high levels of *E. coli*; therefore, the creek is not supporting its 2B (human contact recreation) use designation (Utah Division of Water Quality 2016).

Little Cottonwood Creek. The Little Cottonwood Creek segment from the Metropolitan Water treatment plant to the creek's headwaters exceeds the water quality standards for cadmium and copper and does not support its Class 3A (protected for wildlife) beneficial use. In addition, the pH level of the creek's water was monitored outside the established standard range for water bodies with Class 1C, 2B, and 3A beneficial uses. An approved TMDL analysis has also addressed elevated zinc concentrations observed in Little Cottonwood Creek. Sources of zinc are associated with the historic mining activities in Little Cottonwood

Canyon. In the completed TMDL analysis, transportation facilities were not identified as a source of zinc loading (Utah Division of Water Quality 2002).

12.3.3 Groundwater Quality

The water resources impact analysis area is within the Salt Lake Valley groundwater basin. Groundwater is an important source of drinking water in the Salt Lake Valley. The impact analysis area is within a primary recharge area for the principal aquifer. Generally, the groundwater flow is from the recharge areas along the foothills and within Little Cottonwood Canyon to the west toward the Jordan River. The groundwater underlying Wasatch Boulevard and North Little Cottonwood Road is classified as Class 1A – Pristine (UGS 2009). The primary aquifer does not extend up into Little Cottonwood Canyon, which is a primary recharge zone and contains shallow bedrock, and is therefore is not classified.

- **Class IA – Pristine** is groundwater that has a concentration of total dissolved solids (TDS) less than 500 milligrams per liter (mg/L) and no contaminant concentrations that exceed the groundwater quality standards listed in UAC R317-6-2. Class IA groundwater is protected to the maximum extent feasible from degradation from facilities that discharge or would probably discharge pollutants to groundwater (UAC R317-6-4).

In the impact analysis area, existing transportation corridors are not listed as a potential sources of groundwater contamination. Flood-control facilities, such as the stormwater BMPs (for example, detention and infiltration facilities) that might be constructed as part of the Selected Alternative, are considered "permitted by rule" [UAC R317-6-6.2(A)(5) and R317-6-6.2(A)(7)]. Under permit by rule, UDOT is not required to obtain a groundwater discharge permit for these stormwater management facilities.

12.3.4 Surface Water and Groundwater Water Rights

This section identifies water rights points of diversion. For groundwater rights, the point of diversion is typically the area around the wellhead. For surface waters, the point of diversion could be a diversion structure in a stream or a collection system around a spring. In addition to these sources, in the upper reaches of Little Cottonwood Canyon, water is collected from historic mine tunnels. Salt Lake City owns the majority of surface water rights in the canyon and leases water to other entities.

Eight water systems that draw water from groundwater sources have drinking water protection plans in place near the water resources impact analysis area. The owners of these water systems are Midvale City, White City, Sandy City Water, Alta Town Water, Salt Lake County Service Area #3, Jordan Valley Water Conservation District, Murray City Water, and the Granite Mountain Records Vault. In addition, and as mentioned in Section 12.2.3, Watershed Protection, Metropolitan Water (which is jointly owned by Sandy City and SLCDPU) prepared a drinking water source protection plan for the surface waters in the Little Cottonwood Creek watershed. The drinking water source protection zone is the entire watershed. The limits of these drinking water protection zones are shown above in Figure 12.2-1, Water Rights and Points of Diversion. For security purposes, the individual protection zones are not shown in the figure.

The Utah Division of Water Rights tracks water rights according to an inventoried water right number. Each water right number can represent *one or more* actual groundwater wells, springs, or surface water sources or a combination of these sources. Table 12.3-3 summarizes the number of water rights by type in the

impact analysis area. The approximate locations of points of diversion of clusters of water rights (shown as one point in the figure) are shown above in Figure 12.2-1, Water Rights and Points of Diversion.

Table 12.3-3. Water Rights by Type in the Water Resources Impact Analysis Area

Source	Number of Sources
Surface water	100
Underground (groundwater)	33
Spring	4

Note that a single point in Figure 12.2-1, Water Rights and Points of Diversion, above can represent more than one water right.

12.4 Environmental Consequences and Mitigation Measures

This section discusses the expected water quality impacts to surface water quality, groundwater quality, and water rights from the project alternatives.

12.4.1 Methodology

12.4.1.1 Surface Water Quality

What is scoping?

Scoping is an early and open process for determining the scope of issues to be addressed and for identifying the substantial issues related to a proposed action.

UDOT conducted extensive coordination with Little Cottonwood Creek watershed stakeholders to gather information about the watershed, develop an understanding of the overall regulatory context, and understand the watershed management objectives of the various stakeholders. UDOT held initial meetings with the primary watershed stewards (SLCDPU and the USDA Forest Service) in May 2018. UDOT also organized a formal scoping meeting with a larger stakeholder group, which included Metropolitan Water, Salt Lake County, and Sandy City Public Utilities, in July 2018 to review the initial scoping comments on the project and to define the analysis methods needed for this EIS. UDOT held periodic meetings with various stakeholders during the project's alternatives development stage in 2018 and 2019.

UDOT met monthly with SLCDPU throughout 2020 to refine and execute a water quality analysis study plan. This study plan was executed in stages as follows: (1) select contaminants of concern (COCs); (2) define the water quality model that would be used for a quantitative water quality analysis for the project alternatives; (3) present summaries for model input parameters and their data sources; and (4) present the model results for the action alternatives as the action alternatives were being defined, which included incorporating the water quality treatment potential of BMPs into the model. UDOT held meetings in late 2020 with Metropolitan Water and Sandy City to review the model results and gather feedback regarding other concerns about the action alternatives and their expected impacts.

12.4.1.1.1 Contaminants of Concern

UDOT identified 17 COCs by reviewing the *2015 Salt Lake County Integrated Watershed Plan* (Salt Lake County 2015, as revised in 2017), reviewing watershed management plans, and coordinating with watershed stakeholders. The COCs were defined as those that are typically found in highway stormwater runoff, those for which substantial changes could affect Metropolitan Water's ability to provide safe drinking water to its customers, and those identified as exceeding numeric standards (cadmium, copper, and zinc; see Table 12.3-2 above, Impaired Surface Waters in the Water Resources Impact Analysis Area). The COCs are listed in Table 12.4-1.

Table 12.4-1. Contaminants of Concern

Alkalinity	Hardness	Sulfate
Cadmium	Lead	Total dissolved solids (TDS)
Calcium	Magnesium	Total suspended solids (TSS)
Chloride	Nitrogen	Water temperature
Chromium	pH	Zinc
Copper	Phosphorus	

COCs were discussed in meetings with SLCDPU on March 12 and April 2, 2020.
Note that two of these COCs (pH and hardness) are not contaminants *per se* but are measures of water's physical parameters.

12.4.1.1.2 Water Quality Modeling

Based on scoping comments regarding the importance of Little Cottonwood Creek, UDOT focused the quantitative water quality analysis on Little Cottonwood Creek. UDOT did not obtain existing water quality data for Deaf Smith Canyon Creek. A portion of the 0.25-mile-wide water resources impact analysis area overlaps parts of the Big Cottonwood Water Treatment Plant property. However, infrastructure improvements in the portion of the impact analysis area near Big Cottonwood Canyon would discharge stormwater runoff to Big Cottonwood Creek below the Big Cottonwood Water Treatment Plant water intakes or to existing stormwater infrastructure.

UDOT used a water quality model (the Stochastic Empirical Loading and Dilution Model, or the USGS Model), which was developed by the U.S. Geological Survey (USGS) in cooperation with the Federal Highway Administration, to estimate the water quality effects of the project alternatives on Little Cottonwood Creek. The USGS Model is evidence-based (empirical) and uses, as inputs, monitoring data for Little Cottonwood Creek's stream flows, the creek's COC concentrations, concentrations of COCs in highway stormwater runoff from similar highway sites, and location-specific precipitation data for highway runoff volumes for various storms. The model also considers watershed characteristics (total area, gradient, and level of existing stormwater infrastructure). The USGS Model uses statistical (stochastic) mass balance methods to combine input variables, which can all have a wide range of values, to generate a statistical distribution of possible in-stream concentrations of the COCs after mixing highway stormwater runoff with upgradient stream flows.

UDOT's modeling approach was to assume, for the No-Action and action alternatives, that 100% of highway stormwater runoff would be discharged to Little Cottonwood Creek at a point just above the Metropolitan Water treatment plant. Because space in the canyon is limited, UDOT also assumed that only a portion of new impervious surfaces (for example, about 64% of the new pavement area for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative) could be treated by BMPs. Existing stormwater runoff discharges are more dispersed throughout the canyon, and the action alternatives would maintain these types of dispersed discharges. Therefore, UDOT's modeling methodology, which assumes one point of discharge and does not consider the creek's physiochemical processes on COCs, is conservative and was designed to determine the magnitude of the expected water quality differences among the alternatives.

UDOT compared the USGS Model outputs for the action alternatives to those with the No-Action Alternative to determine the probability for adverse effects. The model outputs were also compared to numeric water quality standards to determine the risk that Little Cottonwood Creek's beneficial uses would be impaired from highway stormwater runoff.

12.4.1.1.3 Compliance with Watershed Management Plans and Forest Plan

UDOT also reviewed applicable drinking water source protection plans (from Metropolitan Water), watershed management plans (from SLCDPU and Sandy City), watershed ordinances (Salt Lake City Ordinance 17), and a health regulation (Salt Lake Valley Health Department Health Regulation 14), which are collectively referred to in this section as *watershed management plans*, as well as the *Revised Forest Plan: Wasatch-Cache National Forest* to evaluate how the action alternatives comply with additional management objectives.

Following are examples of the *Forest Plan*'s management objectives and the watershed management plans' recommendations that are applicable to the transportation improvements and other aspects of the project alternatives.

- The plans encourage maintaining setbacks from new development and Little Cottonwood Creek. Specifically, the *Forest Plan*'s Forestwide Goal 2 addresses watershed health by maintaining stable and productive riparian and aquatic ecosystems and by implementing watershed management programs that support beneficial water uses and protect water quality. Stable riparian vegetation reduces erosion and, by maintaining soil-hydrologic functions, among other ecological functions, helps maintain surface water quality. The USDA Forest Service has defined Riparian Habitat Conservation Areas (RHCAs) as important areas to conserve to help protect the overall health of the watershed. Other watershed plans also point to this management objective. Chapter 13, Ecosystem Resources, describes the impacts of the project alternatives on these RHCAs. Additional *Forest Plan* management objectives, and how the project alternatives address those management objectives, are presented in Section 12.4.8, Forest Plan–related Management Objectives.
- S.R. 210 is identified in the watershed management plans as a source of nonpoint pollution. Petroleum and other types of contamination could enter Little Cottonwood Creek as a result of vehicle accidents and spills and from vehicles leaving the roadway and entering the creek.
- The watershed management plans identify diesel and gasoline storage tanks for fueling and generators, as well as storage facilities for oil and gear lubricants, as potential sources of contaminants if they are not properly managed.

- The watershed management plans mention pathogenic contamination from dispersed recreation resources in the canyon as another source of contamination. The plans recommend restroom facilities at high-use recreation and trailhead areas and prohibit human waste from being disposed of within 300 feet of Little Cottonwood Creek.

What are pathogens?

As used in this chapter, a pathogen is a bacterium or virus that can cause disease.

- The watershed management plans address protecting physical infrastructure in order to maintain drinking water suppliers' ability to put surface water to beneficial use. The impact methodology for these drinking water sources is described in Section 12.4.1.3, Surface Water and Groundwater Water Rights.

