

Water Quality - U.S. 287 Bypass at Lamar

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Region 2

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The proposed construction of the US 287 bypass at Lamar, Colorado has the potential to impact surface waters that intersect with the bypass corridor including the Arkansas River, Willow Creek, and various irrigation canals and ditches. A water quality analysis was performed for this activity by Smith Environmental, Inc. and was documented in a report dated November 8, 2002 (refer to Appendix B). The purpose of this technical memorandum is to provide an updated analysis of the stream flow and water quality data used in the original report and to provide a brief review and discussion of any changes to the potential impacts to surface waters. The preparation for this technical memorandum did not include an in-depth analysis or modeling of the water quality data to estimate the degree of impact to surface water. Any discussion of possible mitigation measures should be considered introductory and not the basis for project design.

Figure 1 provides the locations of the primary surface water bodies in relation to the proposed bypass corridor. The bypass intersects with the Arkansas River, which flows from west to east, northeast of the Lamar commercial district and then with Willow Creek just to the east of the commercial district. In addition to these natural surface waters there is a network of canals and irrigation ditches that serve the areas agricultural operations. The project area intersects with a number of these including the Amity Canal, Markham Arroyo, Vista Del Rio Ditch, and Hyde Canal, which are all located north of the Arkansas River. South of the Arkansas River, the bypass crosses an unnamed ditch, the Lamar Canal, and the Fort Bent Canal. Several smaller ditches, canal laterals, and seepage areas are also present, but are not shown on the figure.

While impacts to all surface waters are relevant to this technical memorandum, the water quality data reviewed is of the Arkansas River, which should be representative of the water quality in the other surface waters.

Water Quality Classifications, Designations and Impaired Waters Listing

The US 287 Bypass project at Lamar, Colorado is located within the Lower Arkansas River Basin. The stream segment is identified as segment 1c of the Lower Arkansas River Basin and includes the main stem of the Arkansas River from the outlet of John Martin Reservoir to the Colorado/Kansas border. This segment has been classified by the Colorado Water Quality Control Commission as a Class 2 Warm Water Aquatic Life, Class E Recreation, Domestic Water Supply, and Agriculture. These classifications are summarized below (CDPHE 2012).

Class 2 Warm Water Aquatic Life - These are waters that are not capable of sustaining a wide variety of warm water biota, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that result in substantial impairment of the abundance and diversity of species.

Class E Recreation - These surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975.

Domestic Water Supply - These surface waters are suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent) these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto.

Agriculture - These surface waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado and which are not hazardous as drinking water for livestock.

Additionally, this segment of the Lower Arkansas River Basin has been designated as Use Protected, which means the Colorado Water Quality Control Commission has determined that this segment does not warrant the special protection provided by the Outstanding Waters designation or the Antidegradation Review process. This segment has also been included in the 303(d) listing for impaired waters for dissolved selenium and dissolved uranium (CDPHE 2012a), indicating that the existing water quality for these parameters exceeded the appropriate water quality standards.

As a result of this impairment there is currently a temporary modification of the dissolved selenium water quality standard. The temporary modification increases the chronic standard of 4.6 ug/l to 22.5 ug/l, which would then be applied in permitting actions. The temporary modification is set to expire December 31, 2013, at which point the underlying chronic standard of 4.6 ug/l would be reinstated if no further action is taken by the Colorado Water Quality Control Commission to adopt a change in the underlying standard or to extend the term of the temporary modification.

Stream Flow and Water Quality Analysis

The stream flow and water quality analyses performed by Smith Environmental to provide baseline characteristics for the Arkansas River used data collected prior to the year 2000. For this reason, the analyses documented in this technical memorandum use stream flow and water quality data collected from 2000 to the present. The previous and current data were both collected from the United States Geological Survey (USGS) Gage Station 07133000 located at the Highway 50/287 Bridge over the Arkansas River. However, the USGS data for this period of record lacked metals data. So, water quality data collected by the Colorado Department of Public Health and Environment (CDPHE), also at the Highway 287/50 Bridge in Lamar, Colorado, was also used to provide baseline characteristics for the river immediately upstream of the project. Table 1 provides a description of the data used.

