Chapter 13: Water Quality

13.1 Introduction

This chapter describes the existing conditions of surface water and groundwater in the water quality impact analysis area and the expected effects of the West Davis Corridor (WDC) Project alternatives on surface waters and groundwater.

This chapter focuses on the expected water quality impacts once the WDC is in use. Water quality impacts during construction are addressed in Chapter 20, Construction Impacts.

> **What is the water quality impact analysis area?**
>
> The water quality impact analysis area is the area shown in Figure 13-1, Water Bodies and Watersheds, in Volume IV.

The existing conditions of wetlands and the expected effects of the WDC on wetlands are discussed in Chapter 14, Ecosystem Resources. Floodplain impacts are discussed in Chapter 15, Floodplains.

Water Quality Impact Analysis Area. Figure 13-1, Water Bodies and Watersheds, in Volume IV shows the water quality impact analysis area as well as the contributing watersheds and major water bodies in the impact analysis area. The water bodies of importance are the Great Salt Lake and several small streams. Many surface waters originate upstream of the impact analysis area and travel through this area to the Great Salt Lake. This chapter analyzes the existing conditions and impacts to surface waters in the impact analysis area.

What is a stream?

In this chapter, the term *stream* is used as a general term to describe linear waterways such as rivers and creeks.

There are no Category 1 or Category 2 waters (Utah Administrative Code [UAC] R317-2-12) in the impact analysis area. Category 1 and Category 2 waters are specific water bodies identified by the State. In addition, there are no sole-source aquifer designations in the impact analysis area (EPA, no date). Therefore no sole-source aquifers would receive direct discharges from any of the project alternatives, and these waters are not evaluated further in this chapter.

13.2 Regulatory Setting

Water quality in Utah is regulated by the Utah Divisions of Water Quality and Drinking Water within the Utah Department of Environmental Quality (UDEQ). These divisions act pursuant to delegated authority to enforce the federal Clean Water Act and the Safe Drinking Water Act and also act pursuant to Utah water quality laws and regulations. The water quality laws and regulations that apply to the WDC Project are discussed in Section 13.2.5, Water Quality Regulations, and summarized in Table 13-2, Water Quality Regulations, on page 13-8. As part of the water quality evaluation process, the WDC team coordinated with UDEQ regarding the methods used and the results of the analysis

13.2.1 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 life. These uses are called *beneficial uses*. Fifteen of these beneficial uses for rivers, streams, lakes, and reservoirs in the impact analysis area are listed in Table 13-1 on page 13-4.

13.2.1.1 Antidegradation Policy

Utah's antidegradation policy states that surface waters whose existing quality is better than the established standards for the waters' designated uses should be maintained at high quality (UAC R317-2-3). 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, existing in-stream uses must be maintained and protected.

What is a discharge?

A discharge is a release of waste-water, stormwater, or pollutants into a water body.

To facilitate this policy, all waters in the state are designated as Category 1, 2, or 3 waters. There are no Category 1 or 2 waters in the impact analysis area; all surface waters in the area are Category 3. New discharges to Category 3 waters are allowed pursuant to antidegradation reviews (see the following section).

Antidegradation Reviews

Antidegradation reviews (ADRs) are required for any activity that requires a federal permit and/or water quality certification. Utah's ADR policy does not prohibit degradation of water quality but requires that, if degradation does occur, it is necessary for social and economic development. For the water bodies in the impact analysis area, degradation is allowed pursuant to these reviews.

Once the Section 404 Clean Water Act permit is applied for, and in concert with the water quality certification, ADRs are conducted at potentially two levels.

- Level I ADRs ensure that proposed actions will not impair existing beneficial uses. If degradation does occur, a Level II ADR is conducted.
- Level II ADRs are prepared, reviewed, and announced in a public notice for activities that result in water quality degradation and for which the proposed degradation is minimized. The Level II review evaluates whether there are any reasonable less-degrading alternatives or alternative treatment options and evaluates the economic and societal costs and benefits of the proposed project.

13.2.1.2 Beneficial-Use Designations

UDEQ designates all surface water bodies in the state according to how the water is used, and each designation has associated standards. The beneficial uses of the various classes of water bodies in Utah are described in Table 13-1 below.

Table 13-1. Designated Beneficial Uses for Surface Waters in the Water Quality Impact Analysis Area

Class	Description
1	Protected for use as a raw water source for domestic water systems.
1C	Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.
2	Protected for recreational use and aesthetics.
2A	Protected for frequent primary contact recreation such as swimming.
2B	Protected for infrequent primary contact and secondary contact recreation such as boating, wading, or similar uses.
3	Protected for use by aquatic wildlife.
3A	Protected for cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain.
3B	Protected for warm-water species of game fish and other warm-water aquatic life, including the necessary aquatic organisms in their food chain.
3C	Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.
3D	Protected for waterfowl, shore birds, and other water-oriented wildlife not included in classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
3E	Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.
4	Protected for agricultural uses including irrigation of crops and stock watering.
5A	Gilbert Bay of the Great Salt Lake. Protected for frequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain.
5D	Farmington Bay of the Great Salt Lake. Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain.
5E	Transitional waters along the shoreline of the Great Salt Lake. Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain.

Source: UAC R317-2-13, January 1, 2017

Numeric standards for water quality are intended to protect the designated beneficial uses of the water, such as providing drinking water, supporting game fish, or supporting swimming. Numeric standards refer to numeric criteria that are applied to each class of water to protect its beneficial uses. Narrative standards are general 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. Utah's narrative standard states:

What are narrative standards?

Narrative standards are general 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.

> It shall be unlawful and a violation of these rules fro any person to discharge or place any waste or other substance in as such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms, or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures; or determined by biological assessments in Subsection R317-2-7.3. (Utah Division of Water Quality 2017)

A water body that meets the water quality standards for its beneficial uses and meets the narrative standards is classified as "supporting" its beneficial uses. A water body that supports some but not all of its beneficial uses is classified as "partially supporting" its beneficial uses.

13.2.1.3 Impaired Beneficial Uses

When a lake, river, or stream fails to meet the water quality standards for its beneficial uses, the State evaluates factors related to water quality standards, designated uses, and numeric criteria and uses the U.S. Environmental Protection Agency's (EPA) five-category, and subcategory, system for classifying these water bodies. These categories are different than the Category 1 and Category 2 water bodies defined under UAC R317-2-12.

What is a Section 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 Section 303(d) list.

Under the five categories, Category 1 water bodies support beneficial uses, while Category 5 water bodies have available data or information that indicate that at least one designated use is not being supported, and the State, in accordance with Section 303(d) of the Clean Water Act, places the water body on a list of "impaired" waters [also known as a Section 303(d) list] and prepares an analysis called a Total Maximum Daily Load (TMDL). This analysis documents the nature and source of the water quality impairment and establishes the maximum amount of a pollutant that the water body can contain while maintaining its beneficial uses.

13.2.2 Surface Water Discharges

The State of Utah administers the Utah Pollutant Discharge Elimination System (UPDES) rules under the Utah Water Quality Act (UAC R317-8). Under this program, industries and municipalities that could discharge wastewater, stormwater, or other pollutants into water bodies must obtain a UPDES permit; this minimizes 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 UDOT to discharge stormwater runoff from transportation facilities to waters of the state. UDOT must address post-construction stormwater runoff from new and redeveloped roadways in accordance with permit conditions.

For the new WDC roadway discharges, UDOT must apply stormwater best management practices to minimize impacts to water quality to the maximum extent practicable. The MS4 permit requires stormwater management selection, design and installation, operation, and maintenance standards necessary to protect water quality and reduce the discharge of pollutants. As necessary to comply with the terms and conditions of the permit, UDOT must establish communication, coordination, cooperation, and collaboration activities with local government entities. UDOT will comply with the conditions of the permit for the WDC Project.

13.2.3 Groundwater Discharges

The Utah Water Quality Board classifies aquifers according to their quality and use (such as ecologically important, irreplaceable, drinking water quality, and saline). The Utah Division of Water Quality publishes numeric standards for each class of aquifer (UAC R317-6). 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 potential detention basins that would be used with the WDC, are considered “permitted by rule.” Under permit by rule, UDOT is not required to obtain a groundwater discharge permit for these detention basins. Operation of the detention basins is not expected to cause groundwater standards or the aquifer’s total dissolved solids (TDS) standard to be exceeded (UAC R317-6-6.2).

What is a detention basin?

A detention basin is a pond that holds stormwater runoff temporarily before releasing it.

13.2.4 Drinking Water Source Protection Plans and 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 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 well owner. Methods of ensuring that water quality is protected include but are not limited to public education, zoning ordinances, existing state regulations, and land-use restrictions within each source protection zone.

Municipalities, through zoning and land use, control whether roads 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 municipality to be a negative impact to the well, methods to reduce and/or eliminate the negative impact may be proposed.

13.2.5 Water Quality Regulations

Table 13-2 shows the water quality regulations that apply to the WDC Project and the analysis of the WDC's effects on water quality.

Table 13-2. Water Quality Regulations

Regulation	Regulatory Agency and Requirement	Applicability
Clean Water Act Section 401 State Water Quality Certification	The Clean Water Act requires UDEQ to certify that the WDC would not cause Utah water quality standards to be exceeded.	**Water Quality Certification** UDEQ provides this certification to the U.S. Army Corps of Engineers.
Clean Water Act Section 402 (UAC R317-8) NPDES Permit (UPDES in Utah) (Limits discharges)	EPA 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 UPDES permit to minimize impacts to water quality associated with construction activities.	**UPDES Permits** Required for roadway construction such as the WDC.
	Operators of municipal separate storm sewer systems (MS4), such as UDOT, must obtain a UPDES permit to minimize impacts associated with discharges.	Compliance with UDOT MS4 permit is required for new 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 standard)	Numeric standards for water quality are based on the water's beneficial uses, such as providing drinking water, supporting game fish, or supporting swimming. Projects cannot cause water quality standards to be exceeded.	**Numeric Standards** Discharges cannot cause the numeric standard to be exceeded.
UAC R317-2-3, Antidegradation Policy	UDEQ assigns protection categories that allow water quality actions. 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 404 permit and has the potential to degrade water quality.	**Antidegradation Review** Will be required to support the 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 or river), existing sources of contamination, and the types of new construction projects that are restricted within each zone.	**Source Protection** Farmington Creek is protected as a drinking water source upstream of the WDC action alternatives.
UAC R317-6, Ground Water Quality Protection	UDEQ classifies aquifers and permits discharges to groundwater to protect and maintain groundwater quality.	**Aquifers Classification** The groundwater aquifer is protected for Class IA – Pristine and Class II – Drinking Water in the impact analysis area. Stormwater detention facilities are permitted by rule by the Utah Division of Water Quality.