12.4.1.1.4 Other Watershed and Water Quality Observations

UDOT conducted field reconnaissance in Little Cottonwood Canyon in June 2018 to identify the existing conditions of the roadway drainage system and culverts along S.R. 210. UDOT found a lack of energy dissipation at some of the culvert outlets, eroding side slopes, and some areas of rill formation along the roadway pavements, which together could contribute sediment and related pollutants to Little Cottonwood Creek.

What is a rill?

A rill is a shallow channel cut into soil by the erosive action of flowing water.

12.4.1.2 Groundwater Quality

In the water resources impact analysis area, existing transportation corridors are not listed as sources of groundwater contamination (UGS 2009). Groundwater discharges from transportation BMPs (for example, detention basins, vegetated filter strips, and infiltration trenches and vaults), which can infiltrate stormwater runoff, are permitted by rule.

12.4.1.3 Surface Water and Groundwater Water Rights

UDOT determined the impacts to water rights by evaluating the action alternatives' physical impacts to points of diversion (surface water diversions or groundwater wellheads). Municipalities control whether roads and other transportation modes are an allowable form of development within each of the various drinking water protection zones. In general, if transportation development encroaches into groundwater source protection Zone 1 (the area within a 100-foot radius of the wellhead) and is determined by the municipality or well owner to have a negative impact to the function of the well, methods to reduce and/or eliminate the negative impact, or relocate the well, may be proposed. UDOT analyzed the locations of the action alternatives relative to this drinking water source protection zone.

12.4.2 No-Action Alternative

This section describes the impacts to water resources from the No-Action Alternative in the Wasatch Boulevard segment of S.R. 210, in the segment of S.R. 210 from North Little Cottonwood Road to the town of Alta, at the gravel pit, and at the park-and-ride lot at 9400 South and Highland Drive. It also describes the impacts to water resources from avalanche mitigation, trailhead parking, and winter parking.

The analysis conducted for the No-Action Alternative assumes that S.R. 210 in the water resources impact analysis area would have the same number of lanes in 2050 as it does currently.

12.4.2.1 S.R. 210 – Wasatch Boulevard

With the No-Action Alternative, no improvements to Wasatch Boulevard, which current has about 17 acres of impervious area, would be made as part of the S.R. 210 Project. Runoff from about 11.6 acres of the existing pavement is conveyed to a detention basin next to the Swamp Lot park-and-ride lot (at 8100 South 3500 East in Cottonwood Heights). The remainder of the existing Wasatch Boulevard stormwater system does not have any BMPs in place to treat stormwater. No new impervious surface would be added, so the water quality impacts would not change. The No-Action Alternative would not change groundwater quality or affect water rights points of diversion.

12.4.2.2 S.R. 210 – North Little Cottonwood Road to Alta

Impacts to Surface Water Quality

UDOT prepared a USGS Model for the No-Action Alternative to simulate the in-stream water quality of Little Cottonwood Creek after stormwater runoff from the existing highway is mixed with upstream creek flows. The existing conditions model was prepared to compare the USGS Model results of the action alternatives. For context, the No-Action Alternative includes 38.7 acres of pavement area.

The USGS Model results for the No-Action Alternative are presented in Table 12.4-2, USGS Model Results for the No-Action and Enhanced Bus Service Alternatives, on page 12-29. With the exception of phosphorus, the modeled range of COC concentrations in Little Cottonwood Creek with the No-Action Alternative does not exceed the numeric standards for the creek's applicable beneficial uses. A discussion of model results for phosphorus is also included in Section 12.4.4, Enhanced Bus Service in Peak-period Shoulder Lane Alternative.

With the No-Action Alternative, UDOT would not immediately address the drainage system and culverts along S.R. 210 in Little Cottonwood Canyon. However, UDOT would address and fix identified problems over time and as funding becomes available.

Impacts to Groundwater Quality

The No-Action Alternative would not affect groundwater quality. Transportation facilities are not identified in the watershed management plans as sources of groundwater contamination.

Impacts to Surface Water and Groundwater Water Rights

The No-Action Alternative would not affect any water rights points of diversion.

Compliance with Watershed Management Plans

With the No-Action Alternative, there would be no new impacts to the *Forest Plan* RHCAs. S.R. 210 in Little Cottonwood Canyon has sharp curves, has limited shoulders, and lacks a clear zone for much of this segment. Therefore, with the expected increase in the total number of vehicles entering the canyon, the risks of water quality impacts associated with spills and vehicles entering the creek could increase. The potential for vehicles to enter the creek was one of the main issues identified by the watershed managers. No additional fuel storage is anticipated, and there would be no impacts to water and wastewater infrastructure. Also see Section 12.4.2.5, Trailhead Parking, regarding the No-Action Alternative's potential to contribute pathogens to Little Cottonwood Creek.

12.4.2.3 Mobility Hubs

12.4.2.3.1 Gravel Pit

With the No-Action Alternative, UDOT would not construct a mobility hub at the gravel pit. Cottonwood Heights City is planning to develop the gravel pit site with commercial and residential uses. Stormwater quality at the developed site would be managed under Cottonwood Heights City's stormwater management plan and the conditions of its MS4 permit.

What is a mobility hub?

A mobility hub is a location where users can transfer from their personal vehicle to a bus (or other transit mode).

12.4.2.3.2 9400 South and Highland Drive

With the No-Action Alternative, the existing park-and-ride lot at 9400 South and Highland Drive would not change. Stormwater quality at the site is managed under Sandy City's stormwater management program and the conditions of its MS4 permit.

What is the gravel pit?

The gravel pit is an existing aggregate (gravel) mine located on the east side of Wasatch Boulevard between 6200 South and Fort Union Boulevard.

12.4.2.4 Avalanche Mitigation

With the No-Action Alternative, snow sheds would not be constructed, and existing water quality would not change.

12.4.2.5 Trailhead Parking

With the No-Action Alternative, there would be no change to trailhead parking along S.R. 210 and no elimination of roadside parking near the trailheads. The water quality impacts would continue at unpaved or paved (without water quality treatment BMPs) trailhead parking areas in addition to locations where vehicles park on the narrow, paved shoulders and unpaved areas adjacent to the shoulders. These activities disturb roadside soils and can lead to increased erosion and sediment in Little Cottonwood Creek. However, in the USGS Model for the No-Action Alternative, UDOT did not account for the stormwater runoff from the current trailheads (many of which are unpaved), disturbed soils near the existing roadway shoulders, or naturally occurring erosion-prone areas in the watershed. With this model methodology, the No-Action or baseline model represents a best-case scenario against which to compare the pollutant contributions of the action alternatives.

Currently, there are no restroom facilities at the Gate Buttress or Lisa Falls Trailheads. This lack of restrooms could cause violations of Salt Lake City Ordinance 17 regarding human waste disposal (Salt Lake City Ordinance, Chapter 17.04, *Watershed Areas*), which could contribute pathogens to the Little Cottonwood Creek watershed. With the No-Action Alternative, UDOT would not construct trailhead improvements or add restrooms. The addition of restroom facilities at these trailheads could be constructed by the USDA Forest Service or one of the other watershed stewards, but UDOT is not aware of any current plans to do so.

12.4.2.6 Winter Parking

With the No-Action Alternative, there would be no change to winter roadside parking. The current winter roadside parking situation was not identified in the watershed management plans as a major source of water pollution.

12.4.3 Enhanced Bus Service Alternative

This section describes the impacts to water resources from the Enhanced Bus Service Alternative, which includes improvements to the Wasatch Boulevard segment of S.R. 210, two mobility hubs, avalanche mitigation alternatives, trailhead parking alternatives, and the No Winter Parking Alternative.

12.4.3.1 S.R. 210 – Wasatch Boulevard

This section describes the impacts to water resources from the Imbalanced-lane Alternative and the Five-lane Alternative, which would both widen the Wasatch Boulevard segment of S.R. 210.

12.4.3.1.1 Imbalanced-lane Alternative

Impacts to Surface Water Quality

Some portions of Wasatch Boulevard would discharge stormwater to Big Cottonwood Creek, though these discharges would occur below the Big Cottonwood Water Treatment Plant, and stormwater from most segments would be discharged to existing storm drain systems or to other surface water bodies that are not sources of drinking water. Therefore, UDOT focused the quantitative water quality analysis on Little Cottonwood Creek.

As part of the roadway widening for the Imbalanced-lane Alternative, UDOT would implement the requirements in its *Stormwater Quality Design Manual*, which authorizes the discharge of stormwater and addresses UDOT's obligations to control water quality, both in the short term during construction and in the long term after construction, through evaluating and implementing BMPs both during and after construction and meeting the terms and conditions of its MS4 permit (No. UTS000003). UDOT's stormwater management goal is to mirror predevelopment runoff and improve water quality through the use of stormwater BMPs.

With the Imbalanced-lane Alternative, UDOT would construct about 13.2 acres of new impervious area (30.2 acres total) and add curb and gutter for the full extent of the Wasatch Boulevard segment of S.R. 210. UDOT would meet its stormwater quality obligations by using detention basins (at the Swamp Lot, near Russell Park Road, and near the intersection of Wasatch Boulevard and North Little Cottonwood Road) or

including other inline water quality treatment features (for example, hydrodynamic separators). In total, runoff from about 24.6 acres of the 30.2 acres of total pavement area of the Imbalanced-lane Alternative would be passed through detention basins. With the addition of stormwater BMPs, the water quality conditions in the Wasatch Boulevard segment of S.R. 210 would be improved compared to the conditions with the No-Action Alternative.

Impacts to Groundwater Quality

Groundwater discharges, through the use of detention basins which infiltrate stormwater runoff, are permitted by rule. Therefore, no groundwater impacts are expected from the Imbalanced-lane Alternative.

Impacts to Surface Water and Groundwater Water Rights

The Imbalanced-lane Alternative would not affect any surface or groundwater points of diversion. The additional pavement from the Imbalanced-lane Alternative would not encroach into any Zone 1 drinking groundwater source protection areas.

Compliance with Watershed Management Plans

The Wasatch Boulevard segment of S.R. 210 is outside the Little Cottonwood Creek watershed, so the Imbalanced-lane Alternative does not need to comply with the watershed management plans or the *Forest Plan*.

12.4.3.1.2 Five-lane Alternative

The Five-lane Alternative would add about 14.4 acres of impervious area (31.4 acres total), about 1.2 acres more than the Imbalanced-lane Alternative. With the addition of detention basins that can treat highway stormwater runoff from about 24.6 acres, the impacts of the Five-lane Alternative to water resources would be about the same as those from the Imbalanced-lane Alternative. With the addition of BMPs, water quality would be improved compared to the No-Action Alternative.

12.4.3.2 S.R. 210 – North Little Cottonwood Road to Alta

Impacts to Surface Water Quality

With the Enhanced Bus Service Alternative, UDOT would not make any roadway improvements to S.R. 210 in Little Cottonwood Canyon. Therefore, the effects of highway stormwater runoff on the water quality of Little Cottonwood Creek would not change compared to the No-Action Alternative. See Section 12.4.4.5, Trailhead Parking Alternatives, for a description of the inputs used in the USGS Model for the Enhanced Bus Service Alternative. See Table 12.4-2, USGS Model Results for the No-Action and Enhanced Bus Service Alternatives, on page 12-29 for the model results.

Impacts to Groundwater Quality

With the Enhanced Bus Service Alternative, UDOT would not make any roadway improvements to S.R. 210 in Little Cottonwood Canyon. Therefore, there would be no change to groundwater quality compared to the No-Action Alternative.

Impacts to Surface Water and Groundwater Water Rights

With the Enhanced Bus Service Alternative, UDOT would not make any roadway improvements to S.R. 210 in Little Cottonwood Canyon. Therefore, there would be no change to surface and groundwater points of diversion or drinking water source protection zones compared to the No-Action Alternative.

