



STAR-ORION SOUTH DIAMOND PROJECT
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX 5.2.8-B

Tables

Table 1 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Caution Creek, 2006 to 2009.

Parameters	Units	Total		Number of Exceedances ⁴		% Exceedance	Spring		Number of Exceedances ⁴		% Exceedance		
		Number of Sampling Events	N ≥ DL ³	Total	Exceeds GL by < Order of Magnitude		Exceeds GL by ≥ Order of Magnitude	Number of Sampling Events	N ≥ DL ³	Total		Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Metals													
Aluminum	mg/L												
Total		49	45	4	2	2	8.2	15	14	2	1	1	13.3
Dissolved		24	24	0	0	0	0	8	8	0	0	0	0
Arsenic	µg/L												
Total		49	49	5	5	0	10.2	15	15	2	2	0	13.3
Dissolved		24	24	0	0	0	0	8	8	0	0	0	0
Cadmium	mg/L												
Total		49	24	2	2	0	4.1	15	0	0	0	0	0
Dissolved		24	0	0	0	0	0	8	0	0	0	0	0
Chromium ⁵	mg/L												
Total		49	26	10	9	1	20.4	15	2	2	2	0	13.3
Dissolved		24	22	19	4	15	79.2	8	7	6	3	4	75
Copper	mg/L												
Total		49	36	2	2	0	4.1	15	11	0	0	0	0
Dissolved		24	23	1	1	0	4.2	8	7	1	1	0	12.5
Iron	mg/L												
Total		49	49	33	29	4	67.3	15	15	9	9	0	60
Dissolved		24	24	3	0	3	12.5	8	8	0	0	0	0
Lead	mg/L												
Total		49	27	0	0	0	0	15	6	0	0	0	0
Dissolved		24	8	0	0	0	0	8	2	0	0	0	0
Mercury ⁶	mg/L												
Total		8	1	1	0	1	12.5	2	0	0	0	0	0
Dissolved		8	0	0	0	0	0	2	0	0	0	0	0
Molybdenum	mg/L												
Total		49	47	0	0	0	0	15	15	0	0	0	0
Dissolved		24	24	0	0	0	0	8	8	0	0	0	0
Nickel	mg/L												
Total		49	48	0	0	0	0	15	15	0	0	0	0
Dissolved		24	24	0	0	0	0	8	8	0	0	0	0
Selenium	mg/L												
Total		49	22	2	2	0	4.1	15	3	1	1	0	6.7
Dissolved		24	8	0	0	0	0	8	1	0	0	0	0
Silver	mg/L												
Total		49	0	0	0	0	0	15	0	0	0	0	0
Dissolved		24	0	0	0	0	0	8	0	0	0	0	0
Thallium	mg/L												
Total		49	0	0	0	0	0	15	0	0	0	0	0
Dissolved		24	0	0	0	0	0	8	0	0	0	0	0
Uranium	µg/L												
Total		49	12	0	0	0	0	15	4	0	0	0	0
Dissolved		24	5	0	0	0	0	8	4	0	0	0	0

Table 1 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Caution Creek, 2006 to 2009.

Parameters	Units	Total		Number of Exceedances ⁴			% Exceedance	Spring		Number of Exceedances ⁴			% Exceedance
		Number of Sampling Events	N ≥ DL ³	Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		Number of Sampling Events	N ≥ DL ³	Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	
Zinc	mg/L												
Total		49	43	1	1	0	2.0	15	11	0	0	0	0
Dissolved		24	22	0	0	0	0	8	7	0	0	0	0
Nutrients													
Nitrate	mg/L	48	30	0	0	0	0	14	5	0	0	0	0
Nitrite	mg/L	3	0	0	0	0	0	2	0	0	0	0	0
Field and Physical Parameters													
pH ⁷													
Field		32	0	9	8	1	28.1	9	0	3	3	0	33.3
Lab		49	49	0	0	0	0	15	9	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	6	0	0	0	0	0	2	0	0	0	0	0

Table 1 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Caution Creek, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Metals																			
Aluminum	mg/L																		
Total		11	9	0	0	0	0	8	7	0	0	0	0	14	14	2	1	1	14.3
Dissolved		7	7	0	0	0	0	2	2	0	0	0	0	7	7	0	0	0	0
Arsenic	µg/L																		
Total		11	11	2	2	0	18.2	8	8	1	1	0	12.5	14	14	1	1	0	7.1
Dissolved		7	7	0	0	0	0	2	2	0	0	0	0	7	7	0	0	0	0
Cadmium	mg/L																		
Total		11	1	1	1	0	9.1	8	0	0	0	0	0	14	1	1	1	0	7.1
Dissolved		7	0	0	0	0	0	2	0	0	0	0	0	7	0	0	0	0	0
Chromium ⁵	mg/L																		
Total		11	3	2	2	0	18.2	8	1	1	1	0	12.5	14	5	4	3	1	28.6
Dissolved		7	6	6	1	5	85.7	2	2	2	0	2	100	7	7	7	0	7	100
Copper	mg/L																		
Total		11	7	0	0	0	0	8	5	1	1	0	12.5	14	12	1	1	0	7.1
Dissolved		7	7	0	0	0	0	2	2	0	0	0	0	7	7	0	0	0	0
Iron	mg/L																		
Total		11	11	7	7	0	63.6	8	8	5	5	0	62.5	14	14	11	7	4	78.6
Dissolved		7	7	0	0	0	0	2	2	0	0	0	0	7	7	3	0	3	42.9
Lead	mg/L																		
Total		11	3	0	0	0	0	8	5	0	0	0	0	14	11	0	0	0	0
Dissolved		7	2	0	0	0	0	2	2	0	0	0	0	7	2	0	0	0	0
Mercury ⁶	mg/L																		
Total		1	1	1	0	1	100	0	-	-	-	-	-	5	0	0	0	0	0
Dissolved		1	0	0	0	0	0	0	-	-	-	-	-	5	0	0	0	0	0
Molybdenum	mg/L																		
Total		11	11	0	0	0	0	8	7	0	0	0	0	14	13	0	0	0	0
Dissolved		7	7	0	0	0	0	2	2	0	0	0	0	7	7	0	0	0	0
Nickel	mg/L																		
Total		11	11	0	0	0	0	8	7	0	0	0	0	14	14	0	0	0	0
Dissolved		7	7	0	0	0	0	2	2	0	0	0	0	7	7	0	0	0	0
Selenium	mg/L																		
Total		11	7	1	1	0	9.1	8	3	0	0	0	0	14	8	0	0	0	0
Dissolved		7	3	0	0	0	0	2	0	0	0	0	0	7	4	0	0	0	0
Silver	mg/L																		
Total		11	0	0	0	0	0	8	0	0	0	0	0	14	0	0	0	0	0
Dissolved		7	0	0	0	0	0	2	0	0	0	0	0	7	0	0	0	0	0
Thallium	mg/L																		
Total		11	0	0	0	0	0	8	0	0	0	0	0	14	0	0	0	0	0
Dissolved		7	0	0	0	0	0	2	0	0	0	0	0	7	0	0	0	0	0