13.3 Affected Environment

13.3.1 Methodology

The WDC team used information from Utah state water plans, Utah's Clean Water Act Section 303(d) list, and other data collected from UDEQ, the Utah Department of Natural Resources, and the Utah Divisions of Drinking Water, Water Rights, Water Resources, and Water Quality to describe the affected environment in the impact analysis area.

The water quality impact analysis area includes surface waters in two watersheds: the Weber River watershed and the Great Salt Lake, as shown in Figure 13-1, Water Bodies and Watersheds, in Volume IV.

What is the WDC team?

The WDC team consists of the lead agencies for the WDC Project (the Federal Highway Administration and UDOT).

13.3.2 Water Resources in the Water Quality Impact Analysis Area

13.3.2.1 Surface Waters and Beneficial-Use Classifications

Weber River Watershed

The WDC alternatives lie within the Great Basin Hydrologic Region (2-digit HUC 16) and more specifically within the Great Salt Lake Sub-region (4-digit HUC 1602). The Lower Weber River Basin cataloguing unit (8-digit HUC 16020102) contains the entire water quality impact analysis area and includes three watersheds (10-digit HUCs): Fourmile Creek–Weber River (1602010206), Cottonwood Creek–Weber River (1602010204), and Farmington Bay Frontal (1602010205) (see Figure 13-1, Water Bodies and Watersheds, in Volume IV).

What are hydrologic unit codes (HUC)?

The U.S. Geological Survey has classified watersheds in the U.S. into a hierarchical system of hydrologic unit codes (HUC). Watersheds are classified according to the following HUCs:

- Region (2-digit HUC)
- Sub-region (4-digit HUC)
- Cataloguing unit (8-digit HUC)
- Watershed (10-digit HUC)

The Weber River flows 125 miles northwest from its headwaters at 11,200 feet elevation in the northwest Uinta Mountains to the place where it discharges to the Great Salt Lake at roughly 4,200 feet elevation. The Weber River flows through much of the Wasatch Range, where several major tributaries join the river.

The Weber River watershed, which includes all the land that drains into the Weber River, occupies all of Weber and Davis Counties (excluding the Great Salt Lake) and most of Morgan and Summit Counties. The term *Weber River basin* is used interchangeably with the term *Weber River Watershed Management Unit* by the Utah Division

What is a watershed?

Watershed is another term for a drainage basin. All of the water within a watershed drains into the same water body.

of Water Resources (2009) and the Utah Division of Water Quality (2006), and this chapter uses the same convention.

Surface water contributes about 56% of the developed water supply in the Weber River basin (Utah Division of Water Resources 1997). Agriculture consumes about 69% of the developed water supply in the basin, while municipal and industrial (M&I) uses consume the remaining 31% (Utah Division of Water Resources 2009). Of the total M&I uses, about 48% is potable (drinkable) water, or about 15% of the total developed supply in the basin.

The demand for potable and secondary municipal water is expected to increase, while agricultural demand is simultaneously expected to decrease as irrigated farmland is converted to residential parcels. These uses are supplied by both groundwater and surface water (see Figures 13-2 and 13-3, Water Sources, in Volume IV).

Table 13-3 below summarizes the surface waters in the water quality impact analysis area and their beneficial-use classifications. There are several other creeks and canals in the impact analysis area in addition to those listed in Table 13-3.

All irrigation ditches and canals in the state, unless otherwise designated, receive the beneficial-use classifications 2B (secondary contact), 3E (severely habitat-limited, narrative standards apply), and 4 (agriculture) (UAC R317-2-13.9). All drainage ditches and canals in the state, unless otherwise designated, receive the beneficial-use classifications 2B (secondary contact) and 3E (severely habitat-limited, narrative standards apply) (UAC R317-2-13.10). Any other waters not specifically classified, including Haight Creek and Shepard Creek, receive the default beneficial-use designations of 2B (secondary contact) and 3D (waterfowl) (UAC R317-2-13.13).

Table 13-3. Surface Waters and Beneficial Uses in the Water Quality Impact Analysis Area

Water Body	Reach	Beneficial Uses
Farmington Creek	Farmington Bay Wildlife Management Area (WMA) to Uinta-Wasatch-Cache National Forest boundary	2B (secondary contact), 3B (warm-water game fish), 4 (agriculture)
Shepard Creek	Farmington Bay to Uinta-Wasatch-Cache National Forest boundary	2B (secondary contact), 3D (protected for waterfowl, shore birds, and other water-oriented wildlife)
Baer (Bair) Creek	Farmington Bay to Interstate 15 (I-15)	2B (secondary contact), 3C (warm-water nongame fish), 4 (agriculture)
Haight Creek	Entire creek	2B (secondary contact), 3D (protected for waterfowl, shore birds, and other water-oriented wildlife)
Holmes Creek	Farmington Bay to Uinta-Wasatch-Cache National Forest boundary	2B (secondary contact), 3B (warm-water game fish), 4 (agriculture)
Kays Creek and tributaries	Farmington Bay to Uinta-Wasatch-Cache National Forest boundary	2B (secondary contact), 3B (warm-water game fish), 4 (agriculture)
Howard Slough	Entire slough	2B (secondary contact), 3C (warm-water nongame fish), 4 (agriculture)
Hooper Slough	Entire slough	2B (secondary contact), 3C (warm-water nongame fish), 4 (agriculture)
Howard Slough State Waterfowl Management Area	Entire management area	2B (secondary contact), 3C (warm-water nongame fish), 3D (protected for waterfowl, shore birds, and other water-oriented wildlife)
Great Salt Lake – Gilbert Bay	Open water if below 4,208 feet elevation	5A (Gilbert Bay; protected for frequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain)
	Transitional waters approximately 4,208 feet to open water	5E (transitional waters; protected for infrequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain)
	Open water if above 4,208 feet elevation	2B (secondary contact), 3B (warm-water game fish), 3D (waterfowl)
Great Salt Lake – Farmington Bay	Open water if below 4,208 feet elevation	5D (Farmington Bay; protected for infrequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain)
	Transitional waters approximately 4,208 feet to open water	5E (transitional waters; protected for infrequent primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain)
	Open water if above 4,208 feet elevation	2B (secondary contact), 3B (warm-water game fish), 3D (waterfowl)

Source: UAC R317-2-13, Classification of Waters of the State, January 1, 2017

Great Salt Lake

Water Surface Level. The Great Salt Lake is a terminal basin lake located in northern Utah. The water surface level of the lake fluctuates based on climate conditions. As the water surface level fluctuates, the surface area of the open water also varies. The highest recorded surface water level of the lake occurred in the 1980s (about 4,211.87 feet using the National Geodetic Vertical Datum [NGVD] of 1929) due to the effects of the 1982–1983 El Niño (Utah Department of Natural Resources 2002). The current surface water level, as measured at the Great Salt Lake Marina, is about 4,195 feet (measured at U.S. Geological Survey gage 10010000 using NGVD 1929; USGS 2017).

Salinity. The Great Salt Lake is documented as one of the most saline (salty) lakes in the world. The concentration in weight percent of salt indicates that, in 1996, the North Arm of the Great Salt Lake was about 27% salt and the South Arm was about 12% salt (Utah Department of Natural Resources 2002). In comparison, ocean water is 3.5% salt and the Dead Sea is 26% salt (Utah Department of Natural Resources 1980).

Bays and Water Quality. Due to the complex hydrology, biology, and chemistry of the Great Salt Lake, the Utah Division of Water Quality has geographically defined four bays of the Great Salt Lake: Gunnison, Gilbert, Farmington, and Bear River. The Division has also assigned narrative water quality standards to the open waters and transitional waters of these bays. In addition to the narrative standards, open water in Gilbert Bay has a numeric water quality standard for selenium in egg tissue (UAC R317-2-14, Numeric Criteria).

What are transitional waters?

Transitional waters are all waters below approximately 4,208 feet elevation down to the current lake elevation of the open water of the Great Salt Lake that receive their source water from naturally occurring springs and streams, impounded wetlands, or facilities requiring a UPDES permit. The geographical areas of these transitional waters change corresponding to the fluctuation of the elevation of the lake's open water.

The impact analysis area includes parts of Gilbert Bay and Farmington Bay, both of which have beneficial uses classified by the surface water rules (UAC R317-2-6 and R317-2-13) of the Utah Division of Water Quality. The geographical boundary of Gilbert Bay is defined as all open waters at or below approximately 4,208 feet elevation south of the Union Pacific Railroad causeway, excluding all of Farmington Bay south of the Antelope Island causeway and all salt evaporation ponds along the east shore of the lake. The geographical boundary of Farmington Bay is defined as all open waters at or below approximately 4,208 feet elevation east of Antelope Island and south of the Antelope Island causeway, excluding salt evaporation ponds. The selection of 4,208 feet elevation as an appropriate boundary condition was based on sovereign land ownership, historical lake level records, dike and causeway elevations, and other information the State of Utah gathered to determine where the Great Salt Lake ends and freshwater criteria apply (Utah Division of Water Quality 2010a).