S.R. 210 from North Little Cottonwood Road to the town of Alta is within Little Cottonwood Creek's surface water protection Zone 1. The modeled impacts to surface water quality show the expected impacts within this zone. See Section 12.4.4.2, S.R. 210 – North Little Cottonwood Road to Alta, for the model results for the Enhanced Bus Service Alternative in this segment of S.R. 210.

Compliance with Watershed Management Plans

The Enhanced Bus Service Alternative would not increase roadway capacity for personal vehicles in the canyon and would reduce personal vehicle use by about 30% from the end of November to mid-April. Therefore, there would likely be fewer vehicle accidents and less risk of spills or vehicles entering Little Cottonwood Creek during the winter compared to the No-Action Alternative. The Enhanced Bus Service Alternative would not change summer vehicle use in Little Cottonwood Canyon compared to the No-Action Alternative. See Section 12.4.8, Forest Plan–related Management Objectives, for a more comprehensive evaluation of how the Enhanced Bus Service Alternative addresses specific *Forest Plan* management objectives.

12.4.3.3 Mobility Hubs Alternative

The Enhanced Bus Service Alternative includes two mobility hubs: a mobility hub at the gravel pit and a mobility hub at the park-and-ride lot at 9400 South and Highland Drive.

12.4.3.3.1 Gravel Pit

The Enhanced Bus Service Alternative includes a 1,500-parking-space mobility hub at the gravel pit. UDOT would construct a new intersection to help personal vehicles and buses access the mobility hub. UDOT would implement the requirements of its *Stormwater Quality Design Manual*, which authorizes the discharge of stormwater with the implementation of BMPs. The goal of UDOT's *Stormwater Quality Design Manual* is to mirror predevelopment conditions. Therefore, the water quality of receiving water bodies would be essentially the same as the existing conditions.

One underground point of diversion (water right #57-8802, Walker Development Partnership) could be affected by the roadway improvements associated with the new intersection near the gravel pit. The exact location of the well and the measures to avoid or mitigate the impact would be determined during the final design of the Selected Alternative.

12.4.3.3.2 9400 South and Highland Drive

The Enhanced Bus Service Alternative includes a 1,000-parking-space mobility hub at 9400 South and Highland Drive. UDOT would implement the requirements of its *Stormwater Quality Design Manual*, which authorizes the discharge of stormwater with the implementation of BMPs that mirror predevelopment conditions. Therefore, the water quality of receiving water bodies would be essentially the same as the existing conditions.

No points of diversion would be affected by a mobility hub at 9400 South and Highland Drive.

12.4.3.4 Avalanche Mitigation Alternatives

The Enhanced Bus Service Alternative includes two alternatives for avalanche mitigation: the Snow Sheds with Berms Alternative and the Show Sheds with Realigned Road Alternative.

12.4.3.4.1 Snow Sheds with Berms Alternative

Impacts to Surface Water Quality

With the Snow Sheds with Berms Alternative, the snow sheds' guiding berms, backfill, and roof would be vegetated and therefore would not change the overall stormwater runoff properties of the areas where the snow sheds would be located. Snow sheds would not increase the velocity of an avalanche flow and, therefore, would not increase the amount of debris entering Little Cottonwood Creek during avalanches. The roofs of the snow sheds would be covered with soil and revegetated, and avalanche debris would accumulate on top of the shed. The Snow Sheds with Berms Alternative would not contribute stormwater pollutants to Little Cottonwood Creek, and water quality would be the same as with the No-Action Alternative.

The snow sheds could slightly decrease the number of vehicle accidents because the road under the snow sheds would be free of snow and ice. In addition, the snow sheds would not increase the likelihood of a vehicle fire compared to the No-Action Alternative. However, because the snow sheds meet the definition of a tunnel, they would likely require a fire-suppression system. Therefore, they would be subject to the fire and life safety requirements of National Fire Protection Association Standard 502.

What is a standpipe?

A standpipe is a vertical pipe extending from a water supply main.

Contingent on a more-detailed engineering evaluation, the snow sheds would be equipped with fire-suppression systems (fire extinguishers, sprinklers, and standpipes) to control fires in the snow sheds, facilitate emergency egress, and protect the structures. The fire-suppression system would be water-based, not glycol-based, but it would be a "dry" system. In a dry system, the pipes and sprinklers are dry (without water) most of the time. UDOT anticipates connecting the snow sheds' fire-suppression system to an existing water line near Snowbird Entry 1. A valve on the existing water line would be turned on during a fire, and a pipe (normally dry) would convey water to the snow sheds' overhead sprinkler system and standpipes. According to a representative with Salt Lake County Service Area #3 (Canyon Water), the existing water system has enough storage capacity to supply fire-suppression flows to the snow sheds (Hanson 2018).

Water discharges from fire-suppression systems are exempt from permitting (UAC R317-8). However, the snow sheds would also include an internal drainage system to contain spills and fire-suppression flows. UDOT would test the drainage water for contaminants. If the water is not contaminated, it would be discharged to Little Cottonwood Creek. If the water is contaminated, it would be pumped out of the containment and discharged to the sanitary sewer system or hauled away for proper disposal. The specific concentrations of pollutants that could be discharged to the creek or the sewer have not been be defined.

Impacts to Groundwater Quality

The Snow Shed with Berms Alternative would not discharge pollutants and would not affect groundwater quality.

Impacts to Surface Water and Groundwater Water Rights

The Snow Shed with Berms Alternative would not affect any points of diversion or encroach into any groundwater source protection zones.

Compliance with Watershed Management Plans

The snow sheds would not affect the frequency of accidents or increase the risk of spills or vehicles entering Little Cottonwood Creek. Barriers inside the snow sheds would be included to protect the snow shed structure. Therefore, the snow sheds would reduce the risk of vehicles entering the creek in the segments of S.R. 210 that are covered by the snow sheds The snow sheds would be located on the north side of the road and would not reduce the existing buffer zone between disturbed areas and the creek. The Snow Sheds with Berms Alternative would comply with the watershed management plans.

12.4.3.4.2 Snow Sheds with Realigned Road Alternative

The impacts from the Snow Sheds with Realigned Road Alternative to water quality would be the same as with the Snow Sheds with Berms Alternative. The Snow Sheds with Realigned Road Alternative would improve the roadway curvature and combine the snow sheds for the White Pine Chutes and White Pine avalanche paths.

12.4.3.5 Trailhead Parking Alternatives

The Enhanced Bus Service Alternative includes three alternatives to address trailhead parking.

- Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative
- Trailhead Improvements and No Roadside Parking from S.R. 209/S.R. 210 Intersection to Snowbird Entry 1 Alternative
- No Trailhead Improvements and No Roadside Parking from S.R. 209/S.R. 210 Intersection to Snowbird Entry 1 Alternative

12.4.3.5.1 Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative

Impacts to Surface Water Quality

With this trailhead parking alternative, trailhead parking would be improved and stormwater BMPs would be implemented in compliance with UDOT's *Stormwater Quality Design Manual*. The alternative would add about 2.4 acres of new pavement area in Little Cottonwood Canyon. Given the small amount of impervious area that would be added, the modeled in-stream water quality of Little Cottonwood Creek with this trailhead parking alternative is the same as with the No-Action Alternative. With the exception of phosphorus concentrations, which would be the same as with the No-Action Alternative, no numeric water quality standards associated with Little Cottonwood Creek's beneficial uses would be exceeded. See Section 12.4.4, Enhanced Bus Service in Peak-period Shoulder Lane Alternative, for the model results for the Enhanced Bus Service Alternative.

UDOT did not account for the stormwater runoff from the current trailheads (many of which are unpaved), disturbed soils near the existing roadway shoulders, or naturally occurring erosion-prone areas in the watershed. With this model methodology, the No-Action or baseline model represents a best-case scenario against which to compare the pollutant contributions of the action alternatives. With paved trailheads, BMPs, and restricted roadside parking, there would be some water quality benefits with this trailhead parking alternative compared to the No-Action Alternative.

Impacts to Groundwater Quality

This trailhead parking alternative would not discharge a substantial amount of stormwater to the ground and would not affect groundwater quality. Stormwater management BMPs that infiltrate stormwater runoff are permitted by rule because they do not add pollutants at level that presents a more–than–*de minimis* risk for groundwater contamination.

What is a *de minimis* impact?

As used in this chapter, a *de minimis* impact is a minor impact that does not pose a substantial risk to water quality.

Impacts to Surface Water and Groundwater Water Rights

There are no groundwater points of diversion or groundwater protection zones near the trailhead parking areas.

Compliance with Watershed Management Plans

Trailhead parking would be improved at the White Pine, Lisa Falls, Bridge, and Gate Buttress Trailheads. In compliance with the watershed management plans and the *Forest Plan*, restroom facilities would be added at these locations along S.R. 210. Therefore, there would be less potential for dispersed recreation to contribute pathogenic pollutants to Little Cottonwood Creek compared to the No-Action Alternative.

12.4.3.5.2 Trailhead Improvements and No Roadside Parking from S.R. 209/S.R. 210 Intersection to Snowbird Entry 1 Alternative

The impacts to water resources from this trailhead parking alternative would be the same as from the Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative except for the elimination of roadside parking. With this alternative, roadside parking would be eliminated, which would reduce the potential for pollutants from roadside parked vehicles and sediment from roadside damage cause by vehicles from entering Little Cottonwood Creek compared to the Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative.

12.4.3.5.3 No Trailhead Improvements and No Roadside Parking from S.R. 209/S.R. 210 Intersection to Snowbird Entry 1 Alternative

No trailhead improvements would be made with this trailhead parking alternative; therefore, the impacts to water resources at the existing trailheads and lack of restrooms would be the same as with the No-Action Alternative. However, with this alternative, roadside parking would be eliminated, which would reduce the potential for pollutants from roadside parked vehicles and sediment from roadside damage caused by vehicles from entering Little Cottonwood Creek compared to the Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative.

12.4.3.6 No Winter Parking Alternative

Because the No Winter Parking Alternative would not change the amount of highway runoff pollutants, it would not affect water quality.

12.4.4 Enhanced Bus Service in Peak-period Shoulder Lane Alternative

This section describes the impacts to water resources from the Enhanced Bus Service in Peak-period Shoulder Lane Alternative, which includes improvements to the Wasatch Boulevard segment of S.R. 210, improvements to the segment of S.R. 210 from North Little Cottonwood Road to the town of Alta, two mobility hubs, avalanche mitigation alternatives, trailhead parking alternatives, and the No Winter Parking Alternative.

12.4.4.1 S.R. 210 – Wasatch Boulevard

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the improvements to Wasatch Boulevard with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would be the same as with the Enhanced Bus Service Alternative.

12.4.4.2 S.R. 210 – North Little Cottonwood Road to Alta

Impacts to Surface Water Quality

The following paragraphs discuss the USGS Model results for the COCs listed on the State of Utah's 303(d) list of impaired waters (cadmium, copper, zinc, and pH) and also the COCs (phosphorus) for which there would be a discernable difference between the effects of the No-Action Alternative and the Enhanced Bus Service in Peak-period Shoulder Lane Alternative as shown in Table 12.4-2, USGS Model Results for the No-Action and Enhanced Bus Service Alternatives, on page 12-29. The model provides a range of concentrations that can be expected (statistically) for different percentages of storm events. The model simulates 1,560 storms over a 32-year period (about 49 storms per year on average). As shown in Table 12.4-2, the results show a low range and a high range. The low end of the reported range represents the in-stream COC concentrations that would be *equaled or exceeded* for 80% of storm events. The high end of the reported range represents the in-stream COC concentrations that would be *equaled or exceeded* for 20% of storm events, which equates to 10 storms per year. The high end of the range also represents in-stream COC concentrations that would be *less than* the reported concentrations for 80% of storm events. Table 12.4-2 also presents applicable numeric water quality standards for Little Cottonwood Creek's designated beneficial uses.

