



Appendix 3-C. Water Quality Supporting Information

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Appendix 3-C. Water Quality Supporting Information

This appendix summarizes the water quality data that the Central Utah Water Conservancy District (District) collected in the area around the confluence of the Spanish Fork River and Diamond Fork Creek, as well as the water quality data that were collected from the Utah Lake Drainage Basin Water Delivery System (ULS) Mapleton-Springville Pipeline that is representative of the 1991 Contract Water from Strawberry Reservoir. This appendix also provides the mass balance calculations that were done to understand the impacts to the Spanish Fork River as a result of implementing the Preferred Alternative. Some narrative to understand the anticipated impacts of the Preferred Alternative is also included.

3-C.1 Water Quality Period of Record

Each summary of water quality data is provided in terms of a period of record. The period of record for a water quality dataset generally gives the date range when samples were collected, the number of samples, and basic statistics about the dataset such as the average, standard deviation, minimum value, and maximum value for each constituent.

Table 3-C-1 shows the period of record for the water quality dataset that was collected for the Spanish Fork River above Diamond Fork Creek. The water quality samples were generally collected monthly from March 2022 to October 2025.

Table 3-C-2 shows the period of record for the water quality dataset that was collected for Diamond Fork Creek above the Spanish Fork River. The water quality samples were generally collected monthly from as early as February 2017 to October 2025.

Table 3-C-3 shows the period of record for the water quality dataset that was collected from the ULS Mapleton-Springville Pipeline, which is representative of the 1991 Contract Water from Strawberry Reservoir. The water quality samples were generally collected monthly from July 2022 to September 2025 during months when this water was delivered.

Table 3-C-4 shows the period of record for the water quality dataset that was collected for the Spanish Fork River below Diamond Fork Creek. This data is from an in-situ water quality meter that continuously monitors various parameters from February 2024 to October 2025.

Table 3-C-1
Period of Record for Spanish Fork River above Diamond Fork Creek

Constituent	Units	Date Range	Number of Samples	Average	Standard Deviation	Minimum	Maximum
Total alkalinity, as CaCO ₃	mg/L	3/30/2022 – 10/20/2025	30	253	30.0	128	291
Conductivity	µmho/cm	3/30/2022 – 10/20/2025	30	694	111	303	853
Dissolved Kjeldahl nitrogen	mg/L	3/30/2022 – 10/20/2025	26	0.258	0.446	0.100 ^a	1.60
Dissolved nitrogen	mg/L	3/30/2022 – 10/20/2025	26	0.329	0.568	0.100 ^a	1.94
Dissolved oxygen ^b	mg/L	7/23/2013 – 2/11/2026	40	9.82	1.21	7.50	12.4
Hardness, dissolved	mg/L	5/31/2022 – 10/20/2025	30	276	24.4	217	327
Nitrate + nitrite, dissolved, as N	mg/L	3/30/2022 – 10/20/2025	26	0.285	0.248	0.100 ^a	1.00
pH	—	3/30/2022 – 10/20/2025	30	8.26	0.161	7.90	8.50
Phosphorus, dissolved, as P	mg/L	3/30/2022 – 10/20/2025	26	0.025	0.014	0.020 ^a	0.090
Phosphorus, total, as P	mg/L	3/30/2022 – 10/20/2025	27	0.518	1.65	0.020 ^a	8.50
TDS	mg/L	3/30/2022 – 10/20/2025	30	433	77.4	208	612
TOC	mg/L	3/30/2022 – 10/20/2025	29	3.65	3.17	1.70	16.3
TSS	mg/L	3/30/2022 – 10/20/2025	30	825	2,734	4.00 ^a	12,000
Turbidity	NTU	3/30/2022 – 10/20/2025	30	372	1,614	2.20	8,900
Water temperature ^b	°C	7/23/2013 – 2/11/2026	40	9.81	5.50	0.78	18.5

Definitions: CaCO₃ = calcium carbonate; mg/L = milligrams per liter; N = nitrogen; NTU = nephelometric turbidity units; P = phosphorus; TDS = total dissolved solids; TOC = total organic carbon; TSS = total suspended solids; µmho/cm = micromhos per centimeter

^a Value represents the minimum reporting limit, which was used for all samples for which the constituent was not detected.

^b Water temperature and dissolved oxygen data were collected using an in-situ water quality meter.