For open water below 4,208 feet elevation and for transitional waters, the narrative standard protects primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain. Open water above 4,208 feet elevation is protected for numeric water quality standards 2B (secondary contact), 3B (warm-water game fish), and 3D (waterfowl). In addition, open water below 4,208 feet elevation in Gilbert Bay (beneficial-use classification 5A) has a numeric water quality standard for selenium of 12.5 mg/kg (milligrams per kilogram) dry weight (UAC R317-2-14, Table 2.14.2, footnote 14) to protect the lake's aquatic wildlife beneficial use.

13.3.2.2 Impaired Water Bodies

Water bodies or specific segments of water bodies that exceed water quality standards for beneficial uses are designated as impaired, and the State must work to develop a TMDL to restore the beneficial uses. The Utah Division of Water Quality's *2016 Final Integrated Report* identifies EPA's collaborative approach to prioritizing impaired water bodies so that resources can be focused on impaired waters that are determined to be high priority. The process for prioritizing water bodies involves estimating environmental, economic, and social costs and benefits, and public and stakeholder outreach and engagement (Utah Division of Water Quality 2016b).

The State released a prioritized 303(d) list in 2016 that identified priority to water bodies "… that have the potential to negatively affect human health" (Utah Division of Water Quality 2016a). In addition, high priority was given to water bodies that are drinking water sources or high-use recreation and to the specific pollutants of toxic pollutants, metals (arsenic and cadmium), nutrients, and the bacterium *E. coli*.

Three water bodies were included in the impact analysis area for which information and data indicate that at least one designated use is not being supported. These impaired water bodies are listed in Table 13-4 below. All three impaired water bodies are ranked as a low priority for developing a TMDL.

Though it is not categorized as an impaired water body, the Great Salt Lake's Farmington Bay (which is downstream of a portion of the WDC action alternatives in the impact analysis area) has been the focus of increased evaluation related to presence of harmful algal blooms and the risk they pose to human health. The State intends, by 2018, to assess compliance with the Utah narrative water quality standard for Farmington Bay's recreational beneficial use (Utah Division of Water Quality 2016a).

Table 13-4. Impaired Surface Waters and Beneficial Uses in the Water Quality Impact Analysis Area

Water Body	Reach	Assessment Unit Category	Description	TMDL Development Priority
Farmington Creek and tributaries – Segment 1	Farmington Bay to Uinta-Wasatch-Cache National Forest boundary	5	*E. coli* does not meet water quality standards for beneficial use 2B (recreation).	Low
			Dissolved copper does not meet water quality standards for beneficial use 3B (warm-water game fish).	Low
Holmes Creek and tributaries	Farmington Bay to Uinta-Wasatch-Cache National Forest boundary	5	*E. coli* does not meet water quality standards for beneficial use 2B (recreation).	Low
			Dissolved copper does not meet water quality standards for beneficial use 3B (warm-water game fish).	Low
Kays Creek and tributaries	Farmington Bay to Uinta-Wasatch-Cache National Forest boundary	5	*E. coli* does not meet water quality standards for beneficial use 2B (recreation).	Low
			Dissolved copper does not meet water quality standards for beneficial use 3B (warm-water game fish).	Low

Source: Utah Division of Water Quality 2016b

13.3.2.3 Groundwater Quality

Groundwater provides about 24% of the developed water supply in the Weber River basin. There are six groundwater basins in the Weber River basin, three of which have had significant groundwater development: the East Shore Area, Ogden Valley, and Park City Area basins (Utah Division of Water Resources 2009). The only groundwater basin crossed by WDC action alternatives is the East Shore Area basin.

Groundwater in the East Shore Area basin is present in unconsolidated valley fill under water-table conditions in the shallow aquifer and under artesian conditions in the deeper, confined principal aquifer (Utah Division of Water Resources 1997). However, most groundwater withdrawal in the basin is from the deeper principal aquifer (USGS 2009). The depth of the shallow aquifer under the WDC can be between 2 and 6 feet depending on the location. Flow is generally to the west, toward the Great Salt Lake.

What is an aquifer?

An aquifer is an underground geologic formation that stores and transmits water. Water in an aquifer can be under either water-table conditions (water is not under pressure) or artesian conditions (water is under pressure and rises toward the surface without the aid of a pump).

The aquifer is recharged along the Wasatch Fault zone (east of I-15) and along the east edge of the Weber River Delta aquifer (Utah Division of Water Resources 2009). Groundwater flow is generally west toward the Great Salt Lake (USGS 2009).

The groundwater quality of the East Shore Area basin generally meets all state and federal standards for culinary use. The highest-quality water in the East Shore Area basin is found in the principal aquifers of the Weber River and Ogden River deltas, where recharge rates are also the highest. Moving radially outward from these two areas, groundwater quality deteriorates as a function of depth, with poor water quality below 1,200 feet in many areas. There are some pockets of brackish water in the northern part of the East Shore Area groundwater basin that might be due to deep mixing of thermal water near the Utah Hot Springs in Weber County (Utah Division of Water Resources 1997).

The State of Utah Water Rights Engineer has currently closed the East Shore Area basin to new groundwater appropriations until further notice, except small appropriations (1 acre-foot or less) and shallow wells (less than 30 feet deep). Water levels in most of the wells in the East Shore Area basin have declined since the 1950s, and some areas have experienced the largest declines in all of Utah (Utah Division of Water Resources 2009).

The East Shore Area principal aquifer is classified as having Class IA groundwater throughout most of the impact analysis area. Two small locations, one near the southern tip of the impact analysis area and a small area centered under the city of Clinton, are classified as having Class II groundwater (Utah Division of Water Quality 2011).

- **Class IA groundwater** has a concentration of TDS less than 500 mg/L (milligrams per liter) 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 to groundwater (UAC R317-6-4). When a contaminant is detectable in Class IA groundwater, concentrations are not permitted to exceed 1.25 times background concentrations, background concentrations plus two standard deviations, or 0.25 times the groundwater standard. In no case may a contaminant exceed the groundwater standard. Class IA groundwater is also referred to as pristine groundwater.
- **Class II groundwater** has a TDS concentration between 500 and 3,000 mg/L and no contaminant concentrations that exceed the groundwater quality standards listed in UAC R317-6-2. Class II groundwater is protected for use as drinking water or other similar beneficial use with conventional treatment prior to use. Class II groundwater is also referred to as drinking water–quality groundwater.

13.3.2.4 Groundwater Rights and Wells

The Utah Division of Water Rights classifies groundwater wells according to their use: domestic (drinking water), irrigation, stock watering, municipal, or recreational. The municipal classification indicates that the well is owned by a City or County for a variety of uses, including drinking water or agriculture. The Division of Water Rights tracks groundwater rights according to an inventoried water right number. Each water right number represents one or more actual groundwater wells. The approximate locations of wells or clusters of wells are shown in Figures 13-2 and 13-3, Water Sources, in Volume IV.

13.3.2.5 Drinking Water Sources

There is one groundwater source within 0.25 mile of the WDC action alternatives that provides public drinking water (see Table 13-5 below and Figure 13-2, Water Sources, in Volume IV). The Zone 1 source protection area would not be affected by the WDC action alternatives. 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 (see Section 13.2.4, Drinking Water Source Protection Plans and Zones).

Table 13-5. Sources of Drinking Water within 0.25 Mile of the Project Alternatives

Source Owner	Number of Wells and Sources
Hooper Water Improvement District	1

13.4 Environmental Consequences

This section discusses the expected water quality impacts to surface water and groundwater from the No-Action Alternative and each of the action alternatives.

13.4.1 Methodology

13.4.1.1 Surface Waters

The methodology used in this section is based on the design of the stormwater drainage system developed for the WDC. Stormwater from the WDC corridor would be treated before release using vegetated filter strips and/or a storm drain system consisting of a network of catch basins, pipes, and overland flow through buffers, swales, and detention basins that would outfall to the nearest surface water.

What are swales and bioswales?

Swales are constructed open-channel drainageways used to convey stormwater runoff. Bioswales are landscape elements designed to remove silt and pollution from surface runoff. They consist of a shallow, gently sloped ditch or trough (swale) filled with vegetation or loose rocks.

What is the WDC study area?

The WDC study area is the area described in Section 1.2, Description of the Needs Assessment Study Area.

The stormwater system for the WDC would not allow water to be discharged directly into adjacent surface waters unless it is detained at a greater rate than that allowed by the local municipalities, which for the WDC study area is 0.2 cubic feet per second (cfs) per acre, except for Weber County which is 0.1 cfs per acre. These discharge rate restrictions are meant to reduce the peak runoff in the stream and prevent in-stream erosion due to high velocities and flow quantities. The WDC stormwater system would be designed to meet UDOT’s municipal stormwater permit requirements.

Because stormwater from the WDC would be held in detention basins before it is released into surface waters, detention based were used in the water quality analysis. Vegetated filter strips would be used in areas where there are no adjacent water bodies that could potentially receive direct stormwater discharge. The detention basins considered in the storm drainage system evaluated in this EIS use a 0.2-cfs-per-acre discharge rate for the 10-year, 24-hour storm. Stormwater best management practices are included in the preliminary project design; these include vegetated filter strips, swales, and detention basins that would remove common highway pollutants before the stormwater is discharged to adjacent receiving waters or land.

What is a 10-year storm?

A 10-year storm is a storm that has a 10% chance of occurring in a given location during a given year, or, in other words, a storm that occurs at that location once every 10 years *on average*.

All water would be detained before it is released into surface waters. The locations of the water treatment types were based on topography, the stormwater discharge rate, the receiving water, and the highway design. Vegetated filter strips would use the 50-foot vegetated clear zone to filter stormwater. UDOT will coordinate with the Utah Division of Water Quality during the final design phase of the project to ensure that water quality goals are being met.