Table 1 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Caution Creek, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Uranium	µg/L																		
Total		11	1	0	0	0	8	2	0	0	0	0	14	4	0	0	0	0	0
Dissolved		7	0	0	0	0	2	0	0	0	0	0	7	1	0	0	0	0	0
Zinc	mg/L																		
Total		11	10	0	0	0	8	8	0	0	0	0	14	13	1	1	0	0	7.1
Dissolved		7	6	0	0	0	2	2	0	0	0	0	7	7	0	0	0	0	0
Nutrients																			
Nitrate	mg/L	11	6	0	0	0	8	6	0	0	0	0	14	12	0	0	0	0	0
Nitrite	mg/L	1	0	0	0	0	0	-	-	-	-	-	0	-	-	-	-	-	-
Field and Physical Parameters																			
pH ⁷																			
Field		10	0	2	1	1	20	4	0	0	0	0	9	0	4	4	0	0	44.4
Lab		11	11	0	0	0	0	8	8	0	0	0	14	0	0	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	2	0	0	0	0	0	2	0	0	0	0	0	-	-	-	-	-	-

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 2 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from 101 Ravine, 2006 to 2008.

Parameters	Units	Total		Number of Exceedances ⁴			% Exceedance	Spring		Number of Exceedances ⁴			% Exceedance
		Number of Sampling Events	N ≥ DL ³	Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		Number of Sampling Events	N ≥ DL ³	Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	
Metals													
Aluminum	mg/L												
Total		8	8	4	4	0	50	3	3	2	2	0	66.7
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0
Arsenic	µg/L												
Total		8	7	0	0	0	0	3	3	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0
Cadmium	mg/L												
Total		8	1	1	1	0	12.5	3	0	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0
Chromium ⁵	mg/L												
Total		8	2	2	2	0	25	3	1	1	1	0	33.3
Dissolved		2	1	1	1	0	50	1	1	1	1	0	100
Copper	mg/L												
Total		8	7	0	0	0	0	3	3	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0
Iron	mg/L												
Total		8	8	7	7	0	87.5	3	3	3	3	0	100
Dissolved		2	2	1	1	0	50	1	1	0	0	0	0
Lead	mg/L												
Total		8	5	0	0	0	0	3	2	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0
Mercury ⁶	mg/L												
Total		2	0	0	0	0	0	1	0	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0
Molybdenum	mg/L												
Total		8	8	0	0	0	0	3	3	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0
Nickel	mg/L												
Total		8	8	0	0	0	0	3	3	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0
Selenium	mg/L												
Total		8	6	0	0	0	0	3	1	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0
Silver	mg/L												
Total		8	0	0	0	0	0	3	0	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0
Thallium	mg/L												
Total		8	0	0	0	0	0	3	0	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0
Uranium	µg/L												
Total		8	8	0	0	0	0	3	3	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0

Table 2 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from 101 Ravine, 2006 to 2008.

Parameters	Units	Total		Number of Exceedances ⁴				Spring		Number of Exceedances ⁴			
		Number of Sampling Events	N ≥ DL ³	Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance	Number of Sampling Events	N ≥ DL ³	Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance
Zinc	mg/L												
Total		8	6	0	0	0	0	3	2	0	0	0	0
Dissolved		2	1	0	0	0	0	1	1	0	0	0	0
Nutrients													
Nitrate	mg/L	48	4	0	0	0	0	3	1	0	0	0	0
Nitrite	mg/L	2	0	0	0	0	0	1	0	0	0	0	0
Field and Physical Parameters													
pH ⁷													
Field		6	0	0	0	0	0	2	0	0	0	0	0
Lab		8	8	0	0	0	0	3	3	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	6	0	1	1	0	16.7	2	0	0	0	0	0

Table 2 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from 101 Ravine, 2006 to 2008.