In compliance with UDOT's *Stormwater Quality Design Manual*, the Enhanced Bus Service in Peak-period Shoulder Lane Alternative includes postconstruction BMPs for the additional 22 acres of additional roadway pavement from widening S.R. 210. UDOT estimated that runoff from about 64% of the new impervious surface can be treated through vegetated filter strip or infiltration trench BMPs.

For the majority of the COCs, there would be *de minimis* differences between the No-Action Alternative and the Enhanced Bus Service in Peak-period Shoulder Lane Alternative. In addition, the minor differences show up only at the higher end of the modeled range (20% of storm events). The following paragraphs discuss the USGS Model results for the COCs listed on the State of Utah's 303(d) list of impaired waters. Also

discussed below are the COCs for which there would be a discernable difference between the effects of the No-Action Alternative and the Enhanced Bus Service in Peak-period Shoulder Lane Alternative.

Cadmium. Cadmium is listed as a low priority for developing a TMDL analysis. The model results show no meaningful difference between the No-Action Alternative, the Enhanced Bus Service Alternative, and the Enhanced Bus Service in Peak-period Shoulder Lane Alternative. The high end of the cadmium concentration range (20% of storms) was modeled at about 0.6 micrograms per liter (µg/L), which is below the most stringent numeric standard, Class 3A protection for cold-water aquatic species, of 1.8 µg/L (1-hour average concentration).

Copper. Copper is listed as a low priority for developing a TMDL analysis. The model results show no meaningful difference between the No-Action Alternative, the Enhanced Bus Service Alternative, and the Enhanced Bus Service in Peak-period Shoulder Lane Alternative. The high end of the copper range (20% of storms) was modeled at about 8.6 µg/L, which is below the most stringent numeric standard, Class 3A protection for cold-water aquatic species, of 13 µg/L (1-hour average concentration).

Zinc. Little Cottonwood Creek was impaired for zinc in 2000, and a TMDL analysis was developed in 2002. The source of zinc impairment was identified as drainage from mine tunnels. The existing roadway was not identified as a source of zinc to the creek (Utah Division of Water Quality 2002). The high end of the modeled zinc concentration range (58.4 µg/L) is below the numeric standard for Class 3A waters (120 µg/L).

pH. pH is listed as a low priority for developing a TMDL analysis. The model results show no meaningful differences in the in-stream values for pH over the range of expected storm events. The modeled pH is within the numeric standard, which is also a range (6.5 to 8.5 for Class 1C waters).

Phosphorus. Little Cottonwood Creek is not impaired for phosphorus. However, the modeled high end of the concentration range (20% of storms) for phosphorus with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative is 0.054 mg/L. This modeled concentration falls within the middle of the numeric standard for phosphorus in Class 3A headwaters streams. The numeric standard is an average ambient concentration in the summer months (July to early September) and is a range between 0.035 and 0.080 mg/L. The model results for the No-Action and enhanced bus service alternatives (0.044 mg/L at the high end, 20% of storms) also fall within the middle of the numeric standard range. The high end of the range for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative is about 0.010 mg/L higher than for the No-Action Alternative.

What is eutrophication?

Eutrophication is the gradual increase in the concentration of phosphorus, nitrogen, and other plant nutrients in a water body.

In-stream phosphorus concentrations at or below the low end of the numeric standard (0.035 mg/L) are unlikely to cause an ecological response that would result in eutrophication problems (low dissolved oxygen). In-stream phosphorus concentrations that exceed the upper numeric standard threshold (0.080 mg/L) could cause eutrophication problems, and UDEQ could conclude that the stream is likely impaired and place the water on the 303(d) list for further evaluation. In-stream phosphorus concentrations that fall between the upper and lower thresholds of the numeric standard require additional investigations to determine a stream's ecological conditions (bioconfirmation) to confirm whether the phosphorus loading (nutrient enrichment) is excessive and is impairing or threatening a stream's designated beneficial uses. These ecological response measurements are the amount of plant and algae growth in the stream and the stream's ecosystem respiration (degree of oxygen depletion) (Utah Division of

Water Quality 2019). These ecological response data are not currently available. Little Cottonwood Creek is also not impaired for low dissolved oxygen concentrations.

The average storm duration is about 8 hours. With the steep gradient of Little Cottonwood Creek, water travels from the upper reaches of the watershed to the Metropolitan Water treatment plant in about 8 hours. However, assuming that highway stormwater runoff affects the in-stream concentrations for 1 day, the total stream flow time with the modeled phosphorus concentrations at the high end of the modeled range (20% of storms, or 10 storms per year) would be 10 days per year, or 3% of annual stream flow time.

The numeric phosphorus standard is an ambient summertime average. Based on 20 years of monitoring data for Little Cottonwood Creek, the average phosphorus concentration in the creek is 0.016 mg/L, which is below the lower phosphorus standard threshold. Because of the short duration of increased phosphorus concentrations due to stormwater runoff, the stream would likely return to ambient conditions within about 1 day, and the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would not affect the aquatic life criteria for phosphorus.

Other COCs. The USGS Model results show some *de minimis* differences for some of the other COCs with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative compared to the No-Action Alternative. These slight differences occur only at the higher end of the modeled range. In addition, the modeled in-stream COC concentrations are all well below numeric water quality criteria.

UDOT met with watershed stakeholders, including the water treatment plant operator (Metropolitan Water), in the fall of 2020 to review the USGS Model results. In the meeting, UDOT said that the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would not contribute COC concentrations at levels that would impair Little Cottonwood Creek's beneficial uses or impair Metropolitan Water's ability to deliver safe drinking water.

Impacts to Groundwater Quality

The proposed BMP in the canyon is vegetated filter strips, which would infiltrate a portion of highway stormwater runoff and which are exempt from permitting. The Enhanced Bus Service in Peak-period Shoulder Lane Alternative would not affect groundwater quality.

Impacts to Surface Water and Groundwater Water Rights

There are two clusters of groundwater points of diversion along North Little Cottonwood Road west of the entrance to Little Cottonwood Canyon: water right numbers 57-10378, Metropolitan Water, and 57-9000, North Despain and North Despain Extension Canal. On the Utah Division of Water Rights' Interactive Map (Utah Division of Water Rights 2020), points of diversion are shown next to the roadway. However, the water sources for these water rights are identified as both springs and Little Cottonwood Creek. No surface springs were observed in this area during UDOT's aquatic resource surveys (UDOT 2020). If a subsurface collection system exists, it would be protected or replaced during construction. Therefore, the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would not affect these water rights points of diversion.

Table 12.4-2. USGS Model Results for the No-Action and Enhanced Bus Service Alternatives

Constituent of Concern	Unit	Downstream Concentration Range Low End (80% of Storms) – High End (20% of Storms)			Numeric Standards		
		No-Action Alternative	Enhanced Bus Service Alternative	Enhanced Bus Service in Peak-period Shoulder Lane Alternative	Primary or Secondary MCL	Beneficial Use 1C	Beneficial Use 3A
Alkalinity	mg/L	41.3–58.8	41.3–58.8	40.9–58.2	—	—	—
Cadmium[a]	µg/L	0.349–0.600	0.349–0.593	0.345–0.584	5	10	1.8
Calcium	mg/L	21.2–27.6	21.9–27.6	21.4–27.5	—	—	—
Chloride	mg/L	12.3–49.8	12.6–50.8	12.7–53.2	250	—	—
Chromium[a,b]	µg/L	1.40–2.93	1.46–2.91	1.51–3.03	100	50	16
Copper[a]	µg/L	3.75–8.31	3.77–8.51	3.85–8.59	1,000	—	13
Hardness	mg/L	64.7–101	67.4–102	66.7–101	—	—	—
Lead[a]	µg/L	0.547–2.70	0.547–2.75	0.588–2.94	15	15	65
Magnesium	mg/L	4.12–6.45	4.16–6.44	4.13–6.42	—	—	—
Nitrogen (nitrate and nitrite)	mg/L	0.187–0.342	0.184–0.336	0.186–0.341	10	10 (nitrates)	0.4–0.8
pH	—	7.32–8.04	7.34–8.05	7.28–8.02	6.5–8.5	6.5–9.0	6.5–9.0
Phosphorus	mg/L	0.010–0.044	0.010–0.044	0.011–0.054	—	—	0.035–0.08
Sulfate	mg/L	12.3–29.1	12.1–28.3	11.9–28.0	1,000	—	—
Total dissolved solids (TDS)	mg/L	104–193	102.1–192.7	102–196	500	—	—
Total suspended solids (TSS)	mg/L	2.43–11.8	2.47–11.7	2.63–13.8	—	—	—
Water temperature	°C	3.79–9.11	3.85–9.14	3.94–9.22	—	—	20° max and 2° change
Zinc[a]	µg/L	28.7–58.3	29.2–58.2	29.4–58.4	5,000	—	120

°C = degrees Celsius, µg/L = micrograms per liter, max = maximum, MCL = maximum contaminant level, mg/L = milligrams per liter

[a] The reported numeric criteria for metals (cadmium, chromium, copper, lead, and zinc) are the 1-hour average standard for Class 3A waters.

[b] The reported standard is for hexavalent chromium.

Compliance with Watershed Management Plans

The Enhanced Bus Service in Peak-period Shoulder Lane Alternative would have some minor encroachments into the vegetated buffer area between the roadway and Little Cottonwood Creek. See Chapter 13, Ecosystem Resources, for impacts to the RHCAs.

This alternative would not increase roadway capacity for personal vehicles in the canyon and would reduce personal vehicle use by about 30% from the end of November to mid-April. Therefore, there would likely be fewer vehicle accidents and less risk of spills or vehicles entering Little Cottonwood Creek during the winter compared to the No-Action Alternative. The alternative would not change summer vehicle use in Little Cottonwood Canyon compared to the No-Action Alternative. The Enhanced Bus Service in Peak-period Shoulder Lane Alternative would comply with the watershed management plans and represents a lower risk for this potential water quality impact. See Section 12.4.8, Forest Plan–related Management Objectives, for a more comprehensive evaluation of the Enhanced Bus Service in Peak-period Shoulder Lane Alternative and how its features and mitigation measures address specific *Forest Plan* management objectives.

Surface water diversions, including the intakes to the Metropolitan Water Treatment Plant, would not be affected. The existing sewer line would be protected in place or relocated.

12.4.4.3 Mobility Hubs Alternative

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the mobility hubs with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would be the same as with the Enhanced Bus Service Alternative.

12.4.4.4 Avalanche Mitigation Alternatives

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the avalanche mitigation alternatives with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would be the same as with the Enhanced Bus Service Alternative.

12.4.4.5 Trailhead Parking Alternatives

The impacts to surface water quality, groundwater quality, surface water and groundwater water rights, and pathogenic pollution risks from the trailhead parking alternatives with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would be the same as with the Enhanced Bus Service Alternative.

12.4.4.6 No Winter Parking Alternative

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the No Winter Parking Alternative with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would be the same as with the Enhanced Bus Service Alternative.

12.4.5 Gondola Alternative A (Starting at Canyon Entrance)

This section describes the impacts to water resources from Gondola Alternative A, which includes a gondola alignment from the entrance to Little Cottonwood Canyon to the Snowbird and Alta ski resorts, two mobility hubs, avalanche mitigation alternatives, trailhead parking alternatives, and the No Winter Parking Alternative.

What are base, angle, and terminal stations?

As used in this chapter, the term *terminal station* refers to the first and last stations on a passenger's gondola trip. Passengers board and disembark the gondola cabins at the terminal stations.

The *base station* is the terminal station at the bottom of the canyon, and a *destination station* is a terminal station at the top of the canyon.