In general, the WDC team evaluated the impacts to surface waters from each alternative based on the following data:

- The amount of impervious surface area added
- The number of stream crossings
- A model analysis of in-stream concentrations of typical highway pollutants (copper, lead, and zinc) after construction using the Federal Highway Administration's (FHWA) water quality model
- An analysis of TDS concentrations in snowmelt as a result of salt applications on the roadway in the winter
- The alternative's potential to affect designated beneficial uses

Impervious Area Added

If not mitigated, additional impervious area from roadway pavement can affect water quality in the following ways:

- Increased volume of stormwater runoff discharged into streams, which can increase the velocity of the water in the stream. Higher water velocities increase the potential for erosion, and erosion increases the concentration of TDS and total suspended solids in the stream.
- Increased amount of paved area, which requires more de-icing chemicals, which can then increase TDS levels in snowmelt.
- Increased automobile traffic, which can increase several automobile-related pollutants, primarily copper, lead, and zinc.
- Reduced infiltration of stormwater into the soil. Infiltration treats and improves water quality because microbes in the soil help filter pollutants and because particulates settle out of the stormwater into the soil.

Direct operational stormwater impacts are assessed and calculated by the area of new impervious surface created by the WDC. The primary operational impacts to water quality are due to stormwater runoff from new impervious surfaces created from the new road and bridges over riparian, wetland, and stream habitats. All of the WDC action alternatives would result in similar increases in highway runoff contaminants.

Stream Crossings

For this analysis, the WDC team counted the number of stream crossings for each WDC alternative. Stream crossings require structures such as bridges or culverts to allow water to pass under the road. Depending on the design and construction methods, the encroachment of the roadway into a stream and the culverts and bridges at stream crossings could adversely affect a stream's natural flow pattern, profile, channel stability, aquatic habitats, streambank vegetation, or riparian habitats.

What is riparian habitat?

Riparian habitat is habitat along a stream or other waterway. Riparian habitat is wetter than the surrounding upland areas and provides a different type of habitat.

Building a roadway farther into a stream can also increase the stream's velocity and can cause downstream erosion. The closer the roadway is to a stream, the greater the potential for water to run off the road and into the stream without undergoing water quality treatment. Types of water quality treatment include detention basins (the detention basins considered in this EIS use a 0.2-cfs-per-acre discharge rate for the 10-year, 24-hour storm), vegetated swales, vegetated filter strips, bioswales, and aeration.

Pollutant Concentrations in Streams

To identify the impacts from the WDC alternatives to adjacent surface waters, the WDC team evaluated the predicted concentrations of typical contaminants from highway runoff from the alternatives to receiving waters. Typical sources and contaminants normally found in highway runoff are listed in Table 13-6 below. The surface water quality analysis assumed the use of detention basins as UDOT would control the release of stormwater to surface waters.

Four highway runoff contaminants (copper, lead, zinc, and TDS) were evaluated using numeric analyses. Data indicate that copper, lead, and zinc are the dominant toxic pollutants in highway stormwater runoff and that TDS results from winter de-icing activities. Concentrations of copper, lead, and zinc in streams that could receive stormwater from the alternatives were modeled using FHWA's water quality model, which is described in the section titled FHWA Water Quality Model on page 13-19. The effects of TDS were assessed by calculating the concentrations of TDS in snowmelt resulting from winter de-icing activities involving salt and brine application.

Table 13-6. Typical Highway Runoff Contaminants

Contaminant	Sources
Bromide	Exhaust
Cadmium	Tire wear, herbicide application
Chloride	De-icing salts
Chromium	Metal plating, engine parts, brake lining wear
Copper	Metal plating, bearing wear, engine parts, brake lining wear, fungicide and insecticide use
Cyanide	Anticake compound used to keep de-icing salts granular
Iron	Auto body rust, steel highway structures, engine parts
Lead	Tire wear, lubricating oil and grease, bearing wear, atmospheric deposition
Manganese	Engine parts
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear, asphalt paving
Nitrogen, phosphorous	Atmosphere, sediments, fertilizers
Particulates (sediments or total suspended solids)	Pavement wear, vehicles, atmosphere, maintenance, snow/ice abrasives, sediment disturbance
Pathogenic bacteria	Soil, litter, bird droppings, trucks hauling livestock/stockyard waste
Polychlorinated biphenyls (PCBs)	Spraying of highway rights-of-way, atmospheric deposition, PCB catalyst in synthetic tires
Petroleum	Spills, leaks, blow-by motor lubricants, antifreeze, hydraulic fluids, asphalt surface leachate
Rubber	Tire wear
Sodium, calcium	De-icing salts, grease
Sulfate	Roadway beds, fuel, de-icing salts
Total dissolved solids (TDS)	De-icing salts, vehicle deposits, pavement wear
Zinc	Tire wear, motor oil, grease

Source: FHWA 1996, 34

FHWA Water Quality Model

FHWA's water quality model was used to quantify the impacts of metals in the runoff from the WDC alternatives to streams receiving stormwater runoff. The model is explained in two FHWA research documents: *Pollutant Loadings and Impacts from Highway Stormwater Runoff* (FHWA 1990) and *Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff* (FHWA 1996).

The available data indicate that copper, lead, and zinc are the dominant toxic pollutants in highway stormwater runoff (FHWA 1981). The procedure used for this analysis is a probabilistic dilution model developed and applied in EPA's Nationwide Urban Runoff Program and reviewed and approved by EPA's Science Advisory Board. The model computes the highest probable in-stream concentration of a pollutant that is expected to occur with new highway discharges during any 3-year period at the given confidence level and taking into account variable storm events and stream flows (FHWA 1990, 1–2).

Flow rates for the modeled streams were determined from U.S. Geological Survey gage data, field measurements available from EPA's STORET database (www.epa.gov/storet), or hydrologic analysis. Hydrologic analysis was performed using the U.S. Geological Survey's StreamStats program (water.usgs.gov/osw/streamstats/utah.html).

The WDC team obtained data for ambient concentrations of copper, lead and zinc from EPA's STORET database for Baer Creek through 2012. The data obtained from STORET were sampling results reported by the Utah Division of Water Quality. For Haight Creek, Shepard Creek, Howard Slough, and Hooper Slough (see Figure 13-1, Water Bodies and Watersheds, in Volume IV), no STORET water quality data are available, so the average concentrations based on STORET data for the other creeks in the impact analysis area (Baer, Holmes, Kays, and Farmington Creeks) were used.

For Farmington, Holmes, and Kays Creeks, the WDC team obtained data for ambient concentrations of copper, lead, and zinc from the sampling results reported by the Utah Division of Water Quality through 2016. These three streams are determined to be impaired due to ambient concentrations of copper that exceed the numeric water quality standard protective of aquatic wildlife. These ambient concentrations were flow-weighted averages to determine the input value for the model's upstream background concentration.

For the FHWA analysis, runoff from the proposed roadway was characterized for typical concentrations of total copper, total lead, and total zinc. FHWA has found that these pollutants occur in stormwater proportional to the amount of traffic that travels a roadway (FHWA 1990). For the WDC, the projected average daily traffic volume in 2040 is about 28,000 vehicles per day. Therefore, the average concentrations in highway stormwater runoff provided by FHWA (1990) for traffic volumes less than 30,000 vehicles per day were used for copper, lead, and zinc in the FHWA model. These concentrations are listed in Table 13-7.

Table 13-7. Average Pollutant Concentrations in Roadway Stormwater Runoff Used in the FHWA Water Quality Model

Pollutant	Event Mean (Average) Concentration (mg/L)
Total copper	0.022
Total lead	0.080
Total zinc	0.080

Source: FHWA 1990

Table 13-8 lists the pollutant-removal efficiencies for typical detention basins; these efficiencies are used for this analysis. These pollutant-removal efficiencies are from EPA's website and are based on the proportion of metal pollution that is removed along with suspended solids as they settle out in a standard dry detention basin with 12 to 48 hours' detention time.

Table 13-8. Pollutant-Removal Efficiencies Used to Model Water Quality

Pollutant	Percent Removed (%)
Copper	37
Lead	55
Zinc	37

Source: EPA 2006

TDS Analysis

This section provides an overview of UDOT's de-icing processes and non-winter operations to help the reader understand the methods and assumptions used in the TDS evaluation conducted in this Environmental Impact Statement (EIS). UDOT applies salt on the roads it maintains to reduce ice and improve traction during heavy snowfall. UDOT applies slightly more salt along the Wasatch Front than in the rest of the state. Along the Wasatch Front, UDOT uses two different methods to apply salt for a winter storm (Bernhard 2005). These methods are based on forecasting and nowcasting (forecasting at the moment when the storm begins) by the UDOT Meteorological Center and meteorological consultants as well as through local observations from UDOT maintenance personnel and meteorologists. Based on these predictions, salting trucks are mobilized and salt is applied as follows:

- From 24 hours up to the actual start of the storm, 30 gallons of 23% salt brine per lane-mile are applied.
- When the storm begins, a mixture of 4 gallons of 23% salt brine and 250 pounds of common salt per lane-mile is applied.

Not all of the salt applied to the road reaches surface water. Some of the salt is precipitated onto the road surface, and some is dissolved in the runoff from melted snow and ice. Much of the granular salt is redeposited along the road shoulders, and some of the dissolved salts from these deposits infiltrate into the roadside soils with the runoff. Some salt could run off into adjacent streams as the snow melts. Salts dissolved in stormwater or snowmelt are typically measured in the form of TDS.

Table 13-9 below shows the calculation for TDS concentrations in snowmelt due to UDOT's anti-icing operations. The spreadsheet model in Table 13-9 assumes that 100% of the salt applied is immediately dissolved and runs off the right-of-way, though it is likely that less than 100% of the applied salt would run off.