Table 3-C-2
Period of Record for Diamond Fork Creek above Spanish Fork River

Constituent	Units	Date Range	Number of Samples	Average	Standard Deviation	Minimum	Maximum
Total alkalinity, as CaCO ₃	mg/L	4/29/2020 – 10/20/2025	46	156	36.5	10.0 ^a	210
Conductivity	µmho/cm	4/29/2020 – 10/20/2025	46	395	84.5	286	541
Dissolved Kjeldahl nitrogen	mg/L	7/31/2019 – 10/20/2025	30	0.297	1.08	0.100 ^a	6.00 ^b
Dissolved nitrogen	mg/L	7/31/2019 – 10/20/2025	30	0.300	1.10	0.100 ^a	6.10 ^b
Dissolved oxygen ^c	mg/L	12/8/2022 – 3/30/2026	91,961	9.88	1.06	7.54	12.7
Hardness, dissolved	mg/L	11/22/2019 – 10/20/2025	33	163	39.8	5.00 ^a	216
Hardness, dissolved, as CaCO ₃	mg/L	2/23/2017 – 2/25/2022	20	174	78.1	123	471
Nitrate + nitrite, dissolved, as N	mg/L	5/30/2019 – 10/20/2025	30	0.117	0.038	0.100 ^a	0.200
pH	—	7/31/2019 – 10/20/2025	46	8.10	0.168	7.60	8.40
Phosphorus, dissolved, as P	mg/L	4/29/2020 – 10/20/2025	30	0.028	0.012	0.020 ^a	0.060
Phosphorus, total, as P	mg/L	7/31/2019 – 10/20/2025	28	0.058	0.059	0.020 ^a	0.300
TDS	mg/L	4/29/2020 – 10/20/2025	46	234	54.3	128	328
TOC	mg/L	4/29/2020 – 10/20/2025	27	3.24	0.404	2.30	4.10
TSS	mg/L	3/30/2017 – 10/20/2025	64	26.7	50.2	4.00 ^a	316
Turbidity	NTU	2/23/2017 – 10/20/2025	64	15.5	34.5	0.550	240
Water temperature ^c	°C	12/8/2022 – 3/30/2026	91,961	7.99	4.35	0.074	18.9

Definitions: CaCO₃ = calcium carbonate; mg/L = milligrams per liter; N = nitrogen; NTU = nephelometric turbidity units; P = phosphorus; TDS = total dissolved solids; TOC = total organic carbon; TSS = total suspended solids; µmho/cm = micromhos per centimeter

^a Value represents the minimum reporting limit, which was used for all samples for which the constituent was not detected.

^b The District believes this value may be an outlier in the data set, but did not exclude it from the analysis.

^c Water temperature and dissolved oxygen data were collected using an in-situ water quality meter.

Table 3-C-3
Period of Record for ULS Mapleton-Springville Pipeline

Constituent	Units	Date Range	Number of Samples	Average	Standard Deviation	Minimum	Maximum
Total alkalinity, as CaCO ₃	mg/L	7/26/2022 – 9/15/2025	12	115	3.18	110	119
Conductivity	µmho/cm	7/26/2022 – 9/15/2025	12	268	7.72	255	280
Dissolved Kjeldahl nitrogen	mg/L	7/26/2022 – 9/15/2025	12	0.175	0.260	0.100 ^a	1.00
Dissolved nitrogen	mg/L	7/26/2022 – 9/15/2025	12	0.200	0.346	0.100 ^a	1.30
Dissolved oxygen ^b	mg/L	7/26/2022 – 9/15/2025	13	9.02	0.379	8.06	9.41
Hardness, dissolved	mg/L	7/26/2022 – 9/15/2025	12	126	7.37	116	136
Nitrate + nitrite, dissolved, as N	mg/L	7/26/2022 – 9/15/2025	12	0.183	0.083	0.100 ^a	0.300
pH	—	7/26/2022 – 9/15/2025	12	7.73	0.374	6.80	8.00
Phosphorus, dissolved, as P	mg/L	7/26/2022 – 9/15/2025	12	0.045	0.022	0.020 ^a	0.090
Phosphorus, total, as P	mg/L	7/26/2022 – 9/15/2025	12	0.048	0.029	0.020 ^a	0.100
TDS	mg/L	7/26/2022 – 9/15/2025	12	159	39.6	100	244
TOC	mg/L	7/26/2022 – 9/15/2025	11	3.75	0.238	3.20	4.20
TSS	mg/L	7/26/2022 – 9/15/2025	12	4.75	1.86	4.00 ^a	10.0
Turbidity	NTU	7/26/2022 – 9/15/2025	12	1.76	1.16	0.790	4.70
Water temperature ^b	°C	7/26/2022 – 9/15/2025	13	12.6	1.93	11.1	17.6