Parameters	Units	Summer						Fall						Winter					
Total		3	3	0	0	0	0	2	2	0	0	0	0	0	-	-	-	-	-
Dissolved		1	1	0	0	0	0	0	-	-	-	-	0	-	-	-	-	-	
Zinc	mg/L																		
Total		3	2	0	0	0	0	2	2	0	0	0	0	0	-	-	-	-	-
Dissolved		1	0	0	0	0	0	0	-	-	-	-	0	-	-	-	-	-	
Nutrients																			
Nitrate	mg/L	3	1	0	0	0	0	2	2	0	0	0	0	0	-	-	-	-	-
Nitrite	mg/L	1	0	0	0	0	0	0	-	-	-	-	0	-	-	-	-	-	
Field and Physical Parameters																			
pH ⁷																			
Field		2	0	0	0	0	0	2	0	0	0	0	0	0	-	-	-	-	-
Lab		3	3	0	0	0	0	2	2	0	0	0	0	0	-	-	-	-	-
Dissolved oxygen (field) ⁸	mg/L	2	0	1	1	0	50	2	0	0	0	0	0	0	-	-	-	-	-

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 3 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Perimeter Ravine, 2006 to 2008.

Parameters	Units	Total						Spring						Summer					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Metals																			
Aluminum	mg/L																		
Total		7	7	3	3	0	42.9	3	3	2	2	0	66.7	2	2	1	1	0	50
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0
Arsenic	µg/L																		
Total		7	7	0	0	0	0	3	3	0	0	0	0	2	2	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0
Cadmium	mg/L																		
Total		7	1	1	1	0	14.3	3	1	1	1	0	33.3	2	0	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Chromium ⁵	mg/L																		
Total		7	4	2	2	0	28.6	3	2	1	1	0	33.3	2	1	1	1	0	50
Dissolved		2	1	1	1	0	50	1	1	1	1	0	100	1	0	0	0	0	0
Copper	mg/L																		
Total		7	7	1	1	0	14.3	3	3	1	1	0	33.3	2	2	0	0	0	0
Dissolved		2	2	1	1	0	50	1	1	1	1	0	100	1	1	0	0	0	0
Iron	mg/L																		
Total		7	6	4	4	0	57.1	3	2	2	2	0	66.7	2	2	1	1	0	50
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0
Lead	mg/L																		
Total		7	6	1	1	0	14.3	3	3	1	1	0	33.3	2	1	0	0	0	0
Dissolved		2	2	1	1	0	50	1	1	1	1	0	100	1	1	0	0	0	0
Mercury ⁶	mg/L																		
Total		2	1	1	0	1	50	1	0	0	0	0	0	1	1	1	0	1	100
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Molybdenum	mg/L																		
Total		7	7	0	0	0	0	3	3	0	0	0	0	2	2	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0
Nickel	mg/L																		
Total		7	6	0	0	0	0	3	2	0	0	0	0	2	2	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0
Selenium	mg/L																		
Total		7	5	0	0	0	0	3	2	0	0	0	0	2	2	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Silver	mg/L																		
Total		7	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	0
Dissolved		2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Thallium	mg/L																		
Total		7	1	0	0	0	0	3	0	0	0	0	0	2	1	0	0	0	0
Dissolved		2	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0
Uranium	µg/L																		
Total		7	7	0	0	0	0	3	3	0	0	0	0	2	2	0	0	0	0
Dissolved		2	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0

Table 3 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Perimeter Ravine, 2006 to 2008.

Parameters	Units	Total						Spring						Summer					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Zinc	mg/L																		
Total		7	7	0	0	0	3	3	0	0	0	2	2	0	0	0	0	0	
Dissolved		2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	
Nutrients																			
Nitrate	mg/L	48	5	0	0	0	3	2	0	0	0	2	1	0	0	0	0	0	
Nitrite	mg/L	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	
Field and Physical Parameters																			
pH ⁷																			
Field		5	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	
Lab		7	7	0	0	0	3	3	0	0	0	2	2	0	0	0	0	0	
Dissolved oxygen (field) ⁸	mg/L	5	0	1	1	0	2	0	0	0	0	1	0	1	1	0	100		

Table 3 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Perimeter Ravine, 2006 to 2008.

Parameters	Units	Fall						Winter						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		
Metals														
Aluminum	mg/L													
Total		2	2	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Arsenic	µg/L													
Total		2	2	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Cadmium	mg/L													
Total		2	0	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Chromium ⁵	mg/L													
Total		2	1	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Copper	mg/L													
Total		2	2	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Iron	mg/L													
Total		2	2	1	1	0	50	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Lead	mg/L													
Total		2	2	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Mercury ⁶	mg/L													
Total		0	-	-	-	-	-	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Molybdenum	mg/L													
Total		2	2	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Nickel	mg/L													
Total		2	2	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Selenium	mg/L													
Total		2	1	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Silver	mg/L													
Total		2	0	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Thallium	mg/L													
Total		2	0	0	0	0	0	0	-	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Uranium	µg/L													
Total		2	2	0	0	0	0	0	-	-	-	-	-	-

Table 3 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Perimeter Ravine, 2006 to 2008.

Parameters	Units	Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance
Total	Exceeds GL by < Order of Magnitude			Exceeds GL by ≥ Order of Magnitude	Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude			
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-
Zinc	mg/L												
Total		2	2	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-
Nutrients													
Nitrate	mg/L	2	2	0	0	0	0	0	-	-	-	-	-
Nitrite	mg/L	0	-	-	-	-	-	0	-	-	-	-	-
Field and Physical Parameters													
pH ⁷													
Field		2	0	0	0	0	0	0	-	-	-	-	-
Lab		2	2	0	0	0	0	0	-	-	-	-	-
Dissolved oxygen (field) ⁸	mg/L	2	0	0	0	0	0	0	-	-	-	-	-

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 4 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Ravine, 2005 to 2009.