WEST DAVIS CORRIDOR

Table 13-9. Approximate TDS in Snowmelt Runoff due to Anti-icing Operations

Input or Standards	Description	Assumptions or Results
Storm event	Total snowfall depth	6 inches
Anti-icing	Number of brine applications	1
	Number of road salt and brine applications	2
Roadway data	Total inside paved shoulder width	7 feet
	Total number of traffic lanes and auxiliary lanes	2
	Total outside paved shoulder width	19.5 feet
	Total tributary vegetated width within right-of-way	5.5 feet
Salt applied	Salt quantity due to brine	1.84 ft^3/mi
	Salt quantity due to spreader	7.75 ft^3/mi
	Total salt applied	9.59 ft^3/mi
Runoff	Runoff from snowmelt	12,362 ft^3/mi
Results	Approximate TDS in snowmelt runoff due to anti-icing operations	**776 mg/L**
Water quality standards	Utah primary drinking water standard for TDS	2,000 mg/L
	Utah water quality standards for TDS	1,200 mg/L
	EPA secondary standard for TDS	500 mg/L

ft^3/mi = cubic feet per mile

Assumptions:

- Water content of snow is 10%.
- Brine is applied once per storm at a rate of 30 gallons per lane-mile with a salt concentration of 23%.
- Each application of salt consists of 250 pounds per lane-mile, plus 4 gallons per lane-mile of 23% salt brine.
- Two salt applications per 6-inch snow event.
- Brine and salt are applied to traffic lanes and auxiliary lanes only.
- Runoff coefficient for pavement = 0.9.
- Runoff coefficient for vegetated right-of-way = 0.25.
- Specific gravity (unit weight of salt) = 2.165 (135 pounds per cubic foot); dry bulk density of rock salt for de-icing = 80 pounds per cubic foot.
- One cubic foot of rock salt is approximately 60% salt by volume.

These assumptions are based on numbers from Lynn Bernhard of UDOT Maintenance (Bernhard 2005; Patterson 2005) specifically for the Wasatch Front.

The typical concentration of TDS in highway stormwater runoff (not winter snowmelt) as sampled by UDOT was 433 mg/L. The location of this sampling was an outlet to the Jordan River on Interstate 215 (I-215) at about 6200 South in Salt Lake County. This outlet discharges stormwater runoff from I-215 (Stantec 2009). As shown in Table 13-9 above, the estimated TDS concentration in snowmelt from the WDC is 776 mg/L, which assumes that 100% of the salt is dissolved and runs off the roadway. Using the same calculations and assumptions as in Table 13-9 above, a 1-inch snow storm, which would require only one application of brine, would result in TDS concentration of about 1,015 mg/L, which is higher than from the 6-inch event because there is less snow to dilute the TDS.

The observed (non-winter) and both of the modeled (winter) concentrations of TDS in stormwater and snowmelt runoff are less than the Utah in-stream TDS standard of 1,200 mg/L.

Beneficial Uses

The WDC team evaluated the impacts to the beneficial uses of water bodies in the impact analysis area. The team conducted numeric water quality modeling for the WDC alternatives to determine whether the beneficial-use classification for the streams identified above in Table 13-3, Surface Waters and Beneficial Uses in the Water Quality Impact Analysis Area, would be affected by runoff from the WDC. Model results were compared to acute (1-hour average) numeric water quality standards (UAC R317-2-14, effective March 1, 2017) associated with the beneficial use of the receiving water. The comparison of the model results to the acute standards was chosen due to the relatively short period during which stormwater is discharged to surface waters.

13.4.1.2 Groundwater

The WDC team evaluated impacts to groundwater from the WDC alternatives based on each alternative's proximity to wells and its expected effects on the shallow and principal aquifers (for more information about these aquifers, see Section 13.3.2.3, Groundwater Quality).

Impacts to Wells and Drinking Water Source Protection Zones

The impacts to drinking water wells and other wells were assessed using geographic information systems (GIS) software to calculate the distance from the wellhead to each WDC alternative. The analysis evaluated both direct impacts and indirect impacts.

- Direct impacts
  - For all wells, a direct impact would occur if an alternative's right-of-way would go over the wellhead.
  - For public drinking water sources, a direct impact would occur if an alternative would encroach on drinking water source protection Zone 1, which is the area within a 100-foot radius of the wellhead.
- Indirect impacts
  - For drinking water sources, an indirect impact would occur if an alternative's right-of-way is within 0.25 mile of a well.
  - If a well needs to be relocated, UDOT would either purchase the water right or the land associated with the water right or negotiate an agreement with the water right owner to replace the well. Impacts to drinking water sources caused by encroaching on wells and drinking water source protection zones are of some concern to the Utah Division of Drinking Water (Jensen 2006) but do not require a permit from the Utah Division of Water Quality (Herbert 2004).

Impacts to Groundwater and Aquifers

The WDC alternatives were evaluated to determine whether they would affect the quality of the shallow aquifer because of stormwater runoff from the highway infiltrating into the aquifer. Stormwater from the WDC would be conveyed through vegetated filter strips or detention basins. Detention basins would store stormwater for a short time before discharging it to surface waters. Storing stormwater in the basins would prevent increased flows and high velocities in the receiving waters, thereby preventing excessive erosion in the receiving waters.

As the stormwater is stored in the basins, some stormwater could infiltrate into the shallow aquifer. However, because the storage time would be short (usually less than 24 hours) it is unlikely that stormwater would substantially reduce groundwater quality. Stormwater that passes over a vegetated filter strip is not stored, so it is unlikely to infiltrate into the shallow aquifer.

The WDC alternatives are not expected to affect the deeper, principal aquifer because the aquifer's recharge area is up-gradient and several miles from the WDC action alternatives and because the aquifer is confined and under pressure (water in the aquifer moves toward the ground surface).

Construction Impacts

To minimize construction-related discharges of pollutants, a UPDES stormwater construction permit and a Stormwater Pollution Prevention Plan would be required for construction activities. Best management practices specified in the Stormwater Pollution Prevention Plan would be used during construction to minimize impacts to surface water. Water quality impacts related to construction are discussed in more detail in Section 20.3.4, Water Quality Construction Impacts.

13.4.2 No-Action Alternative

With the No-Action Alternative, the WDC would not be built, so there would be no effects on water quality associated with the WDC. Vehicles would continue to use arterial streets, most of which have stormwater drainage systems, so the impacts to water quality with the No-Action Alternative would be similar to those with the action alternatives.

Whether or not the WDC is built, residential, commercial, and other development, including infrastructure such as roads, will be built in the impact analysis area over the next 20 years and beyond. This development will increase the amount of impervious area, change runoff characteristics, and potentially degrade water quality. Either with the WDC or without the WDC (that is, with the No-Action Alternative) in Davis and Weber Counties, the amount of urbanized development is projected to increase from about 119,000 acres currently to about 185,000 acres in 2040, an increase of 66,000 acres (see Section 3.4, Environmental Consequences, in Chapter 3, Land Use). This urbanization would include all residential and commercial areas and the necessary infrastructure such as roads. Not all of the 66,000 acres would be impervious surfaces, since the typical amount of impervious land cover in residential areas can vary from 12% to 40% and in commercial areas from 60% to 95% (Canter 1996).

However, the regulatory programs summarized above in Table 13-2, Water Quality Regulations, ensure that water quality degradation in developing areas will be reduced because of the required permitting and should be greatly reduced from the rate that occurred historically before permitting.

The present ongoing development that is occurring could contribute to the degradation of surface water quality and recharge areas for groundwater. If the groundwater recharge areas are degraded under this scenario, groundwater quality could also be affected (see Section 13.3.2.2, Impaired Water Bodies, for the current quality of groundwater).

13.4.3 Alternatives A1–A2

As described in Chapter 2, Alternatives, Alternative A is the more westerly alternative and consists of two separate alternatives: Alternatives A1 and A2. These alternatives are defined in Table 13-10 (also see Figure 13-1, Water Bodies and Watersheds, in Volume IV).

Table 13-10. Components of Alternatives A1–A2

Alternative	I-15 Connection	Four-Lane Highway	Two-Lane Highway	West Point/ Hooper Cities Segment	North Terminus
A1	Glovers Lane	I-15 to 2000 West	2000 West to 1800 North	4100 West	1800 West (West Point)
A2	Glovers Lane	I-15 to 2000 West	2000 West to 5500 South	5400 West	5500 South (Hooper)

Table 13-11 summarizes the effects of Alternatives A1 and A2 on water quality. The surface waters that would be affected by these alternatives include Farmington Creek, Shepard Creek, Haight Creek, Baer Creek, Holmes Creek, Kays Creek, Howard Slough, and Hooper Slough (see Figure 13-1, Water Bodies and Watersheds, in Volume IV). The analysis of the water quality impacts from each alternative follows Table 13-11.

Table 13-11. Water Quality Impacts from Alternatives A1–A2

Alternative	Impervious Area Added (acres)	Stream Crossings	Pollutant Concentrations from WDC Exceed Standards?[a]	Beneficial Uses Adversely Affected from New WDC Discharge?	Wells Directly Affected	
					Ground-water	Public Drinking Water (within 0.25 mile)
A1	242	6	No	No	45	1
A2	262	7	No	No	52	0

[a] Pollutant concentrations from the WDC would not exceed standards. However, the background concentrations for copper in Farmington, Kays, and Holmes Creeks are above their numeric standards.

13.4.3.1 Alternative A1 – Glovers Lane and 4100 West/1800 North

Surface Water Impacts

Impervious Area Added

Alternative A1 would create about 242 acres of new paved surface area in the water quality impact analysis area. The detention basins proposed as part of this alternative would capture and slow runoff from the roadway surface before it is discharged, which would reduce the flow rate and trap some pollutants before the runoff enters surface water bodies.

Number of Stream Crossings

Alternative A1 would cross six streams: Farmington Creek, Shepard Creek, Haight Creek (Rigby Dry Hollow), Baer Creek, Holmes Creek, and Kays Creek (see Figure 13-1, Water Bodies and Watersheds, in Volume IV). Of these streams, none have existing roadway crossings or drainage structures at the location of the proposed WDC crossing. All of these WDC crossings would require new structures.