Definitions: µmho/cm = micromhos per centimeter; CaCO₃ = calcium carbonate; mg/L = milligrams per liter; N = nitrogen; NTU = nephelometric turbidity units; P = phosphorus; TDS = total dissolved solids; TOC = total organic carbon; TSS = total suspended solids

^a Value represents the minimum reporting limit, which was used for all samples for which the constituent was not detected.

^b Water temperature and dissolved oxygen data were collected using an in-situ water quality meter.

Table 3-C-4
Period of Record for Spanish Fork River below Diamond Fork Creek

Constituent	Units	Date Range	Number of Data Points	Average	Standard Deviation	Minimum	Maximum
Dissolved oxygen	%	2/1/2024 – 10/15/2025	41,091	99.0	6.05	83.4	115
Dissolved oxygen	mg/L	2/1/2024 – 10/15/2025	41,091	9.16	0.779	6.83	11.7
fDOM	RFU	2/1/2024 – 10/15/2025	41,091	5.99	1.85	-0.240	48.5
pH	—	2/1/2024 – 10/15/2025	41,091	8.20	0.135	7.80	9.54
Salinity	PSU	2/1/2024 – 10/15/2025	41,091	0.239	0.071	0.010	0.430
Specific conductivity	µS/cm	2/1/2024 – 10/15/2025	41,091	492	143	33	872
Temperature	°C	2/1/2024 – 10/15/2025	41,091	10.7	3.68	0.596	17.7
TDS	mg/L	2/1/2024 – 10/15/2025	41,091	320	93.3	21.0	567
Turbidity	FNU	2/1/2024 – 10/15/2025	41,091	42.8	140	3.51	5,712

Definitions: °C = degrees Celsius; µS/cm = microsiemens per centimeter; fDOM = fluorescent dissolved organic matter; FNU = formazin nephelometric units; mg/L = milligrams per liter; PSU = practical salinity units; RFU = relative fluorescence units; TDS = total dissolved solids

3-C.2 Mass Balance Calculations

The water quality data from the Spanish Fork River above Diamond Fork Creek, from Diamond Fork Creek above the Spanish Fork River, and from the ULS Mapleton-Springville Pipeline (to represent the 1991 Contract Water from Strawberry Reservoir) were used to calculate monthly average pollutant concentrations for the Spanish Fork River below Diamond Fork Creek using a mass balance approach for both the No Action Alternative and the Preferred Alternative. The equation below shows how the mass balance was calculated.

$$C_{DS} = \frac{(Q_1 C_1) + (Q_2 C_2) + (Q_3 C_3)}{(Q_1 + Q_2 + Q_3)}$$

Where:

C_{DS} = monthly average concentration in the Spanish Fork River below Diamond Fork Creek

Q_1 = monthly average Spanish Fork River flow rate above Diamond Fork Creek

Q_2 = monthly average Diamond Fork Creek flow rate above the Spanish Fork River

Q_3 = monthly average 1991 Contract Water flow rate

C_1 = monthly average Spanish Fork River concentration above Diamond Fork Creek

C_2 = monthly average Diamond Fork Creek concentration above the Spanish Fork River

C_3 = monthly average ULS Mapleton-Springville Pipeline concentration

Table 3-C-5 and Table 3-C-6 provide the input values and the resulting concentrations in the Spanish Fork River below Diamond Fork Creek for a subset of constituents that the District believes are of most consequence under the Preferred Alternative. The flow rates used in the calculation are discussed in Section 3.2, *Hydrology*, of the EA. It is assumed that the future instream flow rate from each source would mirror the historic average flow rate from each source. Water quality data for the ULS Mapleton-Springville Pipeline for the months of April and May represent the average concentrations from June through September because the District does not have any data for the months of April and May.