TABLE 1
Description of stream flow and water quality data

Agency	Station Id	Location	Parameters
USGS	07133000	Highway 50/287 bridge in Lamar, Colorado	Stream flow, temperature, specific conductance, dissolved oxygen, pH, total nitrogen, ammonia, nitrite, nitrate, phosphorus, hardness, calcium, magnesium, sodium, adsorption ratio, chloride, sulfate, dissolved iron, dissolved manganese, dissolved selenium, total selenium, E.coli, and total dissolved solids
CDPHE – Storet data	7808	Highway 50/287 bridge in Lamar, Colorado	Dissolved arsenic, dissolved cadmium, dissolved chromium, dissolved copper, dissolved iron, total recoverable iron, dissolved lead, dissolved manganese, total mercury, dissolved selenium, dissolved silver, and dissolved zinc

Stream Flow

USGS monthly stream flow data is shown graphically in Figure 2. Although a few years show some deviation, the general trend of high flows and low flows observed in earlier data can also be seen in the monthly flows for the period of 2000 to 2012. Low flows of less than 100 cfs generally occur from October through April and the high flows of greater than 100 cfs generally occur from May through September. This seasonal trend is driven by both high runoff and also controlled releases from upstream reservoirs.

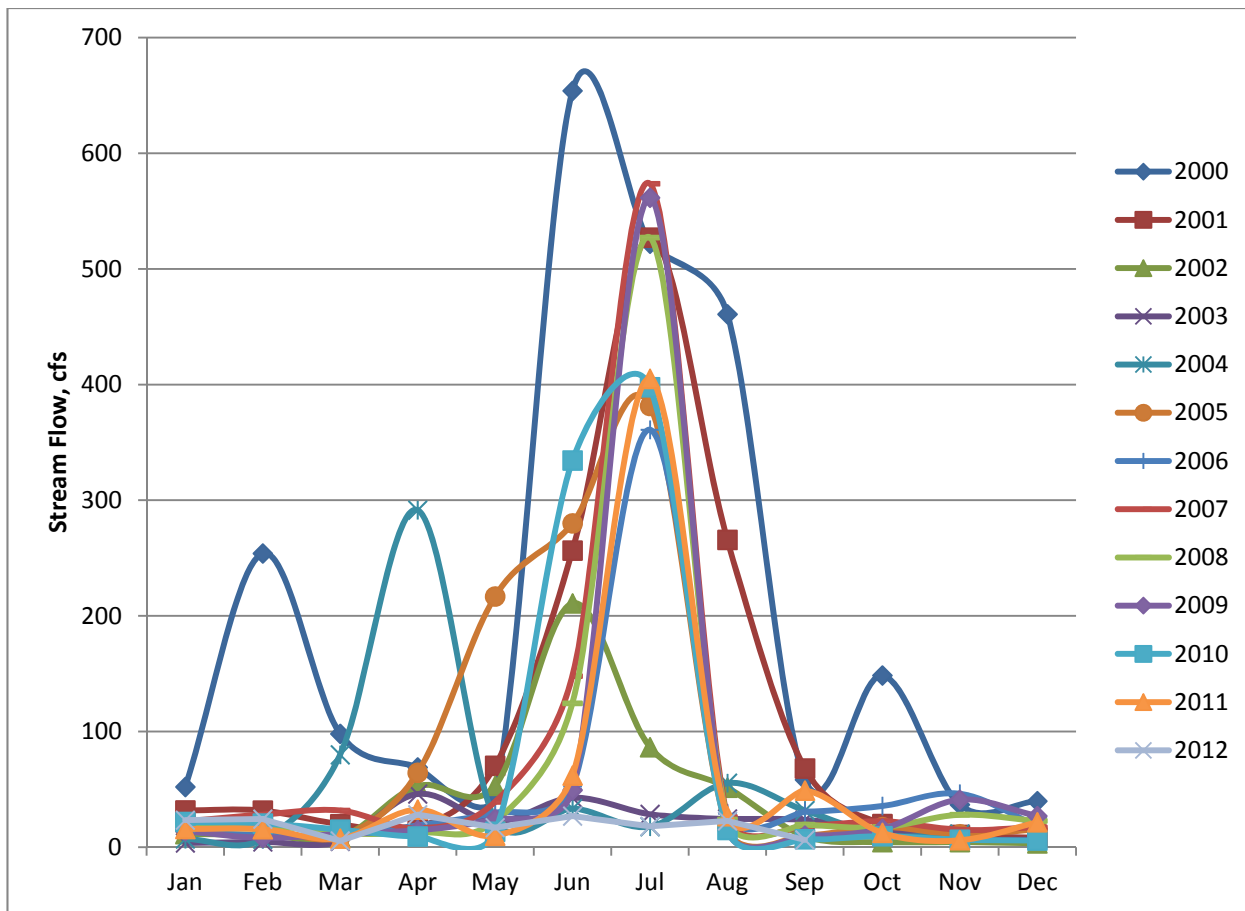


FIGURE 2
Monthly Average Stream Flow

Water Quality

As the original water quality report discussed, there is an inverse relationship between stream flow and salinity levels in the Arkansas River, as stream flows increase the dissolved solids levels typically decrease. Figure 3 demonstrates this relationship using specific conductance, a field parameter that is directly related to the presences of dissolved solids. The specific conductance ranges from 1,160 to 2,690 uS/cm for stream flows greater than 100 cfs. However, for stream flows less than 100 cfs the range is 1,870 to 4,100 uS/cm.