The gondola alternatives also include *angle stations*, which are needed to adjust the horizontal direction of the cabin; passengers remain in the cabin as it passes through an angle station.

A *tower* supports the gondola cable.

12.4.5.1 S.R. 210 – Wasatch Boulevard

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the improvements to Wasatch Boulevard with Gondola Alternative A would be the same as with the Enhanced Bus Service Alternative.

12.4.5.2 S.R. 210 – North Little Cottonwood Road to Alta

With Gondola Alternative A, no roadway improvements would be made on S.R. 210 in Little Cottonwood Canyon. Instead, a gondola system would be used to transport some canyon users from the entrance to Little Cottonwood Canyon to the ski resorts. Gondola riders would park at mobility hubs at the gravel pit (about 1,500 parking spaces) and at 9400 South and Highland Drive (about 1,000 parking spaces) and would take a bus from a mobility hub to the gondola base station.

Gondola Alternative A includes a base station at the existing park-and-ride lot at the entrance to Little Cottonwood Canyon. The existing parking in this area would be reconfigured to construct the gondola base station and to maintain a parking area for the Alpenbock Trail and for gondola operations. About 1.6 acres of new impervious surfaces would be added around the gondola base station, and the USGS Model includes about 2.4 acres at the trailhead parking areas in the canyon. UDOT located the gondola towers outside the Little Cottonwood Creek stream corridor. The area around the gondola towers' foundations and the angle station west of the Tanners Flat Campground (which would require some trees to be removed) would be vegetated. No substantial amount of new impervious areas would be added for the gondola angle station and destination stations.

Impacts to Surface Water Quality

UDOT prepared a USGS Model for Gondola Alternative A. The results are presented in Table 12.4-3, USGS Model Results for the No-Action and Gondola Alternatives, on page 12-34. The model results show no meaningful differences in the in-stream concentration of COCs between Gondola Alternative A and the No-Action Alternative.

Impacts to Groundwater Quality

With Gondola Alternative A, the gondola stations, towers, and cabins would not discharge pollutants to the groundwater, and no groundwater quality impacts are anticipated.

Impacts to Surface Water and Groundwater Water Rights

Gondola Alternative A would not affect any points of diversion in this segment of S.R. 210. The gondola stations and towers would not be located in Zone 1 of any groundwater source protection.

Compliance with Watershed Management Plans

Gondola cabins would be detached from the main haul cables and slowed through the terminal stations to allow passengers to load and unload and, at the angle station, to change directions. Therefore, each terminal station and angle station would have mechanical equipment and would need an emergency generator to supply power to the station's equipment if the regular power supply is disrupted. Gondola Alternative A would include backup electric generators with on-site fuel storage (likely diesel fuel). The fuel storage tanks would be about 500 to 1,000 gallons and, to address watershed management plans, would be dual-walled tanks or have a secondary containment built around the fuel tanks. UDOT would also investigate a leak-detection system and an alarm with the fuel tanks.

Gondola Alternative A would not increase roadway capacity for personal vehicles in the canyon and would reduce personal vehicle use by about 30% from the end of November to mid-April. Therefore, there would likely be fewer vehicle accidents and less risk of spills or vehicles entering Little Cottonwood Creek during the winter compared to the No-Action Alternative. See Section 12.4.8, Forest Plan–related Management Objectives, for a more comprehensive evaluation of Gondola Alternative A's features and how they address specific *Forest Plan* management objectives.

Gondola Alternative A would also operate during the summer. Some users might want to access the resorts using the gondola instead of personal vehicles, which would reduce the risk of accidents and the risk of vehicles entering Little Cottonwood Creek compared to the No-Action Alternative.

12.4.5.3 Mobility Hubs Alternative

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the mobility hubs with Gondola Alternative A would be the same as with the Enhanced Bus Service Alternative.

12.4.5.4 Avalanche Mitigation Alternatives

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the avalanche mitigation alternatives with Gondola Alternative A would be the same as with the Enhanced Bus Service Alternative.

12.4.5.5 Trailhead Parking Alternatives

The impacts to surface water quality, groundwater quality, groundwater water rights, and pathogenic pollution risks from the trailhead parking alternatives with Gondola Alternative A would be the same as with the Enhanced Bus Service Alternative.

The increased impervious area with the trailhead parking improvements (2.4 acres) is included in the quantitative surface water quality modeling results for Gondola Alternative A, which is presented in Table 12.4-3, USGS Model Results for the No-Action and Gondola Alternatives, on page 12-34.

12.4.5.6 No Winter Parking Alternative

The impacts surface water quality, groundwater quality, and surface water and groundwater water rights from the No Winter Parking Alternative with Gondola Alternative A would be the same as with the Enhanced Bus Service Alternative.

12.4.6 Gondola Alternative B (Starting at La Caille)

This section describes the impacts to water resources from Gondola Alternative B, which includes a gondola alignment from La Caille to the Snowbird and Alta ski resorts, two mobility hubs, avalanche mitigation alternatives, trailhead parking alternatives, and the No Winter Parking Alternative.

12.4.6.1 S.R. 210 – Wasatch Boulevard

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the improvements to Wasatch Boulevard with Gondola Alternative A would be the same as with the Enhanced Bus Service Alternative.

12.4.6.2 S.R. 210 – North Little Cottonwood Road to Alta

Impacts to Surface Water Quality

Gondola Alternative B would not include roadway improvements in Little Cottonwood Canyon. However, Gondola Alternative B would add a total of about 6.4 acres of new impervious surface (inclusive of roadway improvements, parking structures, gondola base station, bus stations, and roadways) at the Gondola Alternative B base station mobility hub. These improvements are within surface water protection Zone 1 of Little Cottonwood Creek. Stormwater BMPs would be added to treat the runoff from the impervious areas added around this mobility hub in compliance with UDOT's *Stormwater Quality Design Manual*. Because there is more space available away from the entrance to the canyon, UDOT assumed that more of the new impervious area could be treated by BMPs compared to Gondola Alternative A.

A USGS Model was prepared for Gondola Alternative B, as well as for Gondola Alternative A and the No-Action Alternative. Table 12.4-3 presents the model results for these alternatives and lists the applicable numeric water quality standards. The model results include the additional impervious area from the 2.4-acre trailhead parking improvements.

The USGS Model results for the gondola alternatives show *de minimis* differences for all of the COCs at both ends of the modeled COC concentrations range compared to the No-Action Alternative. In addition, the modeled in-stream COC concentrations are all well below numeric water quality standards. The one exception is phosphorus, which falls in the middle of the standard range. However, the difference between the modeled Little Cottonwood Creek phosphorus concentration between the gondola alternatives and the No-Action Alternative is 0.002 mg/L, at the high end of the range (20% of storms, 10 storms per year), which is small considering the accuracy of all of the model's input parameters.

Table 12.4-3. USGS Model Results for the No-Action and Gondola Alternatives

Constituent of Concern	Unit	Downstream Concentration Range Low End (80% of Storms) – High End (20% of Storms)			Numeric Standards		
		No-Action Alternative	Gondola Alternative A	Gondola Alternative B	Primary or Secondary MCL	Beneficial Use 1C	Beneficial Use 3A
Alkalinity	mg/L	41.3–58.8	41.3–58.8	41.1–58.7	—		
Cadmium[a]	µg/L	0.349–0.600	0.349–0.592	0.349–0.591	5	10	1.8
Calcium	mg/L	21.2–27.6	21.9–27.6	21.6–27.5	—	—	—
Chloride	mg/L	12.3–49.8	12.6–50.8	12.7–51.5	250	—	—
Chromium[a,b]	µg/L	1.40–2.93	1.46–2.93	1.48–2.96	100	50	16
Copper[a]	µg/L	3.75–8.31	3.77–8.51	3.79–8.55	1,000	—	13
Hardness	mg/L	64.7–101	67.4–102	67.3–101	—	—	—
Lead[a]	µg/L	0.547–2.70	0.546–2.76	0.559–2.81	15	15	65
Magnesium	mg/L	4.12–6.45	4.16–6.44	4.14–6.43	—	—	—
Nitrogen (nitrate and nitrite)	mg/L	0.187–0.342	0.185–0.337	0.186–0.338	10	10 (nitrates)	0.4–0.8
pH	—	7.32–8.04	7.33–8.05	7.31–8.04	6.5–8.5	6.5–9.0	6.5–9.0
Phosphorus	mg/L	0.010–0.044	0.010–0.045	0.010–0.046	—	—	0.035–0.08
Sulfate	mg/L	12.3–29.1	12.1–28.3	12.0–28.2	1,000	—	—
Total dissolved solids (TDS)	mg/L	104–193	102–193	102–194	500	—	—
Total suspended solids (TSS)	mg/L	2.43–11.8	2.48–11.7	2.53–12.4	—	—	—
Water temperature	°C	3.79–9.11	3.85–9.15	3.88–9.18	—	—	20° max and 2° change
Zinc[a]	µg/L	28.7–58.3	29.2–58.2	29.3–58.1	5,000		120

°C = degrees Celsius, µg/L = micrograms per liter, max = maximum, MCL = maximum contaminant level, mg/L = milligrams per liter

[a] The reported numeric criteria for metals (cadmium, chromium, copper, lead, and zinc) are the 1-hour average standard for Class 3A waters.

[b] The reported standard is for hexavalent chromium.

UDOT met with watershed stakeholders, including the water treatment plant operator (Metropolitan Water), in the fall of 2020 to review the USGS Model results. In the meeting, UDOT said that the gondola alternatives would not contribute COC concentrations at levels that would impair Little Cottonwood Creek's beneficial uses or impair Metropolitan Water's ability to deliver safe drinking water. The gondola base station area including the parking structure would include detention basins to capture stormwater before it is released into the storm drainage system.

Impacts to Groundwater Quality

With Gondola Alternative B, the gondola stations, towers, and cabins would not discharge pollutants to the groundwater, and no groundwater quality impacts are anticipated.

Impacts to Surface Water and Groundwater Water Rights

Gondola Alternative B would not affect any points of diversion in this segment of S.R. 210. Gondola stations and towers would not be located in Zone 1 of any groundwater source protection.

Compliance with Watershed Management Plans

The compliance with watershed management plans for Gondola Alternative B would be the same as for Gondola Alternative A. Also see Section 12.4.8, Forest Plan–related Management Objectives, for a more comprehensive evaluation of Gondola Alternative B and how its features and mitigation measures address specific *Forest Plan* management objectives.

12.4.6.3 Mobility Hubs Alternative

12.4.6.3.1 Gravel Pit

Since the gravel pit mobility hub with Gondola Alternative B would have fewer parking spaces (600 spaces) than it would with Gondola Alternative A (1,500 spaces), and because an intersection would not be required to access the gravel pit mobility hub, there would be slightly less impervious surface. With the addition of BMPs, which would be designed to mirror predevelopment conditions, the impacts to surface water quality and groundwater quality from the gravel pit mobility hub with Gondola Alternative B would be the same as with the Enhanced Bus Service Alternative.

Because Gondola Alternative B would not need a new intersection on Wasatch Boulevard, it would not affect the one groundwater point of diversion near the gravel pit.

12.4.6.3.2 9400 South and Highland Drive

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the 9400 South and Highland Drive mobility hub with Gondola Alternative B would be the same as with the Enhanced Bus Service Alternative.

12.4.6.4 Avalanche Mitigation Alternatives

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the avalanche mitigation alternatives with Gondola Alternative B would be the same as with the Enhanced Bus Service Alternative.

12.4.6.5 Trailhead Parking Alternatives

The impacts to surface water quality, groundwater quality, groundwater water rights, and pathogenic pollution risks from the trailhead parking alternatives with Gondola Alternative B would be the same as with the Enhanced Bus Service Alternative.