Parameters	Units	Total						Spring						Summer					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Metals																			
Aluminum	mg/L																		
Total		149	149	33	31	2	22.1	38	38	7	7	0	18.4	42	42	6	6	0	14.3
Dissolved		27	26	0	0	0	0	9	9	0	0	0	0	9	9	0	0	0	0
Arsenic	µg/L																		
Total		149	149	13	9	4	8.7	38	38	1	1	0	2.6	42	42	2	2	0	4.8
Dissolved		27	27	0	0	0	0	9	9	0	0	0	0	9	9	0	0	0	0
Cadmium	mg/L																		
Total		149	23	23	16	7	15.4	38	3	3	3	0	7.9	42	5	5	5	0	11.9
Dissolved		27	2	2	1	1	7.4	9	0	0	0	0	0	9	0	0	0	0	0
Chromium ⁵	mg/L																		
Total		149	45	31	20	11	20.8	38	6	4	4	0	10.5	42	9	7	5	2	16.7
Dissolved		28	22	21	9	12	75	9	5	5	3	2	55.6	9	9	9	3	6	100
Copper	mg/L																		
Total		149	128	10	9	1	6.7	38	26	0	0	0	0	42	37	0	0	0	0
Dissolved		27	27	0	0	0	0	9	9	0	0	0	0	9	9	0	0	0	0
Iron	mg/L																		
Total		148	148	126	86	40	85.1	38	38	30	28	2	78.9	42	42	34	25	9	81.0
Dissolved		28	27	5	5	0	17.9	9	9	1	1	0	11.1	9	9	0	0	0	0
Lead	mg/L																		
Total		145	93	2	2	0	1.4	38	13	0	0	0	0	42	30	0	0	0	0
Dissolved		28	10	1	0	1	3.6	9	1	0	0	0	0	9	2	0	0	0	0
Mercury ⁶	mg/L																		
Total		16	11	11	0	11	68.75	3	3	3	0	3	100	3	3	3	0	3	100
Dissolved		27	0	0	0	0	0	9	0	0	0	0	0	9	0	0	0	0	0
Molybdenum	mg/L																		
Total		148	144	0	0	0	0	38	38	0	0	0	0	42	42	0	0	0	0
Dissolved		28	28	0	0	0	0	9	9	0	0	0	0	9	9	0	0	0	0
Nickel	mg/L																		
Total		148	148	0	0	0	0	38	38	0	0	0	0	42	42	0	0	0	0
Dissolved		28	28	1	0	1	3.6	9	9	0	0	0	0	9	9	0	0	0	0
Selenium	mg/L																		
Total		148	82	3	3	0	2.0	38	17	0	0	0	0	42	25	0	0	0	0
Dissolved		28	17	0	0	0	0	9	2	0	0	0	0	9	8	0	0	0	0
Silver	mg/L																		
Total		148	16	2	2	0	1.4	38	3	1	1	0	2.6	42	6	0	0	0	0
Dissolved		28	1	1	0	1	3.6	9	0	0	0	0	0	9	0	0	0	0	0
Thallium	mg/L																		
Total		148	8	0	0	0	0	38	2	0	0	0	0	42	0	0	0	0	0
Dissolved		28	1	0	0	0	0	9	0	0	0	0	0	9	0	0	0	0	0
Uranium	µg/L																		
Total		148	140	0	0	0	0	38	38	0	0	0	0	42	38	0	0	0	0
Dissolved		27	22	1	1	0	3.7	9	9	0	0	0	0	9	6	0	0	0	0

Table 4 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Ravine, 2005 to 2009.

Parameters	Units	Total						Spring						Summer					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Zinc	mg/L																		
Total		141	124	12	11	1	8.5	35	26	0	0	0	0	38	37	2	2	0	5.3
Dissolved		27	27	0	0	0	0	9	9	0	0	0	0	9	9	0	0	0	0
Nutrients																			
Nitrate	mg/L	48	105	3	3	0	2.1	38	26	0	0	0	0	41	22	0	0	0	0
Nitrite	mg/L	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Field and Physical Parameters																			
pH ⁷																			
Field		112	0	18	11	7	16.1	33	0	3	1	2	9.1	33	0	4	4	0	12.1
Lab		144	144	0	0	0	0	38	2	0	0	0	0	41	22	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	6	0	2	2	0	33.3	2	0	0	0	0	0	2	0	2	2	0	100

Table 4 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Ravine, 2005 to 2009.

Parameters	Units	Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	
Metals													
Aluminum	mg/L												
Total		24	24	5	4	1	20.8	45	45	15	14	1	33.3
Dissolved		5	4	0	0	0	0	4	4	0	0	0	0
Arsenic	µg/L												
Total		24	24	3	2	1	12.5	45	45	7	4	3	15.6
Dissolved		5	5	0	0	0	0	4	4	0	0	0	0
Cadmium	mg/L												
Total		24	6	6	4	2	25	45	9	9	4	5	20
Dissolved		5	0	0	0	0	0	4	2	2	1	1	50
Chromium ⁵	mg/L												
Total		24	10	7	5	2	29.2	45	19	13	6	7	28.9
Dissolved		5	4	3	2	1	60	5	4	4	1	3	80
Copper	mg/L												
Total		24	21	2	2	0	8.3	45	44	8	7	1	17.8
Dissolved		5	5	0	0	0	0	4	4	0	0	0	0
Iron	mg/L												
Total		24	24	19	12	7	79.2	44	44	43	22	21	97.7
Dissolved		5	5	2	2	0	40	5	4	2	2	0	40
Lead	mg/L												
Total		24	15	1	1	0	4.2	41	37	1	1	0	2.4
Dissolved		5	3	0	0	0	0	5	3	1	0	1	20
Mercury ⁶	mg/L												
Total		1	1	1	0	1	100	7	4	4	0	4	57.1
Dissolved		5	0	0	0	0	0	4	0	0	0	0	0
Molybdenum	mg/L												
Total		24	24	0	0	0	0	44	40	0	0	0	0
Dissolved		5	5	0	0	0	0	5	5	0	0	0	0
Nickel	mg/L												
Total		24	24	0	0	0	0	44	44	0	0	0	0
Dissolved		5	5	0	0	0	0	5	5	1	0	1	20
Selenium	mg/L												
Total		24	19	1	1	0	4.2	44	31	2	2	0	4.5
Dissolved		5	2	0	0	0	0	5	3	0	0	0	0
Silver	mg/L												
Total		24	4	0	0	0	0	44	5	1	1	0	2.3
Dissolved		5	0	0	0	0	0	5	1	1	0	1	20
Thallium	mg/L												
Total		24	3	0	0	0	0	44	3	0	0	0	0
Dissolved		5	0	0	0	0	0	5	1	0	0	0	0
Uranium	µg/L												
Total		24	21	0	0	0	0	44	43	0	0	0	0

Table 4 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from West Ravine, 2005 to 2009.