Pollutant Concentrations in Streams

In general, the greater the runoff volume and the smaller the receiving stream flow, the greater the potential for impacts to water quality.

Table 13-12 below compares the stormwater concentration leaving the WDC right-of-way, the receiving water in-stream concentration, and the State's numeric standard for each pollutant of concern. Table 13-12 shows that the runoff concentration from the WDC right-of-way would not exceed the State's numeric standards. The in-stream concentrations for copper would exceed the standards because background concentrations are above the numeric standard.

Table 13-12 shows the highest concentrations from Table 13-13 below for the impaired water bodies. Table 13-13 shows the FHWA model results of the maximum expected concentrations of the pollutants of concern in each stream during any 3-year period.
Table 13-13 also shows the TDS spreadsheet model concentrations in runoff from the four-lane divided highway sections using the same analysis method presented in Table 13-9 above, Approximate TDS in Snowmelt Runoff due to Anti-icing Operations.

Table 13-12. Maximum Pollutant Concentrations from the WDC (All Alternatives) to Impaired Water Bodies

in milligrams per liter (mg/L)

Pollutant of Concern	Maximum Expected 3-Year Stormwater Runoff Concentration Leaving the WDC	Maximum Expected 3-Year Storm, In-stream Concentration from the WDC[a]	UAC R317 Numeric Standard
Copper	0.014	0.097	0.032[b]
Lead	0.036	0.015	0.172[b]
Zinc	0.051	0.026	0.255[b]
TDS	776[c]	Not applicable	1,200[d]

[a] This is the highest in-stream concentration, including the background concentration, to Kays Creek, Holmes Creek, and Farmington Creek, of the pollutant that is expected to occur from any WDC alternative over a 3-year period as result of a storm according to FHWA's model (see the section titled FHWA Water Quality Model on page 13-19).

[b] Class 3 acute (1-hour) standards, hardness = 250 mg/L calcium carbonate ($CaCO_3$).

[c] This is the highest concentration of TDS in snowmelt from any WDC alternative.

[d] Class 4 agricultural standard use is based on surrounding agricultural canals and uses. This standard is for the protection of agricultural uses including irrigation of crops and stock watering.

Table 13-13. Three-Year Maximum Predicted In-stream Metals Concentrations and TDS in Concentrations in Snowmelt from Alternatives A1–A2 for Non-impaired and Impaired Waters

in milligrams per liter (mg/L)

	Stream Potentially Receiving Stormwater Discharges from the WDC						
Pollutant	Farmington Creek (Impaired)[a]	Shepard Creek	Haight Creek	Baer Creek	Holmes Creek (Impaired)[a]	Kays Creek (Impaired)[a]	Howard Slough
Alternative A1							
Copper	0.097	0.021	ND	0.022	0.043	0.015	ND
Lead	0.015	0.009	ND	0.008	0.003	0.002	ND
Zinc	0.021	0.057	ND	0.041	0.023	0.026	ND
TDS	638	638	ND	638	638	638	ND
Alternative A2							
Copper	0.097	0.021	ND	0.022	0.043	0.015	0.015
Lead	0.015	0.009	ND	0.008	0.003	0.002	0.005
Zinc	0.021	0.057	ND	0.041	0.023	0.026	0.044
TDS	638	638	ND	638	638	638	776

ND = no discharge from project alternative

[a] Impaired stream ambient conditions exceed copper water quality standards. The model for impaired waters was prepared in 2017 based on latest ambient background and flow data as reported by the Utah Division of Water Quality's monitoring results database.

Beneficial Uses

Table 13-12 above shows the typical highway pollutants of concern and the numeric criteria intended to protect designated beneficial uses of waterways in the water quality impact analysis area. Table 13-13 above shows the maximum pollutant concentrations expected to occur in each stream in any 3-year period with Alternative A1 as a result of stormwater discharges from the WDC.

Numeric modeling using FHWA's dilution model (see the section titled FHWA Water Quality Model on page 13-19) indicates that the concentrations of pollutants in streams combined with the concentrations of pollutants in stormwater runoff from Alternative A1 would exceed the acute copper water quality standards (see Table 13-13 above) in the three streams (Farmington, Kays, and Holmes Creeks) that are currently listed as impaired for exceeding the copper water quality standard. FHWA's model results indicate that pollutant concentrations in the stormwater discharges leaving the WDC right-of-way would not exceed the copper, lead, or zinc water quality standards.

Groundwater Impacts

Aquifers

The WDC alternatives were evaluated to determine whether they would affect the quality of groundwater in the shallow aquifer because of stormwater runoff from the highway infiltrating into the aquifer. Stormwater from the WDC would be conveyed through vegetated filter strips or detention basins. Detention facilities proposed for the WDC action alternatives would be permitted by the Utah Division of Water Quality. Detention basins would store stormwater for a short time before discharging it to surface waters. As the stormwater is stored in the basins, some stormwater could infiltrate into the shallow aquifer. However, because the storage time would be short (usually less than 24 hours), it is unlikely that stormwater would substantially reduce groundwater quality.

The stormwater runoff from the WDC action alternatives is not expected to affect the deeper, principal aquifer because the aquifer's recharge area is up-gradient and several miles from Alternative A1 and because the aquifer is confined and under pressure (water in the aquifer moves toward the ground surface).

The WDC action alternatives were evaluated for their effects on the flow of shallow groundwater. During scoping, the WDC team received comments about the proposed roadway embankment and whether it would consolidate groundwater-bearing soils, thereby impounding groundwater by reducing the porosity and permeability of the soils beneath the roadway. This consolidation could elevate the groundwater table on the up-gradient side of the embankment and lower the groundwater table by a corresponding amount on the down-gradient side, effectively removing the shallow groundwater as a water source for down-gradient wetlands.

What is scoping?

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

> **What is a piezometer?**
>
> A piezometer is a device used to measure groundwater pressure.

Shallow groundwater was monitored from 1997 to 2006 as part of the Legacy Parkway Project. This monitoring consisted of two-dimensional computer simulations of shallow groundwater and 4 years of field monitoring shallow groundwater using 60 piezometers (HDR 1997, 1998, 1999; Forster 2006). Although Legacy Parkway is south of the WDC alternatives, the two projects are expected to have comparable effects on the flow of shallow groundwater. Both projects have the same number of lanes and the same proposed embankment configuration. In addition, the hydrology of the areas surrounding each project is comparable, including their groundwater flow, soils, hydrogeology, topography, and the influence of deeper aquifers.

Both the Legacy Parkway monitoring and a wetland study conducted for Farmington Bay wetlands (near the WDC alternatives) found that wetlands are located primarily in groundwater discharge areas for the principal deeper aquifers where there are one or more confined aquifers with an upward vertical flow gradient at depth and an overlying shallow unconfined aquifer near the land surface (Utah Geological Survey 2009).

The computer simulations for the Legacy Parkway predicted a 0.15-to-0.25-foot rise in the water table up-gradient of the roadway embankment and a corresponding 0.15-to-0.25-foot drop in the water table down-gradient of the roadway embankment (HDR 1998, 1999). The field monitoring results indicated that wetlands are fed by the shallow groundwater system and most likely depend on the vertical flow of water from underlying aquifer systems rather than lateral flows through the shallow system, and can also be influenced by seasonal (summer) discharge through evapotranspiration.

Although it is difficult to predict specifically how the WDC would affect the shallow groundwater that provides water to wetlands in the WDC study area, studies suggest that most wetlands fed by the shallow groundwater system likely depend most on the vertical flow of water from the underlying aquifer system rather than on lateral flow through the shallow system. However, since there is some lateral flow in the aquifer system, this flow could be disturbed by the WDC near the right-of-way, and this disturbance could reduce flow to wetlands (Forster 2006).

Wells and Other Drinking Water Sources

One public drinking water well is within 0.25 mile of Alternative A1 but is not within 100 feet of the alternative (see Section 13.3.2.5, Drinking Water Sources). This alternative would therefore have an indirect impact to the wellhead for this public drinking water source because of the potential to disrupt the well recharge area. The Zone 1 protection area would not be affected by this alternative.

There are 504 other wells within 0.25 mile of Alternative A1 (see Figures 13-2 and 13-3, Water Sources, in Volume IV). Of these wells, 45 groundwater wells are within the proposed right-of-way. If a well needs to be relocated, UDOT would either purchase the water right and the land associated with the right or negotiate an agreement with the water right owner to replace the well.

Great Salt Lake

Alternative A1 would produce stormwater runoff, and some runoff would be conveyed from the roadway to detention basins with outfalls to adjacent surface waters. These outfalls would discharge stormwater to tributaries, ditches, and drainages that convey stormwater to the Great Salt Lake, specifically Gilbert and Farmington Bays. Numeric modeling of the tributaries receiving runoff from the WDC indicates that in-stream water quality standards would be maintained (see Table 13-12 above, Maximum Pollutant Concentrations from the WDC), except for the three streams currently listed as impaired for exceeding copper water quality standards. Because of the complex hydrology and geochemistry and lack of numeric standards for typical roadway pollutants in Farmington and Gilbert Bays, no numeric analyses were conducted directly for those waters.

The effects of Alternative A1 on the Great Salt Lake are related to the amount of impervious area created by the alternative (see Table 13-11 above, Water Quality Impacts from Alternatives A1–A2). Pollutants of concern for the Great Salt Lake are selenium (Gilbert Bay) and mercury. These pollutants are not commonly detected in highway stormwater runoff (FHWA 1981).

Farmington Bay has been the focus of increased evaluation related to the presence of harmful algal blooms and the risk they pose to human health. Typical pollutants that can cause harmful algal blooms include phosphorous and nitrogen. However, the State has not identified the pollutants of concern associated with the Farmington Bay algal blooms (Utah Division of Water Quality 2016b). Stormwater runoff from highways and roadways are not typically identified as significant sources of phosphorous and nitrogen targeted for pollutant load reductions.