The increased impervious area with the trailhead parking improvements (2.4 acres) is included in the quantitative surface water quality modeling results for Gondola Alternative B, which is presented in Section 12.4.6.2, S.R. 210 – North Little Cottonwood Road to Alta.

12.4.6.6 No Winter Parking Alternative

The impacts to surface water quality, groundwater quality, and surface water and groundwater water rights from the No Winter Parking Alternative with Gondola Alternative B would be the same as with the Enhanced Bus Service Alternative.

12.4.7 Cog Rail Alternative (Starting at La Caille)

This section describes the impacts to water resources from the Cog Rail Alternative, which includes a cog rail alignment from La Caille to the Snowbird and Alta ski resorts, improvements to the Wasatch Boulevard segment of S.R. 210, improvements to the segment of S.R. 210 on North Little Cottonwood Road, two mobility hubs, avalanche mitigation alternatives, trailhead parking alternatives, and the No Winter Parking Alternative.

What are cog rail base and terminal stations?

As used in this chapter, the term *terminal station* refers to the first and last stations on a passenger's cog rail trip. Passengers board and disembark the cog rail vehicles at the terminal stations.

The *base station* is the terminal station at the bottom of the canyon, and a *destination station* is a terminal station at the top of the canyon.

12.4.7.1 S.R. 210 – Wasatch Boulevard

The impacts from the Wasatch Boulevard alternatives with the Cog Rail Alternative would be the same as with the Enhanced Bus Service Alternative.

12.4.7.2 S.R. 210 – North Little Cottonwood Road to Alta

Impacts to Surface Water Quality

With the Cog Rail Alternative, no roadway capacity improvements would be made to S.R. 210 in Little Cottonwood Canyon. Instead, a cog rail system would be used to transport some canyon users from the entrance to Little Cottonwood Canyon to the ski resorts. The Cog Rail Alternative would add a southbound lane from Wasatch Boulevard to the 1,500-space parking structure. The Cog Rail Alternative would also include an operations and maintenance facility at the location of the existing Little Cottonwood Canyon park-

and-ride lot (at the intersection of S.R. 209 and S.R. 210), which would require the existing parking lot to be reconfigured to serve as the trailhead for the Alpenbock Trail. BMPs (detention basins and vegetated filter strips) would be used to treat stormwater runoff from these facilities and the new paved, in-canyon trailhead parking areas that would be affected by the Cog Rail Alternative (the Gate Buttress and Lisa Falls Trailheads as well as the improved Grit Mill Trailhead) before the stormwater is discharged to Little Cottonwood Creek.

The cog rail track would be constructed primarily on imported ballast. In order to minimize the rail footprint near the existing trailhead parking areas, some segments of double and single track would be embedded in the roadway. Ballast is a porous material, but some runoff would occur during higher-intensity storm events, and stormwater would infiltrate the ballast and be blocked by rock or other impervious subgrade. This stormwater would travel laterally and into trackside ditches and an under drain (pipe) before being discharged to the creek (see Figure 2.6-38, Cog Rail Alternative – Cross-section, in Chapter 2, Alternatives).

UDOT conservatively assumes that 70% of rainfall would run off the ballasted track segments and that 100% of stormwater would run off the embedded track segments. UDOT also assumes, conservatively, that the cog rail corridor would generate runoff pollutants at the same concentrations as highway stormwater runoff. No BMPs were initially assumed for the water quality analysis for the track components (about 23 acres) of the Cog Rail Alternative. During the final design of the Selected Alternative, UDOT would evaluate the feasibility of BMPs, including inline water quality treatment features, pursuant to its *Stormwater Quality Design Manual*.

In total, about 43 acres of new imperious surfaces would be constructed within the Little Cottonwood Creek watershed with the Cog Rail Alternative. This includes the trailhead parking areas, sections of embedded track, and the cog rail destination stations. Table 12.4-4 presents the USGS Model results for the Cog Rail Alternative and the No-Action Alternative.

For the majority of the COCs, there would be *de minimis* differences between the No-Action Alternative and the Cog Rail Alternative. In addition, the minor differences show up only at the higher end of the modeled range (20% of storm events). The following paragraphs discuss the USGS Model results for the COCs listed on the State of Utah's 303(d) list of impaired waters (copper, cadmium, zinc, and pH). Also discussed below is phosphorus because there is a discernable difference between the No-Action Alternative and the Cog Rail Alternative and the model result is within the numeric standard range.

Cadmium. Cadmium is listed as a low priority for developing a TMDL analysis. The model results show no meaningful difference between the No-Action Alternative and the Cog Rail Alternative. The high end of the cadmium concentration range (20% of storms) was modeled at about 0.6 µg/L, which is below the most stringent numeric standard, Class 3A protection for cold-water aquatic species, of 1.8 µg/L (1-hour average concentration).

Copper. Copper is also listed as a low priority for developing a TMDL analysis. The model results show a slight difference (0.7 µg/L) between the No-Action Alternative and the Cog Rail Alternative. The high end of the copper range (20% of storms) was modeled at about 9.01 µg/L, which is below the most stringent numeric standard, Class 3A protection for cold-water aquatic species, of 13 µg/L (1-hour average concentration).

Table 12.4-4. USGS Model Results for the No-Action and Cog Rail Alternatives

Constituent of Concern	Unit	Downstream Concentration Range Low End (80% of Storms) – High End (20% of Storms)		Numeric Standards		
		No-Action Alternative	Cog Rail Alternative	Primary or Secondary MCL	Beneficial Use 1C	Beneficial Use 3A
Alkalinity	mg/L	41.3–58.8	40.4–57.7	—	—	—
Cadmium[a]	µg/L	0.349–0.600	0.346–0.592	5	10	1.8
Calcium	mg/L	21.2–27.6	21.0–27.3	—	—	—
Chloride	mg/L	12.3–49.8	12.9–54.5	250	—	—
Chromium[a,b]	µg/L	1.40–2.93	1.55–3.14	100	50	16
Copper[a]	µg/L	3.75–8.31	3.96- 9.01	1,000	—	13
Hardness	mg/L	64.7–101	66.0–100.3	—	—	—
Lead[a]	µg/L	0.547–2.70	0.65–3.41	15	15	65
Magnesium	mg/L	4.12–6.45	4.05–6.37	—	—	—
Nitrogen (nitrate and nitrite)	mg/L	0.187–0.342	0.188–0.346	10	10 (nitrates)	0.4–0.8
pH	—	7.32–8.04	7.24–7.99	6.5–8.5	6.5–9.0	6.5–9.0
Phosphorus	mg/L	0.010–0.044	0.012–0.062	—	—	0.035–0.08
Sulfate	mg/L	12.3–29.1	11.8–27.9	1,000	—	—
Total dissolved solids (TDS)	mg/L	104–193	102–198	500	—	—
Total suspended solids (TSS)	mg/L	2.43–11.8	2.88–18.36	—	—	—
Water temperature	°C	3.79–9.11	4.02–9.37	—	—	20° max and 2° change
Zinc[a]	µg/L	28.7–58.3	30.2–60.2	5,000	—	120

°C = degrees Celsius, µg/L = micrograms per liter, max = maximum, MCL = maximum contaminant level, mg/L = milligrams per liter

[a] The reported numeric criteria for metals (cadmium, chromium, copper, lead, and zinc) are the 1-hour average standard for Class 3A waters.

[b] The reported standard is for hexavalent chromium.

Zinc. Little Cottonwood Creek was impaired for zinc in 2000, and a TMDL analysis was developed in 2002. The source of zinc impairment was identified as drainage from mine tunnels. The existing roadway was not identified as a source of zinc to the creek (Utah Division of Water Quality 2002). The high end of the modeled zinc concentration range (60.2 µg/L) for the Cog Rail Alternative is below the numeric standard for Class 3A waters (120 µg/L).

pH. pH is listed as a low priority for developing a TMDL analysis. The model results show no meaningful differences in the in-stream values for pH over the range of expected storm events. The modeled pH range is within the numeric standard, which is also a range (6.5 to 8.5 for Class 1C waters).

Phosphorus. Little Cottonwood Creek is not impaired for phosphorus. However, the modeled high end of the concentration range (20% of storms) for phosphorus with the Cog Rail Alternative is 0.062 mg/L. This modeled concentration falls within the middle of the numeric standard for phosphorus in Class 3A headwaters streams (0.035 and 0.080 mg/L). The model results for the No-Action Alternative (0.044 mg/L) and the Cog Rail Alternative (0.062 mg/L at the high end, 20% of storms) also fall within the middle of the numeric standard range. The high end of the range for the Cog Rail Alternative is about 0.018 mg/L higher than for the No-Action Alternative. As described for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative, the short duration of storm events (8 hours) and the infrequent occurrence (about 20% or 10 storms per year, on average) should not result in water quality exceeding the numeric standard for phosphorus, which is a summertime average.

Impacts to Groundwater Quality

Groundwater discharges, through the use of detention basins, or other runoff infiltration–focused BMPs, are permitted by rule. Therefore, no groundwater impacts are expected from the Cog Rail Alternative.

Impacts to Surface Water and Groundwater Water Rights

There are two clusters of groundwater points of diversion near the proposed cog rail base station: water right numbers 57-10378, Metropolitan Water, and 57-9000, North Despain and North Despain Extension Canal. On the Utah Division of Water Rights' Interactive Map (Utah Division of Water Rights 2020), points of diversion are shown next to the expanded roadway for the Cog Rail Alternative. However, the water sources for these water rights are identified as both springs and Little Cottonwood Creek. No surface springs were observed in this area during UDOT's aquatic resource surveys (UDOT 2020). If a subsurface collection system exists, it would be protected or replaced during construction. Therefore, the Cog Rail Alternative would not affect these water rights points of diversion. The additional impervious area with the Cog Rail Alternative would not encroach into any Zone 1 drinking groundwater source protection areas.

Compliance with Watershed Management Plans

The watershed management plans identify fuel storage tanks and storage facilities for oil and gear lubricants as potential sources of contaminants if they are not properly managed. The Cog Rail Alternative would use diesel-electric motors to propel the cog rail vehicles. Therefore, diesel fuel storage tanks of about 20,000 gallons would be needed at the rail operations and maintenance facility. The fuel tanks would be dual-walled tanks or have a secondary containment built around the fuel tanks. UDOT would also investigate a leak-detection system and an alarm with the fuel tanks.

The Cog Rail Alternative would not increase roadway capacity for personal vehicles in the canyon and would reduce personal vehicle use by about 30% from the end of November to mid-April. Therefore, there would likely be fewer vehicle accidents and less risk of spills or vehicles entering Little Cottonwood Creek during the winter compared to the No-Action Alternative. See Section 12.4.8, Forest Plan–related Management Objectives, for a more comprehensive evaluation of how the Cog Rail Alternative's features and mitigation measures address specific *Forest Plan* management objectives.

The Cog Rail Alternative would also operate during the summer. Some users might want to access the resorts using the cog rail instead of personal vehicles, which would reduce the risk of accidents and the risk of vehicles entering Little Cottonwood Creek compared to the No-Action Alternative.

12.4.7.3 Mobility Hubs Alternative

The impacts from the mobility hubs with the Cog Rail Alternative would be the same as with Gondola Alternative B.

12.4.7.4 Avalanche Mitigation Alternatives

Impacts to Surface Water Quality

In the mid-canyon segment of the canyon, the snow sheds would be in the same locations as with the enhanced bus service and gondola alternatives. For the Cog Rail Alternative, wider snow sheds would be required to cover both the road (about 48 feet) and the cog rail tracks (about 29 feet). These wider snow sheds are not anticipated to have any different impacts to water quality compared to the narrower, road-only snow sheds. The impacts of the snow sheds on water quality are described in Section 12.4.3.4, Avalanche Mitigation Alternatives, for the Enhanced Bus Service Alternative.