Parameters	Units	Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance		
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total		Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Dissolved		5	3	0	0	0	0	4	4	1	1	0	25
Zinc	mg/L												
Total		23	21	3	3	0	13.0	45	40	7	6	1	15.6
Dissolved		5	5	0	0	0	0	4	4	0	0	0	0
Nutrients													
Nitrate	mg/L	24	22	0	0	0	0	42	35	3	3	0	7.1
Nitrite	mg/L	0	-	-	-	-	-	0	-	-	-	-	-
Field and Physical Parameters													
pH ⁷													
Field		24	0	6	4	2	25	22	0	5	2	3	22.7
Lab		24	24	0	0	0	0	43	0	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	2	0	0	0	0	0	0	-	-	-	-	-

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 5 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from East Ravine, 2006 to 2009.

Parameters	Units	Total						Spring					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance		
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total		Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Metals													
Aluminum	mg/L												
Total		147	147	36	34	2	24.5	33	33	12	10	3	36.4
Dissolved		46	43	0	0	0	0	13	13	0	0	0	0
Arsenic	µg/L												
Total		146	146	16	16	0	11.0	33	33	1	1	0	3.0
Dissolved		46	46	1	1	0	2.2	13	13	0	0	0	0
Cadmium	mg/L												
Total		147	21	19	14	5	12.9	33	3	3	2	1	9.1
Dissolved		46	0	0	0	0	0	13	0	0	0	0	0
Chromium ⁵	mg/L												
Total		147	72	29	19	10	19.7	33	10	5	3	2	15.2
Dissolved		46	36	34	14	20	73.9	13	10	9	5	4	69.2
Copper	mg/L												
Total		147	139	9	9	0	6.1	33	28	2	2	0	6.1
Dissolved		46	43	0	0	0	0	13	13	0	0	0	0
Iron	mg/L												
Total		147	147	120	114	6	81.6	33	33	29	27	2	87.9
Dissolved		46	46	0	0	0	0	13	13	0	0	0	0
Lead	mg/L												
Total		147	118	0	0	0	0	33	23	0	0	0	0
Dissolved		46	10	0	0	0	0	13	2	0	0	0	0
Mercury ⁶	mg/L												
Total		19	1	1	0	1	5.3	4	0	0	0	0	0
Dissolved		41	0	0	0	0	0	13	0	0	0	0	0
Molybdenum	mg/L												
Total		147	144	0	0	0	0	33	33	0	0	0	0
Dissolved		46	46	0	0	0	0	13	13	0	0	0	0
Nickel	mg/L												
Total		147	147	0	0	0	0	33	33	0	0	0	0
Dissolved		46	46	0	0	0	0	13	13	0	0	0	0
Selenium	mg/L												
Total		147	82	1	1	0	0.7	33	12	0	0	0	0
Dissolved		46	18	0	0	0	0	13	1	0	0	0	0
Silver	mg/L												
Total		147	13	1	1	0	0.7	33	6	0	0	0	0
Dissolved		46	0	0	0	0	0	13	0	0	0	0	0
Thallium	mg/L												
Total		147	7	1	1	0	0.7	33	2	0	0	0	0
Dissolved		46	2	0	0	0	0	13	1	0	0	0	0
Uranium	µg/L												
Total		146	142	0	0	0	0	33	33	0	0	0	0
Dissolved		46	46	0	0	0	0	13	13	0	0	0	0

Table 5 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from East Ravine, 2006 to 2009.

Parameters	Units	Total						Spring					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance		
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total		Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Zinc	mg/L												
Total		147	135	10	9	1	6.8	33	28	0	0	0	0
Dissolved		46	45	2	1	1	4.3	13	12	0	0	0	0
Nutrients													
Nitrate	mg/L	48	101	4	4	0	2.7	33	18	0	0	0	0
Nitrite	mg/L	2	0	0	0	0	0	1	0	0	0	0	0
Field and Physical Parameters													
pH ⁷													
Field		104	0	13	9	4	11.5	30	0	2	1	1	6.7
Lab		136	136	0	0	0	0	32	10	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	6	0	1	1	0	16.7	2	0	0	0	0	0