Given that Alternative A1 would create an additional 242 acres of impervious area in the Great Salt Lake watershed of 21,000 square miles (13,440,000 acres), the impacts of typical pollutants from Alternative A1 to the water quality of the Great Salt Lake would be negligible. In addition, the best management practices proposed as part of the WDC Project (detention basins and vegetated filter strips) would reduce concentrations of any heavy metal pollutants that do run off. Similarly, TDS from UDOT's winter de-icing activities could have some effect on the water quality of the Great Salt Lake, but this effect is expected to be small given the size of the Great Salt Lake watershed.

Hazardous Spills

UDOT designs highways for safe operations to minimize the potential for accidents. UDOT and local emergency responders such as fire departments maintain an incident monitoring and response team so that they can rapidly respond to any accident. However, an accident on the WDC involving hazardous material could affect surface water quality. The likelihood of an accident involving hazardous material on the WDC would be less than that on I-15, for example, because the WDC would not be a major truck route.

Impacts associated with hazardous material spills are difficult to quantify because their location, severity, and conditions are not known in advance; however, immediate action by the party responsible and spill response teams would minimize adverse impacts. If a spill were to occur, it is possible that hazardous waste or other chemical spills in wetland habitats could harm wildlife, particularly when water levels are high. Existing UDOT, FHWA, and EPA requirements for safe transport of these materials and emergency spill containment programs would minimize these effects under most conditions. However, unavoidable accidents could occur. Most spills would be local and would therefore vary in effect, but the effects would be worst in aquatic habitats.

13.4.3.2 Alternative A2 – Glovers Lane and 5400 West/5500 South

Surface Water Impacts

Impervious Area Added

Alternative A2 would create about 262 acres of new paved surface area in the water quality impact analysis area. Alternative A2 would have the most acres of impervious area of the WDC action alternatives. For surface waters adjacent to Alternative A2, the detention basins proposed as part of this alternative would capture and slow runoff from the roadway surface before it is discharged, which would reduce the flow rate and trap some pollutants before the runoff enters surface water bodies.

Number of Stream Crossings

Alternative A2 would cross seven streams: Farmington Creek, Shepard Creek, Haight Creek, Baer Creek, Holmes Creek, Kays Creek, and Howard Slough (see Figure 13-1, Water Bodies and Watersheds, in Volume IV). Of these streams, none have existing roadway crossings or drainage structures at the location of the proposed WDC crossing. All of these WDC crossings would require new structures.

Pollutant Concentrations in Streams

The potential impacts to in-stream concentrations from Alternative A2 would be the same as those from Alternative A1.

Beneficial Uses

The potential impacts to beneficial uses from Alternative A2 would be the same as those from Alternative A1.

Groundwater Impacts

Aquifers

Because the amount and composition of stormwater runoff would be similar among all action alternatives, the impacts to aquifers from Alternative A2 would be the same as those from Alternative A1.

Wells and Other Drinking Water Sources

There are no public drinking water wells within 0.25 mile of Alternative A2, so there would be no direct or indirect impacts to such wells and no impacts to Zone 1 protection areas.

There are 533 other wells within 0.25 mile of Alternative A2 (see Figures 13-2 and 13-3, Water Sources, in Volume IV). Of those wells, 52 groundwater wells are within the proposed right-of-way. If a well needs to be relocated, UDOT would either purchase the water right and the land associated with the right or negotiate an agreement with the water right owner to replace the well.

Great Salt Lake

Because the amount of impervious area near the Great Salt Lake in Farmington created by Alternative A2 would be about 20 acres more than the amount of impervious area created by Alternative A1 in the same area, the impacts to the Great Salt Lake resulting from stormwater runoff from Alternative A2 would be slightly greater than those from Alternative A1.

Catastrophic Hazardous Spills

The potential for and impacts from a hazardous material spill with this alternative would be the same as for Alternative A1.

13.4.4 Alternatives B1–B2

As described in Chapter 2, Alternatives, Alternative B is the more easterly alternative and consists of two separate alternatives: Alternatives B1 and B2. These alternatives are defined in Table 13-14.

Table 13-14. Components of Alternatives B1–B2

Alternative	I-15 Connection	Four-Lane Highway	Two-Lane Highway	West Point City Segment	North Terminus
B1	Glovers Lane	I-15 to Antelope Drive[a]	Antelope Drive to 1800 North	4100 West	1800 North (West Point)
B2	Glovers Lane	I-15 to Antelope Drive[a]	Antelope Drive to 1800 North	4800 West	1800 North (West Point)

[a] The transition from a four-lane highway to a two-lane highway would occur between Antelope Drive and 700 South.

Table 13-15 summarizes the effects of Alternatives B1 and B2 on water quality. The surface waters that would be affected by these alternatives include Farmington, Shepard, Baer, Haight, Holmes, and Kays Creeks. In summary, Alternatives B1 and B2 would not create long-term adverse water quality conditions in any streams or aquifers, based on the methodology described in Section 13.4.1, Methodology. The analysis of the water quality impacts from each of the B Alternatives follows Table 13-15.

Table 13-15. Water Quality Impacts from Alternatives B1–B2

Alternative	Impervious Area Added (acres)	Stream Crossings	Pollutant Concentrations from WDC Exceed Standards?[a]	Beneficial Uses Adversely Affected from New WDC Discharge?	Wells Directly Affected	
					Ground-water	Public Drinking Water (within 0.25 mile)
B1	259	6	No	No	34	1
B2	258	6	No	No	37	0

[a] Pollutant concentrations from the WDC would not exceed standards. However, the background concentrations for copper in Farmington, Kays, and Holmes Creeks are above their numeric standards.

13.4.4.1 Alternative B1 – Glovers Lane and 4100 West/1800 North

Surface Water Impacts

Impervious Area Added

Alternative B1 would create about 259 acres of new paved surface area in the water quality impact analysis area. For surface waters adjacent to Alternative B1, the detention basins proposed as part of this alternative would capture and slow runoff from the roadway surface before it is discharged, which would reduce the flow rate and trap some pollutants before the runoff enters surface water bodies.

Number of Stream Crossings

Alternative B1 would cross six streams: Farmington Creek, Shepard Creek, Haight Creek, Baer Creek, Holmes Creek, and Kays Creek (see Figure 13-1, Water Bodies and Watersheds, in Volume IV). Of these streams, none have existing roadway crossings or drainage structures at the location of the proposed WDC crossing. All of these WDC crossings would require new structures.

Pollutant Concentrations in Streams

In general, the greater the runoff volume and the smaller the receiving stream flow, the greater the potential for impacts to water quality.

Table 13-12 above, Maximum Pollutant Concentrations from the WDC (All Alternatives) to Impaired Water Bodies, shows the State's numeric standard for each pollutant of concern. Table 13-16 below shows the FHWA model results of the maximum expected concentrations of the pollutants of concern in each stream during any 3-year period. Table 13-16 also shows the TDS spreadsheet model result for the four-lane divided highway sections using the same analysis method presented in Table 13-9 above, Approximate TDS in Snowmelt Runoff due to Anti-icing Operations. As described for Alternative A1, the stormwater concentration leaving the WDC right-of-way would not exceed the State's numeric standards. The in-stream concentrations for copper would exceed the standards because background concentrations are above the numeric standard.

Table 13-16. Three-Year Maximum Predicted In-stream Metals Concentrations and TDS in Concentrations in Snowmelt from Alternatives B1–B2 for Non-impaired and Impaired Waters

in milligrams per liter (mg/L)

	Stream Potentially Receiving Stormwater Discharges from WDC						
Pollutant	**Farmington Creek (Impaired)[a]**	**Shepard Creek**	**Haight Creek**	**Baer Creek**	**Holmes Creek (Impaired)[a]**	**Kays Creek (Impaired)[a]**	**Howard Slough**
Alternative B1							
Copper	0.097	0.021	ND	0.022	0.043	0.015	ND
Lead	0.015	0.009	ND	0.008	0.003	0.002	ND
Zinc	0.021	0.057	ND	0.041	0.023	0.026	ND
TDS	638	638	ND	638	638	638	ND
Alternative B2							
Copper	0.097	0.021	ND	0.022	0.043	0.015	ND
Lead	0.015	0.009	ND	0.008	0.003	0.002	ND
Zinc	0.021	0.057	ND	0.041	0.023	0.026	ND
TDS	638	638	ND	638	638	638	ND

ND = no discharge from project alternative

[a] Impaired stream ambient conditions exceed copper water quality standards. The model for impaired waters prepared was prepared in 2017 based on latest ambient background and flow data as reported by the Utah Division of Water Quality's monitoring results database.

Beneficial Uses

Table 13-16 above shows the maximum pollutant concentrations expected to occur in each stream in any 3-year period with Alternative B1.

Numeric modeling using FHWA's dilution model (see the section titled FHWA Water Quality Model on page 13-19) indicates that the concentrations of pollutants in streams combined with the concentrations of pollutants in stormwater runoff from Alternative B1 would exceed the acute copper water quality standards (see Table 13-16 above) in the three streams (Farmington, Kays, and Holmes Creeks) that are currently listed as impaired for exceeding the copper water quality standards. FHWA's model results indicate that pollutant concentrations in the stormwater discharges leaving the WDC right-of-way would not exceed the copper, lead, or zinc water quality standards.

Groundwater Impacts

Aquifers

Because the amount and composition of stormwater runoff would be similar among all action alternatives, the impacts to aquifers from Alternative B1 would be the same as those from Alternative A1.

Wells and Other Drinking Water Sources

One public drinking water well is within 0.25 mile of Alternative B1 but is not within 100 feet of the alternative. This alternative would therefore have an indirect impact to the wellhead for this public drinking water source of the potential to disrupt the well recharge area, as defined in Section 13.3.2.5, Drinking Water Sources. The Zone 1 protection area would not be affected by this alternative.