Two additional snow sheds would be required in the upper-canyon segment for the Cog Rail Alternative. About 3,645 feet of snow sheds would be needed to protect the cog rail tracks through the East Hellgate, Superior, Little Superior, and Hilton avalanche paths. The upper-canyon snow sheds would not contribute stormwater pollutants to Little Cottonwood Creek, and water quality would be the same as with the No-Action Alternative.

Contingent on a more-detailed engineering evaluation, the snow sheds would be equipped with fire-suppression systems (fire extinguishers, sprinklers, and standpipes) to control fires in the snow sheds, facilitate emergency egress, and protect the structures. The fire-suppression system would be water-based, not glycol-based, but it would be a “dry” system. In a dry system, the pipes and sprinklers are dry (without water) most of the time. UDOT anticipates connecting the snow sheds’ fire-suppression system to an existing water line near Snowbird Entry 1. A valve on the existing water line would be turned on during a fire, and a pipe (normally dry) would convey water to the snow sheds’ overhead sprinkler system and standpipes. According to a representative with Salt Lake County Service Area #3 (Canyon Water), the existing water system has enough storage capacity to supply fire-suppression flows to the snow sheds (Hanson 2018).

Water discharges from fire-suppression systems are exempt from permitting (UAC R317-8). However, the snow sheds would also include an internal drainage system to contain spills and fire-suppression flows. UDOT would test the drainage water for contaminants. If the water is not contaminated, it would be discharged to Little Cottonwood Creek. If the water is contaminated, it would be pumped out of the containment and discharged to the sanitary sewer system or hauled away for proper disposal. The specific concentrations of pollutants that could be discharged to the creek or the sewer have not been be defined.

Impacts to Groundwater Quality

No groundwater quality impacts are expected from the avalanche mitigation alternatives.

Impacts to Surface Water and Groundwater Water Rights

The snow sheds included with the Cog Rail Alternative would not impact wells or surface water diversions. The snow sheds with the Cog Rail Alternative would not encroach into any Zone 1 drinking groundwater source protection areas.

Compliance with Watershed Management Plans

The snow sheds with the Cog Rail Alternative would be in compliance with watershed management plans.

12.4.7.5 Trailhead Parking Alternatives

12.4.7.5.1 Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative

Impacts to Surface Water Quality

Because the Cog Rail Alternative would impact the Grit Mill, Gate Buttress, and Lisa Falls Trailheads, these trailheads would need to be replaced. The water quality impacts are discussed in Section 12.4.7.2, S.R. 210 – North Little Cottonwood Road to Alta. Parking improvements at the Bridge and White Pine Trailheads with the Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative would be improved, and stormwater BMPs would be implemented in compliance with UDOT's *Stormwater Quality Design Manual*. If the Grit Mill Trailhead is impacted, it would be reconfigured to replace its BMPs and restrooms. This trailhead parking alternative would add about 1.5 acres of new pavement area in Little Cottonwood Canyon. Given the small amount of impervious area that would be added, the modeled in-stream water quality of Little Cottonwood Creek with this trailhead parking alternative would be the same as with the No-Action Alternative. With the exception of phosphorus concentrations, which would be the same as with the No-Action Alternative, no numeric water quality standards associated with Little Cottonwood Creek's beneficial uses would be exceeded.

UDOT did not account for the stormwater runoff from the current trailheads (many of which are unpaved), disturbed soils near the existing roadway shoulders, or naturally occurring erosion-prone areas in the watershed. With this model methodology, the No-Action or baseline model represents a best-case scenario against which to compare the pollutant contributions of the action alternatives. With paved trailheads, BMPs, and restricted roadside parking, there would be some water quality benefits with this trailhead parking alternative compared to the No-Action Alternative.

Impacts to Groundwater Quality

This trailhead parking alternative would not discharge a substantial amount of stormwater to the ground and would not affect groundwater quality. Stormwater management BMPs that infiltrate stormwater runoff are permitted by rule because they do not add pollutants at level that presents a more–than–*de minimis* risk for groundwater contamination.

Impacts to Surface Water and Groundwater Water Rights

There are no groundwater points of diversion or groundwater protection zones near the trailhead parking areas.

Compliance with Watershed Management Plans

With this trailhead parking alternative, trailhead parking would be improved at the White Pine Trailhead. In compliance with the watershed management plans and the *Forest Plan*, restroom facilities would be added at these locations. Therefore, there would be less potential for dispersed recreation to contribute pathogenic pollutants to Little Cottonwood Creek compared to the No-Action Alternative.

12.4.7.5.2 Trailhead Improvements and No Roadside Parking from S.R. 209/S.R. 210 Intersection to Snowbird Entry 1 Alternative

The impacts to water resources from this trailhead parking alternative would be the same as from the Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative except for the elimination of roadside parking. With this alternative, roadside parking would be eliminated, which would reduce the potential for roadside parked vehicles pollutants and increased sediment from roadside damaged cause by vehicles from entering Little Cottonwood Creek.

12.4.7.5.3 No Trailhead Improvements and No Roadside Parking from S.R. 209/S.R. 210 Intersection to Snowbird Entry 1 Alternative

No trailhead improvements would be made with this trailhead parking alternative; therefore, the impacts to water resources at the existing trailheads and lack of restrooms would be the same as with the No-Action Alternative. However, with this alternative, roadside parking would be eliminated, which would reduce the potential for pollutants from roadside parked vehicles and sediment from roadside damaged cause by vehicles from entering Little Cottonwood Creek compared to the Trailhead Improvements and No S.R. 210 Roadside Parking within ¼ Mile of Trailheads Alternative.

12.4.7.6 No Winter Parking Alternative

The impacts from the No Winter Parking Alternative with the Cog Rail Alternative would be the same as with the Enhanced Bus Service Alternative. Because the No Winter Parking Alternative would not change the amount of highway runoff pollutants, it would not affect water quality.

12.4.8 Forest Plan–related Management Objectives

This section presents the *Forest Plan*'s watershed-related objectives, prescriptions, standards, and guidelines. Collectively, these are referred to as *management objectives* in this section. A description of applicable management objectives is provided below. A general description of how each alternative addresses these management objectives is provided in Table 12.4-5, How the Project Alternatives Address Forest Plan Management Objectives, on page 12-45.

Forestwide Standards and Guidelines. UDOT evaluated the following Forestwide water quality/watershed related standards and guidelines applicable to the Little Cottonwood Creek watershed health:

- **Standard S2.** Apply runoff controls during project implementation to prevent pollutants including fuels, sediment, and oil from reaching surface water and groundwater.
- **Standard S4.** Place new sources of chemical or pathogenic pollution where such pollutants will not reach surface water or groundwater.
- **Standard S6.** Within legal authorities, ensure that new proposed management activities in watersheds containing 303(d)-listed water bodies improve or maintain overall progress toward beneficial use attainment for pollutants which led to listing; and do not allow additions of pollutants in quantities that result in unacceptable adverse effects.
- **Guideline G2.** Projects in watersheds with 303(d)-listed water bodies should be supported by scale and level of analysis sufficient to permit understanding of the implications of the project within the larger watershed context.
- **Guideline G3.** Proposed actions analyzed under the National Environmental Policy Act should adhere to the *State Nonpoint Source Management Plan* to best achieve consistency with both Sections 313 and 319 of the Federal Water Pollution Control Act.
- **Guideline G11.** Use BMPs and soil and water conservation practices during project-level assessment and implementation to ensure maintenance of soil productivity and minimization of sediment discharge into streams, lakes, and wetlands to protect designated beneficial uses.
- **Guideline G12.** Locate new actions (such as incident bases, fire-suppression camps, staging areas, livestock-handling facilities, recreation facilities, roads, and improvements including trails) outside RHCAs. If the only suitable location for such actions is within RHCAs, sites will be located to minimize resource impacts.

Management Prescriptions, Section 3.0 – Multiple Resource Uses Where Aquatic/Watershed and Terrestrial Habitat Integrity Are Emphasized (3.1W). This management objective puts emphasis on maintaining or improving the quality of watershed conditions by limiting the type of construction that can occur within each *Forest Plan* land prescription. See Chapter 3, Land Use, for information regarding how the project alternatives address this *Forest Plan* management objective.

Forestwide Goals and Subgoals, Forestwide Goal 2 – Watershed Health. UDOT's analysis considered the Forestwide subgoals 2b, maintain and/or improve water quality to provide a stable and productive riparian and aquatic ecosystem, and 2d, protect waters meeting or surpassing state water quality standards by planning and designing land-management activities to protect water quality.

Central Wasatch Management Areas Direction, Watershed Desired Future Conditions. The underlying premise of this management objective for the Central Wasatch Management Area is the need to provide long-term, high-quality culinary water to the large urban population of the Salt Lake Valley. Salt Lake City owns the largest percentage of water rights in Little Cottonwood Canyon and has authority delegated by Congress to protect the water supply. Given the importance of water coming from this area, watershed maintenance, protection, and enhancement will be a primary consideration in all management decisions. Watersheds and streams need to continue to provide high-quality water supplies to the Salt Lake Valley.

As mentioned in the previous paragraph, the underlying premise of the overarching Central Wasatch Management Area objective is the need to protect the watershed to provide long-term, high-quality culinary water to the large urban population of the Salt Lake Valley. UDOT has worked extensively with SLCDPU and with the USDA Forest Service when preparing the analysis to support this EIS. UDOT does not believe that any of the project alternatives would introduce substantial risks to water quality or culinary water supplies. UDOT has added mitigation measures to further reduce risks. The project alternatives also address the USDA Forest Service's water quality and watershed-related management objectives in the *Forest Plan*.

Table 12.4-5. How the Project Alternatives Address Forest Plan Management Objectives

Forest Plan Management Objective[a]	Enhanced Bus Service Alternative	Enhanced Bus Service in Peak-period Shoulder Lane Alternative	Gondola Alternative A	Gondola Alternative B	Cog Rail Alternative
Standard S2 – Use of Runoff Controls	A construction stormwater pollution prevention plan (SWPPP) with runoff controls and restoration procedures will be prepared and a general UPDES permit secured prior to construction. Trailhead improvements include space to implement postconstruction BMPs to treat runoff from new impervious surfaces.	The need for a construction SWPPP and construction permit is the same as with the Enhanced Bus Service Alternative. Runoff controls for the improved trailhead parking are the same as with the Enhanced Bus Service Alternative. UDOT defined areas adjacent to the expanded roadway where post-construction, or permanent, BMPs are feasible, in accordance with its *Stormwater Quality Design Manual* and MS4 permit.	The need for a construction SWPPP and construction permit is the same as with the Enhanced Bus Service Alternative. Runoff controls for the improved trailhead parking are the same as with the Enhanced Bus Service Alternative. UDOT will add post-construction BMPs for new impervious areas in the watershed where feasible pursuant to its *Stormwater Quality Design Manual*.	The need for a construction SWPPP and construction permit is the same as with the Enhanced Bus Service Alternative. Runoff controls for the improved trailhead parking are the same as with the Enhanced Bus Service Alternative. UDOT will add post-construction BMPs for new impervious areas in the watershed where feasible pursuant to its *Stormwater Quality Design Manual*.	The need for a construction SWPPP and construction permit is the same as with the Enhanced Bus Service Alternative. Runoff controls for the improved trailhead parking are the same as with the Enhanced Bus Service Alternative. Although initially UDOT did not consider BMPs in the canyon for the purpose of water quality modeling, UDOT did consider BMPs at the base station; UDOT will evaluate postconstruction BMPs for the Cog Rail Alternative where feasible pursuant to its *Stormwater Quality Design Manual*.
Standard S4 – Placement of Pollutant Sources	Restroom facilities at trailheads would be located more than 100 feet from a water course in compliance with Salt Lake City Watershed Ordinance 17.	Trailhead restrooms would be located more than 100 feet from a water course.	Trailhead restrooms would be located more than 100 feet from a water course. Emergency power generators would be equipped with dual-walled fuel tanks and a leak-detection system.	Restroom facilities would be located more than 100 feet from a water course. Emergency power generators would be equipped with dual-walled fuel tanks and a leak-detection system.	Restroom facilities would be located more than 100 feet from a water course. Diesel fuel would be stored at the cog rail operations and maintenance facility in dual-walled tanks that would include leak detection.