Table 3-C-5
Mass Balance for Spanish Fork River below Diamond Fork Creek by Month – No Action Alternative

Month	Q ₁	Q ₂	Q ₃	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}
January	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	59.1	21.7	0.0	0.100	0.100	--	0.100	0.035	0.020	--	0.031	8.15	8.00	--	8.11
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				434	288	--	395	57.0	13.5	--	45.3	34.5	8.80	--	27.6
February	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	67.4	21.7	0.0	0.100	0.100	--	0.100	0.030	0.030	--	0.030	8.35	8.15	--	8.30
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				504	286	--	451	31.5	15.0	--	27.5	23.0	7.83	--	19.3
March	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	100.3	22.1	0.0	0.550	0.100	--	0.469	0.275	0.075	--	0.239	8.40	8.13	--	8.35
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				461	266	--	426	216	39.8	--	184	39.0	22.2	--	36.0
April	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	267.9	23.8	6.2	0.100	0.100	0.200	0.102	0.300	0.097	0.045	0.278	8.20	8.08	7.74	8.18
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				346	252	155	335	288	81.4	4.69	266	235	59.6	1.76	216
May	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	459.8	29.6	74.5	0.990	0.100	0.200	0.839	0.300	0.055	0.045	0.253	8.30	8.20	7.74	8.22
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				386	214	155	346	452	33.0	4.69	371	180	16.2	1.76	148

Appendix 3-C. Water Quality Supporting Information

Month	Q ₁	Q ₂	Q ₃	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}
June	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	205.8	33.1	208.2	0.100	0.100	0.100	0.100	0.040	0.027	0.020	0.030	8.37	8.18	8.00	8.18
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				375	199	128	247	61.0	7.00	4.00	30.5	91.7	4.36	1.85	43.4
July	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	104.1	36.0	250.1	0.460	0.100	0.100	0.196	0.518	0.038	0.043	0.169	8.25	7.97	7.93	8.02
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				475	193	160	247	3,014	11.4	6.00	809	126	4.79	2.30	35.5
August	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	84.0	35.8	212.7	0.713	2.10	0.500	0.726	2.87	0.175	0.067	0.787	8.00	7.90	7.23	7.50
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				491	182	151	240	3,255	45.3	4.00	830	3,010	21.4	1.06	763
September	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	63.2	37.0	143.9	0.100	0.100	0.100	0.100	0.068	0.045	0.060	0.060	8.25	8.10	7.80	7.96
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				407	201	181	243	82.0	18.6	4.75	26.8	53.4	6.69	1.85	15.9
October	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	72.2	24.2	0.0	0.100	0.100	--	0.100	0.023	0.053	--	0.031	8.30	8.22	--	8.28
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				415	300	--	386	19.7	12.8	--	17.9	16.0	8.32	--	14.1
November	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	58.6	21.2	0.0	0.100	0.100	--	0.100	0.020	0.035	--	0.024	8.35	8.23	--	8.32

Month	Q ₁	Q ₂	Q ₃	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				446	272	--	400	22.0	9.40	--	18.6	15.5	6.10	--	13.0
December	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	55.8	21.5	0.0	--	--	--	--	--	--	--	--	--	8.10	--	--
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				--	280	--	--	--	8.00	--	--	--	5.00	--	--

Definitions: cfs = cubic feet per second; mg/L = milligrams per liter; TDS = total dissolved solids; TSS = total suspended solids

Table 3-C-6
Mass Balance for Spanish Fork River below Diamond Fork Creek by Month – Preferred Alternative

Month	Q ₁	Q ₂	Q ₃	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}
January	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	59.1	21.7	0.0	0.100	0.100	--	0.100	0.035	0.015	--	0.030	8.15	8.00	--	8.11
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				434	288	--	395	57.0	13.5	--	45.3	34.5	8.80	--	27.6
February	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	67.4	21.7	0.0	0.100	0.100	--	0.100	0.030	0.030	--	0.030	8.35	8.15	--	8.30
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				504	286	--	451	31.5	15.0	--	27.5	23.0	7.83	--	19.3
March	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	100.3	22.1	0.0	0.550	0.100	--	0.469	0.275	0.075	--	0.239	8.40	8.13	--	8.35
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				461	266	--	426	216	39.8	--	184	39.0	22.2	--	36.0
April	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	267.9	23.8	0.0	0.100	0.100	--	0.100	0.300	0.097	--	0.283	8.20	8.08	--	8.19
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				346	252	--	338	288	81.4	--	271	235	59.6	--	221
May	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	459.8	29.6	0.0	0.990	0.100	--	0.936	0.300	0.055	--	0.285	8.30	8.20	--	8.29
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				386	214	--	376	452	33.0	--	427	180	16.2	--	170