Table 5 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from East Ravine, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	
Metals																			
Aluminum	mg/L																		
Total		41	41	11	11	0	26.8	24	24	4	4	0	16.7	48	48	9	9	0	18.75
Dissolved		13	13	0	0	0	0	8	6	0	0	0	0	12	11	0	0	0	0
Arsenic	µg/L																		
Total		41	41	10	10	0	24.4	24	24	2	2	0	8.3	47	47	2	2	0	4.3
Dissolved		13	13	1	1	0	7.7	8	8	0	0	0	0	12	12	0	0	0	0
Cadmium	mg/L																		
Total		41	2	2	1	1	4.9	24	6	5	5	0	20.8	48	10	9	6	3	18.75
Dissolved		13	0	0	0	0	0	8	0	0	0	0	0	12	0	0	0	0	0
Chromium ⁵	mg/L																		
Total		41	12	8	6	2	19.5	24	10	5	4	1	20.8	48	16	11	6	5	22.9
Dissolved		13	10	9	3	6	69.2	8	7	7	4	3	87.5	12	9	9	3	6	75
Copper	mg/L																		
Total		41	39	1	1	0	2.4	24	24	1	1	0	4.2	48	47	5	5	0	10.4
Dissolved		13	13	0	0	0	0	8	8	0	0	0	0	12	10	0	0	0	0
Iron	mg/L																		
Total		41	41	37	37	0	90.2	24	24	16	16	0	66.7	48	48	39	30	9	81.25
Dissolved		13	13	0	0	0	0	8	8	0	0	0	0	12	11	0	0	0	0
Lead	mg/L																		
Total		41	32	0	0	0	0	24	22	0	0	0	0	48	40	0	0	0	0
Dissolved		13	3	0	0	0	0	8	2	0	0	0	0	12	2	0	0	0	0
Mercury ⁶	mg/L																		
Total		4	1	1	0	1	25	2	0	0	0	0	0	4	0	0	0	0	0
Dissolved		13	0	0	0	0	0	7	0	0	0	0	0	8	2	0	0	0	0
Molybdenum	mg/L																		
Total		41	41	0	0	0	0	24	24	0	0	0	0	48	45	0	0	0	0
Dissolved		13	13	0	0	0	0	8	8	0	0	0	0	12	12	0	0	0	0
Nickel	mg/L																		
Total		41	41	0	0	0	0	24	24	0	0	0	0	48	48	0	0	0	0
Dissolved		13	13	0	0	0	0	8	8	0	0	0	0	12	11	0	0	0	0
Selenium	mg/L																		
Total		41	24	1	1	0	2.4	24	16	0	0	0	0	48	29	0	0	0	0
Dissolved		13	7	0	0	0	0	8	3	0	0	0	0	12	7	0	0	0	0
Silver	mg/L																		
Total		41	3	0	0	0	0	24	4	0	0	0	0	48	3	1	1	0	2.1
Dissolved		13	0	0	0	0	0	8	0	0	0	0	0	12	0	0	0	0	0
Thallium	mg/L																		
Total		41	1	1	1	0	2.4	24	4	0	0	0	0	48	1	0	0	0	0
Dissolved		13	1	0	0	0	0	8	0	0	0	0	0	12	0	0	0	0	0
Uranium	µg/L																		
Total		41	39	0	0	0	0	24	23	0	0	0	0	47	47	0	0	0	0

Table 5 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from East Ravine, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	
Dissolved		13	13	0	0	0	0	8	8	0	0	0	0	12	12	0	0	0	0
Zinc	mg/L																		
Total		41	39	4	4	0	9.8	24	23	0	0	0	0	48	45	6	5	1	12.5
Dissolved		13	13	0	0	0	0	8	8	0	0	0	0	12	12	2	1	1	16.7
Nutrients																			
Nitrate	mg/L	41	15	0	0	0	0	24	19	1	1	0	4.2	48	48	3	3	0	6.25
Nitrite	mg/L	1	0	0	0	0	0	0	-	-	-	-	-	0	-	-	-	-	-
Field and Physical Parameters																			
pH ⁷																			
Field		29	0	2	2	0	6.9	21	0	4	3	1	19.0	22	0	5	3	2	22.7
Lab		37	12	0	0	0	0	23	7	0	0	0	0	43	0	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	2	0	1	1	0	50	2	0	0	0	0	0	0	-	-	-	-	-

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 6 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Duke Ravine, 2008 to 2009.

Parameters	Units	Total						Spring					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance		
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total		Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Metals													
Aluminum	mg/L												
Total		13	13	3	2	1	23.1	4	4	3	2	1	75
Dissolved		10	10	1	1	0	10	3	3	1	1	0	33.3
Arsenic	µg/L												
Total		13	13	0	0	0	0	4	4	0	0	0	0
Dissolved		10	10	1	1	0	10	3	3	1	1	0	33.3
Cadmium	mg/L												
Total		13	1	1	1	0	7.7	4	1	1	1	0	25
Dissolved		10	1	1	0	1	10	3	1	1	0	1	33.3
Chromium ⁵	mg/L												
Total		13	6	4	4	0	30.8	4	4	3	3	0	75
Dissolved		10	9	8	2	6	80	3	3	3	1	2	100
Copper	mg/L												
Total		13	13	1	1	0	7.7	4	4	1	1	0	25
Dissolved		10	10	1	1	0	10	3	3	1	1	0	33.3
Iron	mg/L												
Total		13	13	6	5	1	46.2	4	4	3	2	1	75
Dissolved		10	10	1	0	1	10	3	3	1	0	1	33.3
Lead	mg/L												
Total		13	10	0	0	0	0	4	4	0	0	0	0
Dissolved		10	5	0	0	0	0	3	2	0	0	0	0
Mercury ⁶	mg/L												
Total		3	0	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-
Molybdenum	mg/L												
Total		13	13	0	0	0	0	4	4	0	0	0	0
Dissolved		10	10	0	0	0	0	3	3	0	0	0	0
Nickel	mg/L												
Total		13	13	0	0	0	0	4	4	0	0	0	0
Dissolved		10	10	0	0	0	0	3	3	0	0	0	0
Selenium	mg/L												
Total		13	10	0	0	0	0	4	4	0	0	0	0
Dissolved		10	7	0	0	0	0	3	1	0	0	0	0
Silver	mg/L												
Total		13	0	0	0	0	0	4	0	0	0	0	0
Dissolved		10	0	0	0	0	0	3	0	0	0	0	0
Thallium	mg/L												
Total		13	0	0	0	0	0	4	0	0	0	0	0
Dissolved		10	0	0	0	0	0	3	0	0	0	0	0
Uranium	µg/L												
Total		13	13	0	0	0	0	4	4	0	0	0	0
Dissolved		10	10	0	0	0	0	3	3	0	0	0	0

Table 6 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Duke Ravine, 2008 to 2009.