(*continued on next page*)

Table 12.4-5. How the Project Alternatives Address Forest Plan Management Objectives

Forest Plan Management Objective[a]	Enhanced Bus Service Alternative	Enhanced Bus Service in Peak-period Shoulder Lane Alternative	Gondola Alternative A	Gondola Alternative B	Cog Rail Alternative
Standard S6 – Impaired Waters and Beneficial Uses	The existing S.R. 210 roadway, which would be maintained with this alternative, is not identified as a source of impairment in the zinc TMDL for Little Cottonwood Creek. Other constituents on the State's 303(d) list have not been studied in detail. The USGS Model output presents the range of expected water quality concentrations for runoff from the Enhanced Bus Service Alternative and shows that most constituents would be within numeric standards for the creek's designated beneficial uses.	The USGS Model output presents the range of expected water quality concentrations for runoff from the Enhanced Bus Service with Peak-period Shoulder Lane Alternative and shows that the in-stream concentration of most constituents would be within numeric standards for the creek's designated beneficial uses, and existing impairments would not be affected.	The USGS Model output presents the range of expected water quality concentrations for runoff from Gondola Alternative A and shows that most constituents would be within numeric standards for the creek's designated beneficial uses, and existing impairments would not be affected.	The USGS Model output presents the range of expected water quality concentrations for runoff from Gondola Alternative B and shows that most constituents would be within numeric standards for the creek's designated beneficial uses, and existing impairments would not be affected.	The USGS Model output presents the range of expected water quality concentrations for runoff from the Cog Rail alternative and shows that most constituents would be within numeric standards for the creek's designated beneficial uses, and existing impairments would not be affected.
Guideline G3 – Adhere to Nonpoint Source Management	UDOT will follow its *Stormwater Quality Design Manual*, which addresses nonpoint source controls (BMPs) for runoff from new impervious areas pursuant to its MS4 permit.	Same as Enhanced Bus Service Alternative.	Same as Enhanced Bus Service Alternative.	Same as Enhanced Bus Service Alternative.	Same as Enhanced Bus Service Alternative.

(*continued on next page*)

Table 12.4-5. How the Project Alternatives Address Forest Plan Management Objectives

Forest Plan Management Objective[a]	Enhanced Bus Service Alternative	Enhanced Bus Service in Peak-period Shoulder Lane Alternative	Gondola Alternative A	Gondola Alternative B	Cog Rail Alternative
Guideline G11 – Use BMPs and Soil and Water Conservation Practices	UDOT is committing to use BMPs during construction, restore and stabilize disturbed and backfill areas, and implement post-construction stormwater controls.	Same as Enhanced Bus Service Alternative.	Same as Enhanced Bus Service Alternative.	Same as Enhanced Bus Service Alternative.	Same as Enhanced Bus Service Alternative.
Guideline G12 – Avoid RHCAs Unless Siting is the Only Suitable Location[b]	Trailheads would be improved near their existing locations. Minor encroach-ments (about 0.8 acre total) into the RHCA are also associated with snow sheds, which are proposed to cover the road in its current location across critical avalanche paths.	The Enhanced Bus Service in Peak-period Shoulder Lane Alternative includes about 2.3 acres in the RHCA, which includes trailhead parking and snow sheds. Roadway widening would occur mainly on the north side of the existing roadway where riparian habitat is limited.	Impacts to the RHCA for trailheads and snow sheds would be the same as with the Enhanced Bus Service Alternative. Gondola towers and stations would not impact riparian areas within the RHCA.	Impacts of trailhead parking and snow sheds would be the same as with the Enhanced Bus Service Alternative. Gondola towers and stations would not impact riparian areas in the RHCA.	Construction of the Cog Rail Alternative includes about 1.3 acres of encroachment within the RHCA, which includes areas for trailhead parking and snow sheds. The cog rail alignment would be on the north side of the road where riparian habitat is limited.

(*continued on next page*)

Table 12.4-5. How the Project Alternatives Address Forest Plan Management Objectives

Forest Plan Management Objective[a]	Enhanced Bus Service Alternative	Enhanced Bus Service in Peak-period Shoulder Lane Alternative	Gondola Alternative A	Gondola Alternative B	Cog Rail Alternative
Forestwide Goals and Subgoals, Forestwide Goal 2 – Watershed Health	Activities in the Wasatch-Cache National Forest with this alternative would be limited to roadside parking restrictions and trailhead improvements, including the addition of restroom facilities where currently none exist at most trailheads (with the exception of White Pine). Both activities would improve watershed conditions compared to the No-Action Alternative. According to the USGS Model, the small increase in impervious area (2.4 acres) in the watershed would have a negligible effect on the resulting in-stream water quality after stormwater runoff is mixed with the stream flow compared to the No-Action Alternative.	The watershed health benefits of the improved trailheads and restriction on roadside parking with this alternative would be the same as with the Enhanced Bus Service Alternative. According to the USGS Model, the increase in impervious area (22 acres total) in the watershed would have a negligible effect on the resulting in-stream water quality compared to the No-Action Alternative. The proposed BMPs would be effective in addressing most highway stormwater runoff pollutants, the model results show that pollutant concentrations would be below applicable water quality standards, and the creek's beneficial uses would be maintained.	The watershed health benefits of the improved trailheads and restriction on roadside parking with this alternative would be the same as with the Enhanced Bus Service Alternative. According to the USGS Model, the small increase in impervious area (4 acres total) in the watershed would have a negligible effect on the resulting in-stream water quality compared to the No-Action Alternative. The proposed BMPs around the gondola base station would be effective in addressing stormwater runoff pollutants, the model results show that concentrations would be below applicable water quality standards, and the creek's beneficial uses would be maintained.	The watershed health benefits of the improved trailheads and restriction on roadside parking with this alternative would be the same as with the Enhanced Bus Service Alternative. According to the USGS Model, the increase in impervious area (8.8 acres total) in the watershed would have a negligible effect on the resulting in-stream water quality compared to the No-Action Alternative. The proposed BMPs around the gondola base station would be effective in addressing stormwater runoff pollutants, the model results show concentrations would be below applicable water quality standards, and the creek's beneficial uses would be maintained.	The watershed health benefits of the improved trailheads and restriction on roadside parking with this alternative would be the same as with the Enhanced Bus Service Alternative. According to the USGS Model, the increase in impervious area (43 acres total) in the watershed would have a negligible effect on the resulting in-stream water quality compared to the No-Action Alternative. The proposed BMPs at the cog rail base station would be effective in addressing stormwater runoff pollutants, the model results show that pollutant concentrations would be below applicable water quality standards, and the creek's beneficial uses would be maintained.

[a] Forest Plan Management Objectives include Forestwide Desired Future Conditions; Forestwide Goals Subgoals, and Objectives; Forest Wide Standards and Guidelines; Management Prescriptions; and Management Area (Central Wasatch) Directions – Desired Future Conditions.

[b] See Chapter 13, Ecosystem Resources, for more information about the effects of the project alternatives on the riparian areas within the RHCA.

12.4.9 Mitigation Measures

The following mitigation measures will help ensure that water quality is maintained.

- UDOT or its design consultants will follow UDOT's *Stormwater Quality Design Manual*.
- UDOT or its construction contractors will prepare an SWPPP and obtain a UPDES permit for construction and will monitor restoration efforts for revegetation success.
- UDOT will visually inspect and maintain water quality BMPs to check that they are functioning properly.
    - During construction, inspectors for the project will certify that the BMPs were installed according to contract documents and UDOT standards.
    - After construction, UDOT will document and maintain records of inspections, any deficiencies identified during inspections, and the repairs performed on the BMPs.
- UDOT will work with SLCDPU, Metropolitan Water, and the sewer district to determine the procedures for discharging the fire-suppression water from the snow sheds.
- If a gondola or cog rail alternative is selected, UDOT will ensure that the emergency generators and fuel storage tanks are inspected for damage and evidence of leaks, and if feasible that they include leak-detection systems. The tanks will be dual-walled with secondary containment systems.

SLCDPU and Metropolitan Water (Sandy City) stated that one of their primary water quality concerns is vehicle accidents in which a vehicle leaves the roadway and enters Little Cottonwood Creek, with the result that vehicle fluids directly contaminate the creek and potentially contaminate the water treatment processes. To address this concern, UDOT evaluated 10 years of accident data to determine the primary location(s) of roadway departure accidents within 200 feet of the creek (HDR 2020).

Based on that analysis and to improve both roadway safety and water quality, UDOT will include concrete barriers with all of the action alternatives if the required shoulder and 2-foot safety distance between the travel lane and barrier can be maintained and if the barriers do not substantially impede UDOT's ability to remove snow from the roadway. Subject to UDOT's final evaluation, the barriers will be located between mileposts 4.9 and 5.7, 6.7 and 7.0, and 8.7 and 9.0. UDOT will work with the USDA Forest Service before installing any barriers to address the Forest Service's concerns about visual impacts.

12.5 References

[EPA] U.S. Environmental Protection Agency

No date Sole Source Aquifers for Drinking Water. https://www.epa.gov/dwssa. Accessed January 19, 2019.

Hanson, Keith

2018 Personal conversation between Keith Hanson, Salt Lake County Service Area #3, and Terry Warner of HDR regarding fire-suppression flows to snow sheds. August 29.

HDR, Inc.

2020 Memorandum on Recommendations for Placing Additional Barrier along S.R. 210. December 21.

[Metropolitan Water] Metropolitan Water District of Salt Lake and Sandy

2013 Drinking Water Source Protection Plan for Little Cottonwood Creek. December.

Salt Lake County

2015 2015 Salt Lake County Integrated Watershed Plan. Update to the 2009 Salt Lake Countywide Water Quality Stewardship Plan. https://www.slco.org/globalassets/1-site-files/watershed/2015_slco_integratedwatershedplan_revsep2017.pdf. Revised September 2017.

Sandy City

2002 Sandy City Watershed Management Plan 2002. Planning Commission Draft. April 2.

[SLCDPU] Salt Lake City Department of Public Utilities

1999 Salt Lake City Watershed Management Plan, Final Draft. March.

2013 Update to the Salt Lake City Watershed Management Plan. December.

[UDOT] Utah Department of Transportation

2020 Aquatic Resources Delineation Report for the S.R. 210 Project. February.

[UGS] Utah Geological Survey

2009 Ground-Water Quality Classification for the Principal Basin-fill Aquifer, Salt Lake Valley, Salt Lake County, Utah. Open File Report 560.

[USDA Forest Service] U.S. Department of Agriculture, Intermountain Region

2003 Revised Forest Plan: Wasatch-Cache National Forest. South Jordan, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Region, Uinta-Wasatch-Cache National Forest. https://www.fs.usda.gov/detailfull/uwcnf/landmanagement/planning/?cid=stelprdb5076923&width=full.

Utah Division of Water Quality

2002 Total Maximum Daily Load for Dissolved Zinc in Little Cottonwood Creek. March.

2016 Utah's Final 2016 Integrated Report. December 7.

2019 Proposed Nutrient Criteria: Utah Headwater Streams. June.

Utah Division of Water Rights

2020 Interactive Map. https://maps.waterrights.utah.gov. Accessed October 14, 2020.