Including the single drinking water source mentioned above, there are 497 wells within 0.25 mile of Alternative B1 (see Figures 13-2 and 13-3, Water Sources, in Volume IV). Of those 497 wells, 34 groundwater wells, including the single drinking water source mentioned above, are within the proposed right-of-way. If a well needs to be relocated, UDOT would either purchase the water right and the land associated with the right or negotiate an agreement with the water right owner to replace the well.

Great Salt Lake

Because the amount of impervious area created by Alternative B1 would be less than the amount of impervious area created by Alternative A2, the impacts to the Great Salt Lake resulting from stormwater runoff from Alternative B1 would be less than those from Alternative A2, and therefore the impacts would be negligible.

Catastrophic Hazardous Spills

The potential for and impact from a hazardous material spill with this alternative would be the same as for Alternative A1.

13.4.4.2 Alternative B2 – Glovers Lane and 4800 West/1800 North

Surface Water Impacts

Impervious Area Added

Alternative B2 would create about 258 acres of new paved surface area in the water quality impact analysis area. For surface waters adjacent to Alternative B2, the detention basins proposed as part of this alternative would capture and slow runoff from the roadway surface before it is discharged, which would reduce the flow rate and trap some pollutants before the runoff enters surface water bodies.

Number of Stream Crossings

Alternative B2 would cross the same six streams as Alternative B1: Farmington, Shepard, Haight, Baer, Holmes, and Kays Creeks (see Figure 13-1, Water Bodies and Watersheds, in Volume IV). Of these streams, none have existing roadway crossings or drainage structures at the location of the proposed WDC crossing. All of these WDC crossings would require new structures.

Pollutant Concentrations in Streams

The potential impacts to in-stream concentrations from Alternative B2 would be the same as those from Alternative B1.

Beneficial Uses

The potential impacts to beneficial uses from Alternative B2 would be the same as those from Alternative B1.

Groundwater Impacts

Aquifers

Because the amount and composition of stormwater runoff would be similar among all action alternatives, the impacts to aquifers from Alternative B2 would be the same as those from Alternative A1.

Wells and Other Drinking Water Sources

There are no public drinking water wells within 0.25 mile of Alternative B2, so there would be no direct impacts to a Zone 1 protection area and no indirect impacts to drinking water sources.

There are 478 other wells within 0.25 mile of Alternative B2 (see Figures 13-2 and 13-3, Water Sources, in Volume IV). Of those wells, 37 groundwater wells are within the proposed right-of-way. If a well needs to be relocated, UDOT would either purchase the water right and the land associated with the right or negotiate an agreement with the water right owner to replace the well.

Great Salt Lake

Because the amount of impervious area created by Alternative B2 would be less than the amount of impervious area created by Alternative A2, the impacts to the Great Salt Lake from Alternative B2 would be less than those from Alternative A2, and therefore the impacts would be negligible.

Catastrophic Hazardous Spills

The potential for and impact from a hazardous material spill with this alternative would be the same as for Alternative A1.

13.4.5 Wetland Avoidance Options

Two wetland avoidance options are being evaluated in this Final EIS, as shown in Table 13-17. The purpose of these options is to avoid wetland impacts per guidance from the U.S. Army Corps of Engineers on wetland avoidance. Either wetland avoidance option could be implemented with any of the A or B Alternatives.

In this section, the impact information for the wetland avoidance options provides only the differences in impacts for the A and B Alternatives as a result of using the wetland avoidance options. The differences in impacts would apply to any of the A and B Alternatives if they were to use the wetland avoidance options.

Table 13-17. Components of the Wetland Avoidance Options

Option	Location	City	Description
Farmington	Prairie View Drive and West Ranches Road	Farmington	Shift the A and B Alternatives in Farmington about 150 feet east to the southwest side of the intersection of Prairie View Drive and West Ranches Road.
Layton	2200 West and 1000 South	Layton	Shift the A and B Alternatives in Layton about 500 feet east to the northeast side of the intersection of 2200 West and 1000 South.

The wetland avoidance options would result in minor alignment shifts and would not result in any additional stream crossings or impacts to public drinking wells. There would be no change in the amount of impervious surface added for any of the WDC action alternatives. Therefore, the wetland avoidance options would not change the water quality analysis described above for Alternatives A1, A2, B1, and B2.

13.4.6 Mitigation Measures

This section discusses mitigation measures for surface water and groundwater impacts.

13.4.6.1 Mitigation Measures for Impacts to Surface Water

UDOT will mitigate stormwater runoff by discharging stormwater into detention basins before it is released into receiving waters or using vegetated filter strips where there are no adjacent water bodies that could potentially receive direct stormwater discharge This practice will reduce impacts to streams by reducing peak-flow discharge and by allowing particulates and sediment in stormwater to settle to reduce the amount of pollutants discharged to the receiving water. The benefits of detention basins and vegetated filter strips were included in the numeric in-stream analyses for copper, lead, and zinc. The WDC stormwater system would be designed to meet UDOT's municipal stormwater permit requirements. UDOT will coordinate with the Utah Division of Water Quality during the final design phase of the project to ensure that water quality goals are being met. Other water treatment measures including the use of hydrodynamic separators and other inline treatments will be evaluated during the final design process.

13.4.6.2 Mitigation for Groundwater Impacts

UDOT will conduct pre- and post-construction monitoring of the upper aquifer to better understand how the WDC could change subsurface water flows under the highway.

13.4.6.3 Mitigation Measures for Impacts to Groundwater Wells

There are groundwater wells within the proposed right-of-way for each of the action alternatives. Depending on the alternative selected, if a well needs to be relocated, UDOT will negotiate an agreement with the water right owner to either (1) purchase the water right or the land associated with the right or (2) replace the well at a different location acceptable to the owner.

13.4.7 Cumulative Impacts

What are cumulative impacts?

Cumulative impacts are the resulting impacts from the proposed action combined with impacts from other past, present, and reasonably foreseeable future actions.

As part of the WDC EIS process, scoping meetings were held with the public and resource agencies to help identify issues to be analyzed in this EIS. The WDC team reviewed the comments received during the public and agency scoping period to determine whether any significant issues were identified. EPA identified impacts to water quality as a concern. Chapter 24, Cumulative Impacts, provides a detailed analysis of the potential cumulative impacts to water quality. This section provides a summary of that analysis.

Because of the controls that would be placed on each project to manage runoff and minimize water quality impacts, the other transportation-related projects listed in Chapter 24 are not expected to contribute to major stormwater runoff or reduce water quality. In addition, many of these projects would improve existing roads that have no stormwater controls by adding control measures that could reduce water quality impacts. It is likely that one of the greatest contributors to future water quality impacts will be the urban development that is converting existing undeveloped land into residential, industrial, and commercial uses.

The amount of urbanized development either with the WDC or without the WDC (that is, with the No-Action Alternative) in Davis and Weber Counties is projected to increase from about 119,000 acres currently to about 185,000 acres in 2040, an increase of 66,000 acres (see Section 3.4, Environmental Consequences, in Chapter 3, Land Use). This urbanization would include all residential and commercial areas and the necessary infrastructure such as roads (including roads such as the WDC). Not all of the 66,000 acres would be impervious surfaces, since the typical amount of impervious land cover in residential areas can vary from 12% to 40% and in commercial areas from 60% to 95% (Canter 1996). The future development would be subject to water quality regulations that should help improve the water quality of stormwater runoff.

As regulatory requirements for treating discharges to surface waters continue to become more stringent and as numeric standards are established for the Great Salt Lake, the long-term future trend would be an improvement in the quality of water that is discharged into the Great Salt Lake. As urban development and redevelopment occur adjacent to the Great Salt Lake, requirements would be triggered, and updated methods of treating and managing point and non-point discharges would be implemented.

What is a point source?

A point source is any single, identifiable source, such as a pipe or ditch, from which pollutants are discharged.

Even with the water quality regulations placed on future development, the continued urbanization of Davis and Weber Counties could further contribute to cumulative impacts to, and some degradation of, water quality as more stormwater runoff enters the Great Salt Lake. However, this increase in urbanization would also decrease the amount of agriculture and resource extraction, which are two of the larger factors that impair water quality. It is also likely that, in the future, regulatory controls would be increased to reduce water quality impacts from all sources.

Any of the WDC action alternatives would increase the amount of impervious surface by about 242 acres to 262 acres, which would increase the potential for stormwater runoff. Modeling results showed that the WDC would contribute small amounts of stormwater pollutants from the increase in the amount of impervious surface. However, the WDC would include measures to control stormwater runoff and would use detention basins to minimize the amounts of pollutants that are discharged into adjacent surface waters.

Overall, there would be a substantial increase in impervious surfaces in the future, which increase could contribute further impairment to area waters (copper currently exceeds its numeric standards in Farmington, Kays, and Holmes Creeks). However, there would be water quality controls and reduction in agricultural uses, which could benefit future runoff by reducing pollutants. With the water quality controls that would be used for the WDC, its contribution to water quality impacts would be minor, but it would further exacerbate the impairment in water bodies that are impaired for copper. Given the current condition of water resources, the WDC is not expected to substantially change the overall water quality in the impact analysis area.

13.4.8 Summary of Impacts

Table 13-18 summarizes the water quality impacts from each alternative. The water quality impacts would be the same with or without the wetland avoidance options.

Table 13-18. Summary of Water Quality Impacts

	Alternative			
Impact	**A1**	**A2**	**B1**	**B2**
Impervious area added (acres)	242	262	259	258
Number of stream crossings	6	7	6	6
Pollutant concentrations from the WDC exceed acute water quality standards?	No	No	No	No
Beneficial uses adversely affected from new WDC discharge?	No	No	No	No
Number of groundwater wells within the WDC right-of-way	45	52	34	37
Number of public drinking water wells within 0.25 mile of the WDC right-of-way	1	0	1	0

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