Parameters	Units	Total						Spring					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance		
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total		Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Zinc	mg/L												
Total		13	12	1	1	0	7.7	4	3	1	1	0	25
Dissolved		10	10	1	1	0	10	3	3	1	1	0	33.3
Nutrients													
Nitrate	mg/L	48	12	1	1	0	7.7	4	4	0	0	0	0
Nitrite	mg/L	0	-	-	-	-	-	0	-	-	-	-	-
Field and Physical Parameters													
pH ⁷													
Field		13	0	2	2	0	15.4	4	0	0	0	0	0
Lab		13	13	0	0	0	0	4	1	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	3	0	1	1	0	33.3	1	0	0	0	0	0

Table 6 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Duke Ravine, 2008 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N \geq DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N \geq DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N \geq DL ³	Number of Exceedances ⁴		% Exceedance			
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by \geq Order of Magnitude	Total				Exceeds GL by < Order of Magnitude	Exceeds GL by \geq Order of Magnitude		Total	Exceeds GL by < Order of Magnitude	Exceeds GL by \geq Order of Magnitude
Metals																			
Aluminum	mg/L																		
Total		4	4	0	0	0	2	2	0	0	0	0	3	3	0	0	0	0	0
Dissolved		3	3	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0	0
Arsenic	μ g/L																		
Total		4	4	0	0	0	2	2	0	0	0	0	3	3	0	0	0	0	0
Dissolved		3	3	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0	0
Cadmium	mg/L																		
Total		4	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0
Dissolved		3	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0
Chromium ⁵	mg/L																		
Total		4	0	0	0	0	2	1	0	0	0	0	3	1	1	1	1	0	33.3
Dissolved		3	3	2	0	2	1	1	1	1	0	100	3	2	2	0	2	66.7	
Copper	mg/L																		
Total		4	4	0	0	0	2	2	0	0	0	0	3	3	0	0	0	0	0
Dissolved		3	3	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0	0
Iron	mg/L																		
Total		4	4	1	1	0	2	2	0	0	0	0	3	3	2	2	0	66.7	
Dissolved		3	3	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0	0
Lead	mg/L																		
Total		4	3	0	0	0	2	1	0	0	0	0	3	3	0	0	0	0	0
Dissolved		3	0	0	0	0	1	1	0	0	0	0	3	2	0	0	0	0	0
Mercury ⁶	mg/L																		
Total		0	-	-	-	-	0	-	-	-	-	-	3	0	0	0	0	0	0
Dissolved		0	-	-	-	-	0	-	-	-	-	-	3	0	0	0	0	0	0
Molybdenum	mg/L																		
Total		4	4	0	0	0	2	2	0	0	0	0	3	3	0	0	0	0	0
Dissolved		3	3	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0	0
Nickel	mg/L																		
Total		4	4	0	0	0	2	2	0	0	0	0	3	3	0	0	0	0	0
Dissolved		3	3	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0	0
Selenium	mg/L																		
Total		4	2	0	0	0	2	1	0	0	0	0	3	3	0	0	0	0	0
Dissolved		3	3	0	0	0	1	0	0	0	0	0	3	3	0	0	0	0	0
Silver	mg/L																		
Total		4	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0
Dissolved		3	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0
Thallium	mg/L																		
Total		4	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0
Dissolved		3	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0
Uranium	μ g/L																		
Total		4	4	0	0	0	2	2	0	0	0	0	3	3	0	0	0	0	0

Table 6 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Duke Ravine, 2008 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N \geq DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N \geq DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N \geq DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by \geq Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by \geq Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by \geq Order of Magnitude				
Dissolved Zinc	mg/L	3	3	0	0	0	1	1	0	0	0	3	3	0	0	0	0		
Total Zinc		4	4	0	0	0	2	2	0	0	0	3	3	0	0	0	0		
Dissolved Nutrients		3	3	0	0	0	1	1	0	0	0	3	3	0	0	0	0		
Nitrate	mg/L	4	3	0	0	0	2	2	0	0	0	3	3	1	1	0	33.3		
Nitrite	mg/L	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-		
Field and Physical Parameters																			
pH ⁷																			
Field		4	0	1	1	0	2	0	0	0	0	3	0	1	1	0	33.3		
Lab		4	1	0	0	0	2	2	0	0	0	3	0	0	0	0	0		
Dissolved oxygen (field) ⁸	mg/L	1	0	1	1	0	1	0	0	0	0	0	-	-	-	-	-		

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) \geq analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log₁₀ scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10 .

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 7 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Wapiti Ravine, 2008.

Parameters	Units	Total						Spring						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		
Metals														
Aluminum	mg/L													
Total		3	3	1	1	0	33.3	1	1	1	1	0	100	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Arsenic	µg/L													
Total		3	3	0	0	0	0	1	1	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Cadmium	mg/L													
Total		3	1	1	1	0	33.3	1	1	1	1	0	100	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Chromium ⁵	mg/L													
Total		3	2	2	2	0	66.7	1	1	1	1	0	100	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Copper	mg/L													
Total		3	3	1	1	0	33.3	1	1	1	1	0	100	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Iron	mg/L													
Total		3	3	2	1	1	66.7	1	1	1	0	1	100	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Lead	mg/L													
Total		3	2	0	0	0	0	1	1	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Mercury ⁶	mg/L													
Total		0	-	-	-	-	-	0	-	-	-	-	-	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Molybdenum	mg/L													
Total		3	3	0	0	0	0	1	1	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Nickel	mg/L													
Total		3	3	0	0	0	0	1	1	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Selenium	mg/L													
Total		3	3	0	0	0	0	1	1	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Silver	mg/L													
Total		3	1	0	0	0	0	1	0	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Thallium	mg/L													
Total		3	0	0	0	0	0	1	0	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	
Uranium	µg/L													
Total		3	3	0	0	0	0	1	1	0	0	0	0	
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	

Table 7 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Wapiti Ravine, 2008.