Month	Q ₁	Q ₂	Q ₃	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}
June	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	205.8	33.1	0.0	0.100	0.100	--	0.100	0.040	0.027	--	0.038	8.37	8.18	--	8.34
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				375	199	--	350	61.0	7.00	--	53.5	91.7	4.36	--	79.6
July	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	104.1	36.0	0.0	0.460	0.100	--	0.368	0.518	0.038	--	0.394	8.25	7.97	--	8.18
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				475	193	--	403	3,014	11.4	--	2,243	126	4.79	--	94.8
August	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	84.0	35.8	0.0	0.713	2.10	--	1.13	2.87	0.175	--	2.07	8.00	7.90	--	7.97
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				491	182	--	399	3,255	45.3	--	2,295	3,010	21.4	--	2,116
September	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	63.2	37.0	0.0	0.100	0.100	--	0.100	0.068	0.045	--	0.059	8.25	8.10	--	8.19
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				407	201	--	331	82.0	18.6	--	58.6	53.4	6.69	--	36.2
October	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	72.2	24.2	0.0	0.100	0.100	--	0.100	0.023	0.053	--	0.031	8.30	8.22	--	8.28
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				415	300	--	386	19.7	12.8	--	17.9	16.0	8.32	--	14.1
November	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	58.6	21.2	0.0	0.100	0.100	--	0.100	0.020	0.035	--	0.024	8.35	8.23	--	8.32

Appendix 3-C. Water Quality Supporting Information

Month	Q ₁	Q ₂	Q ₃	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}	C ₁	C ₂	C ₃	C _{DS}
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				446	272	--	400	22.0	9.40	--	18.6	15.5	6.10	--	13.0
December	Flow Rates (cfs)			Dissolved nitrogen (mg/L)				Total phosphorus (mg/L)				pH			
	55.8	21.5	0.0	--	--	--	--	--	--	--	--	--	8.10	--	--
				TDS (mg/L)				TSS (mg/L)				Turbidity			
				--	280	--	--	--	8.00	--	--	--	5.00	--	--

Definitions: cfs = cubic feet per second; mg/L = milligrams per liter; TDS = total dissolved solids; TSS = total suspended solids

Table 3-C-7 presents the average annual concentration in the Spanish Fork River downstream of Diamond Fork for each of the selected constituents based on the average monthly concentration in the Spanish Fork River. The month of December was excluded from this calculation since there is no water quality data that could be used to calculate the monthly average concentration. Based on this analysis, the average annual concentrations of most pollutants is anticipated to increase under the Preferred Alternative compared to the No Action Alternative.

Table 3-C-7
Average Annual Concentrations in the Spanish Fork River below Diamond Fork Creek with the No Action Alternative and the Preferred Alternative

Constituent	Units	Average Annual Concentration	
		No Action Alternative	Preferred Alternative
Dissolved nitrogen	mg/L	0.270	0.332
Total phosphorus	mg/L	0.178	0.322
pH	--	8.13	8.23
TDS	mg/L	337	387
TSS	mg/L	242	522
Turbidity	NTU	123	261

Definitions: mg/L = milligrams per liter; NTU = nephelometric turbidity units; TDS = total dissolved solids; TSS = total suspended solids

The following potential water quality impacts are anticipated based on the water volume changes in the Spanish Fork River between the Spanish Fork River Flow Control Structure and the Spanish Fork River Diversion. With the removal of the 1991 Contract Water from the Spanish Fork River channel, it is anticipated that the water quality would be more similar to the water quality of the Spanish Fork River channel upstream of Diamond Fork Creek with some improvement due to the inflow from Diamond Fork Creek (both natural and in-stream flows).

Dissolved Nitrogen. The average annual concentration of dissolved nitrogen is anticipated to increase about 23% from about 0.270 milligrams per liter (mg/L) with the No Action Alternative to about 0.332 mg/L under the Preferred Alternative. Both of these concentrations are below the state water quality standard of 10 mg/L for beneficial use 3A (cold-water fishery and aquatic life). These concentrations are also below the pollution indicator of 4 mg/L that has been established.