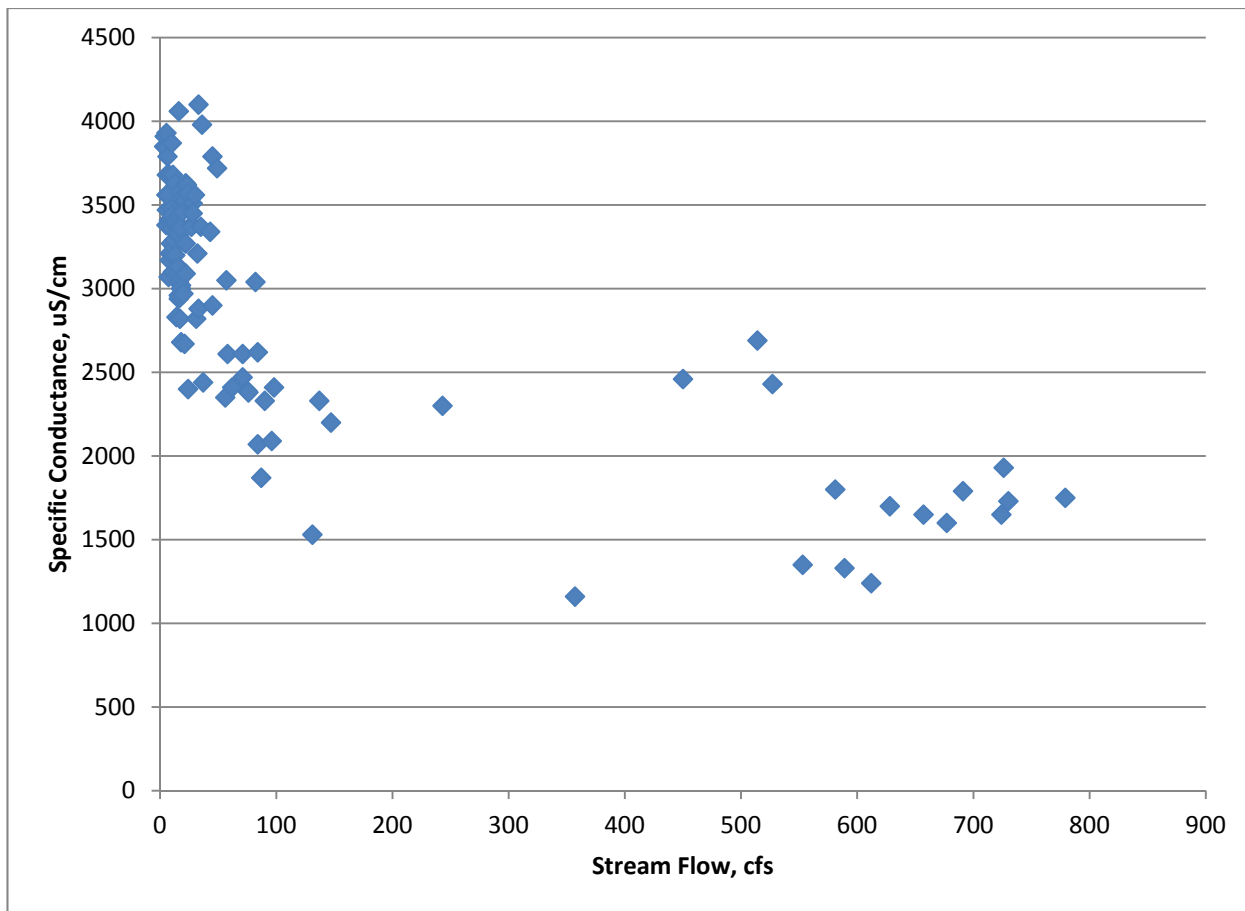


FIGURE 3
Relationship between Stream Flow and Specific Conductance

Table 2 presents water quality data collected at the USGS station on September 4, 2002. This is the most recent comprehensive sampling event conducted by the USGS at this gage station. The previous comprehensive sampling event of August 18, 1988 is presented in the original water quality report. The water quality data collected by the USGS does not indicate any exceedances of the numeric standards. The dissolved selenium concentration of 5 ug/l is slightly above the underlying standard of 4.6 ug/l.

TABLE 2
Arkansas River Water Quality Data at Lamar, Colorado for September 4, 2002 – USGS Gage Station 07133000

Parameter	Units	Result	Numeric Standard
Temperature	degrees C	19	30 ^a
Specific Conductance	us/cm	3680	NA
Dissolved Oxygen	mg/l	7.8	5
pH		8	6.5 - 9.0
Total Nitrogen	mg/l	1.7	NA
Ammonia	mg/l	0.06	0.9
Nitrite + Nitrate	mg/l	1.24	^b
Phosphorus	mg/l	0.024	NA
Hardness	mg/l	1440	NA
Calcium	mg/l	320	NA
Magnesium	mg/l	156	NA
Sodium	mg/l	381	NA

TABLE 2
Arkansas River Water Quality Data at Lamar, Colorado for September 4, 2002 – USGS Gage Station 07133000

Parameter	Units	Result	Numeric Standard
Sodium Adsorption Ratio		4.37	NA
Chloride	mg/l	95.2	250
Sulfate	mg/l	1830	1900
Dissolved Iron	ug/l	< 30.0	300
Dissolved Manganese	ug/l	643	642
Dissolved Selenium	ug/l	5.0	22.5 ^c
Total Selenium	ug/l	7.0	NA
E. coli	#/100 ml	100	126
Total Dissolved Solids	mg/l	3210	NA

NA means that a numeric standard is not applicable to that parameter.

^a New temperature standards will become applicable after December 31, 2012

^b There is not a nitrite + nitrate standard; however, the nitrite standard is 0.5 mg/l and the nitrate standard is 10 mg/l

^c The dissolved selenium standard shown is the temporary modification. The underlying chronic standard is 4.6 ug/l.