Total Phosphorus. The average annual concentration of total phosphorus is anticipated to increase about 81% from about 0.178 mg/L with the No Action Alternative to about 0.322 mg/L under the Preferred Alternative. Soldier Creek, an upstream tributary of the Spanish Fork River,

is impaired for total phosphorus due to the presence of highly erodible soils in the upstream watershed (UDEQ 2006). This impairment likely contributes to the average annual total phosphorus concentration of about 0.410 mg/L in the Spanish Fork River upstream of Diamond Fork. The 1991 Contract Water from Strawberry Reservoir has an average annual total phosphorus concentration of about 0.05 mg/L which matches the state water quality pollution indicator for total phosphorus. The Preferred Alternative would remove this source of dilution from the Spanish Fork River during the summer months and increase the average annual total phosphorus concentration.

pH. Levels of pH in the Spanish Fork River downstream of Diamond Fork would remain about the same under the Preferred Alternative (8.23) as with the No Action Alternative (8.13). The state water quality standard for surface water is between 6.5 and 9.0.

Total Dissolved Solids. The average annual TDS concentration is anticipated to increase about 15% from about 337 mg/L with the No Action Alternative to about 387 mg/L under the Preferred Alternative. Both of these concentrations are below the state water quality standard of 2,000 mg/L for agricultural beneficial uses, including irrigation and stock watering.

Total Suspended Solids. The average annual TSS concentration is anticipated to increase from 242 mg/L with the No Action Alternative to about 522 mg/L under the Preferred Alternative. The average annual TSS concentration in the Spanish Fork River upstream of Diamond Fork is more than 25 times the average annual TSS concentration in Diamond Fork Creek and more than 140 times the 1991 Contract Water average annual TSS concentration. There is no established water quality standard for TSS.

Turbidity. The average annual turbidity level is anticipated to increase from about 123 NTU with the No Action Alternative to about 261 NTU under the Preferred Alternative. The average annual turbidity in the Spanish Fork River upstream of Diamond Fork is about 25 times the average annual turbidity in Diamond Fork Creek and about 200 times the average annual 1991 Contract Water turbidity. There is no established water quality standard for turbidity outside of an increase of 10 NTU during runoff events.

Pathogens. The District did not sample for *Escherichia coli* (*E. coli*) or other pathogen concentrations in the upstream assessment unit (Spanish Fork River-2), which is not impaired for *E. coli* like the downstream assessment unit (Spanish Fork River-1) is. Without this information, it is not known whether sources of *E. coli* upstream of the Spanish Fork River Diversion might be contributing to the *E. coli* impairment downstream of the diversion. It is possible that the reduction of water that is available for mixing could increase pathogen concentrations in both Spanish Fork River assessment units.

Water Temperature. Mass balance calculations of average annual water temperature show that the water temperature in the Spanish Fork River downstream of Diamond Fork would increase from about 8.3 degrees Celsius (°C) for the No Action Alternative to about 8.6 °C under the Preferred Alternative. With less water in the Spanish Fork River channel during the summer months, the water would be exposed to the same amount of solar radiation from the sun, and this increased intensity of sunlight could further elevate water temperatures. The lower water depth could also increase the magnitude of temperature swings because less instream water would heat up faster during the day and cool down faster overnight. Maximum water temperature is anticipated to remain below the 20 °C water quality standard for cold-water fisheries and other aquatic life.

Dissolved Oxygen. Mass balance calculations of average annual dissolved oxygen concentration show that the dissolved oxygen concentration in the Spanish Fork River is anticipated to decrease from about 9.30 mg/L with the No Action Alternative to about 9.26 mg/L under the Preferred Alternative. The dissolved oxygen concentration could decrease further in the channel as a result of the anticipated decrease in velocity because there would be less natural aeration (mixing with air due to turbulence). Decreased water volumes could also provide less support to naturally occurring plants, which provide oxygen to the system through photosynthesis. Increased temperature and nutrient concentrations could also decrease the dissolved oxygen concentrations. Elevated nutrient levels can cause high algae growth, and, when the algae die, oxygen is consumed as the organisms decompose.

All of these potential impacts to the Spanish Fork River as a result of the Preferred Alternative would make the water quality in the Spanish Fork River below the Diamond Fork Creek confluence more representative of the natural water quality. For over 100 years, this reach has artificially had higher water quantity volumes during irrigation season due to the 1991 Contract Water from Strawberry Reservoir being discharged to and conveyed in the Spanish Fork River. Some degree of water quality improvement over the natural flows would still be provided because the Diamond Fork Creek instream flows would remain in the river between the Diamond Fork Creek confluence and the Spanish Fork River Diversion.

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