Table 3 presents metals data collected by the CDPHE. Multiple sampling events were performed to provide a larger data set. Therefore, the data have been analyzed to show statistical results of the mean, 50th percentile, 85th percentile, and maximum. When comparing the statistical results to the numeric standards the 85th percentile is used for dissolved parameters and the 50th percentile is used for total or total recoverable parameters to determine exceedances. As with the USGS data, the data does not show any exceedances with the exception that the 85th percentile of the dissolved selenium data exceeds the underlying standard.

TABLE 3
Arkansas River Water Quality Data at Lamar, Colorado – CDPHE

Parameter	Units	Count	Mean	50 th Percentile	85 th Percentile	Maximum	Numeric Standard
Arsenic, dissolved	ug/l	56	0.73	0	2	3	340 ^a
Cadmium, dissolved	ug/l	65	0.023	0	0	1	1.2
Chromium, dissolved	ug/l	2	0	0	0	0	11 ^b
Copper, dissolved	ug/l	65	1.02	0	0	15	29
Iron, dissolved	ug/l	47	5.40	0	14	63	300
Iron, total recoverable	ug/l	47	253	110	481	1600	1000
Lead, dissolved	ug/l	63	0.241	0	0	14	11
Manganese, dissolved	ug/l	47	159	110	262	1600	642
Mercury, total	ug/l	7	0	0	0	0	0.1
Selenium, dissolved	ug/l	64	10.6	10.5	15	27	22.5 ^c
Silver, dissolved	ug/l	47	0	0	0	0	3.5
Zinc, dissolved	ug/l	47	15.9	0	59	120	428

Chronic standards are shown for numeric standards unless otherwise indicated

^a Dissolved arsenic has an acute standard only.

^b The chronic standard for dissolved chromium VI is shown.

^c The dissolved selenium standard shown is the temporary modification. The underlying chronic standard is 4.6 ug/l.

The CDPHE also collected some metals data for Willow Creek, including dissolved arsenic, dissolved cadmium, dissolved copper, dissolved lead and dissolved selenium. These data showed that for most parameters, the levels were below the detection levels with the exception of dissolved selenium. The levels of dissolved selenium ranged from 7 to 53 ug/l, indicating that dissolved selenium levels are exceeding the numeric standards in Willow Creek.

Potential Surface Water Impacts

The original water quality report summarized the short-term and long-term impacts as well as applicable mitigation measures. The surface water impacts caused by the construction activities and long-term use of the highway have not changed since the original report was developed. However, since that time, the Arkansas River has been included in the 303(d) listing for impaired waters for dissolved selenium and dissolved uranium.

Both selenium and uranium occur naturally due to surface water and groundwater contacting and weathering bedrock formations and soils that contain these parameters. Construction activities could potentially increase the levels of these parameters in runoff by disturbing and exposing soil and bedrock that contain selenium and uranium to storm water runoff. Additionally, dewatering activities could also potentially discharge groundwater with levels of dissolved selenium and dissolved uranium higher than the numeric standards; although, the groundwater in the vicinity of the Arkansas River would have similar water quality to the river water. The mitigation measures identified in the original water quality report to control erosion would reduce these potential impacts.

Summary

The updated water quality analysis provided in this technical memorandum showed similar results as that found in the original water quality report, specifically in regards to stream flow and salinity levels. Since the original report was developed, the Arkansas River was included on the 303(d) list for dissolved selenium and dissolved uranium. Short-term impacts from construction activities could potentially increase the discharge of these parameters. However, temporary erosion control measures would mitigate these impacts.

References

Colorado Department of Public Health and Environment, Water Quality Control Commission, CDPHE 2012. Regulation No. 32: Classifications and Numeric Standards for Arkansas River Basin, 5CCR 1002-32.

Colorado Department of Public Health and Environment, Water Quality Control Commission, CDPHE 2012a. Regulation No. 93: Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List, 5CCR 1002-93.