Parameters	Units	Total						Spring					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	
Zinc	mg/L												
Total		3	3	0	0	0	0	1	1	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-
Nutrients													
Nitrate	mg/L	48	3	0	0	0	0	1	1	0	0	0	0
Nitrite	mg/L	0	-	-	-	-	-	0	-	-	-	-	-
Field and Physical Parameters													
pH ⁷													
Field		3	0	0	0	0	0	1	0	0	0	0	0
Lab		3	3	0	0	0	0	1	1	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	3	0	1	1	0	33.3	1	0	0	0	0	0

Table 7 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Wapiti Ravine, 2008.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude
Metals																			
Aluminum	mg/L																		
Total		1	1	0	0	0	0	1	1	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Arsenic	µg/L																		
Total		1	1	0	0	0	0	1	1	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Cadmium	mg/L																		
Total		1	0	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Chromium ⁵	mg/L																		
Total		1	1	1	1	0	100	1	0	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Copper	mg/L																		
Total		1	1	0	0	0	0	1	1	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Iron	mg/L																		
Total		1	1	1	1	0	100	1	1	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Lead	mg/L																		
Total		1	1	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Mercury ⁶	mg/L																		
Total		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Molybdenum	mg/L																		
Total		1	1	0	0	0	0	1	1	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Nickel	mg/L																		
Total		1	1	0	0	0	0	1	1	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Selenium	mg/L																		
Total		1	1	0	0	0	0	1	1	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Silver	mg/L																		
Total		1	1	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Thallium	mg/L																		
Total		1	0	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	-
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Uranium	µg/L																		
Total		1	1	0	0	0	0	1	1	0	0	0	0	0	-	-	-	-	-

Table 7 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from Wapiti Ravine, 2008.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Dissolved Zinc	mg/L	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-	-	
Total Zinc		1	1	0	0	0	1	1	0	0	0	0	-	-	-	-	-	-	
Dissolved Nutrients		0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-	-	
Nitrate	mg/L	1	1	0	0	0	1	1	0	0	0	0	-	-	-	-	-	-	
Nitrite	mg/L	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-	-	
Field and Physical Parameters																			
pH ⁷																			
Field		1	0	0	0	0	1	0	0	0	0	0	-	-	-	-	-	-	
Lab		1	1	0	0	0	1	1	0	0	0	0	-	-	-	-	-	-	
Dissolved oxygen (field) ⁸	mg/L	1	0	1	1	0	1	0	0	0	0	0	-	-	-	-	-	-	

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 8 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from English Creek, 2006 to 2009.

Parameters	Units	Total						Spring						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		
Metals														
Aluminum	mg/L													
	Total	27	27	5	4	1	18.5	8	8	3	2	1	37.5	
	Dissolved	14	14	0	0	0	0	5	5	0	0	0	0	
Arsenic	µg/L													
	Total	27	27	13	13	0	48.1	8	8	3	3	0	37.5	
	Dissolved	14	14	2	2	0	14.3	5	5	0	0	0	0	
Cadmium	mg/L													
	Total	27	3	3	0	3	11.1	8	0	0	0	0	0	
	Dissolved	14	1	1	1	0	7.1	5	0	0	0	0	0	
Chromium ⁵	mg/L													
	Total	27	10	7	4	3	25.9	8	2	1	1	0	12.5	
	Dissolved	14	11	10	6	4	71.4	5	4	4	2	2	80	
Copper	mg/L													
	Total	27	25	0	0	0	0	8	7	0	0	0	0	
	Dissolved	14	13	1	1	0	7.1	5	4	0	0	0	0	
Iron	mg/L													
	Total	27	27	26	26	0	96.3	8	8	7	7	0	87.5	
	Dissolved	14	14	2	2	0	14.3	5	5	0	0	0	0	
Lead	mg/L													
	Total	27	12	0	0	0	0	8	3	0	0	0	0	
	Dissolved	14	8	0	0	0	0	5	2	0	0	0	0	
Mercury ⁶	mg/L													
	Total	6	0	0	0	0	0	2	0	0	0	0	0	
	Dissolved	6	1	1	1	0	16.7	2	0	0	0	0	0	
Molybdenum	mg/L													
	Total	27	26	0	0	0	0	8	8	0	0	0	0	
	Dissolved	14	14	0	0	0	0	5	5	0	0	0	0	
Nickel	mg/L													
	Total	27	27	0	0	0	0	8	8	0	0	0	0	
	Dissolved	14	14	0	0	0	0	5	5	0	0	0	0	
Selenium	mg/L													
	Total	27	10	1	1	0	3.7	8	3	0	0	0	0	
	Dissolved	14	3	0	0	0	0	5	0	0	0	0	0	
Silver	mg/L													
	Total	27	0	0	0	0	0	8	0	0	0	0	0	
	Dissolved	14	0	0	0	0	0	5	0	0	0	0	0	
Thallium	mg/L													
	Total	27	0	0	0	0	0	8	0	0	0	0	0	
	Dissolved	14	0	0	0	0	0	5	0	0	0	0	0	
Uranium	µg/L													
	Total	26	21	0	0	0	0	8	4	0	0	0	0	
	Dissolved	14	4	0	0	0	0	5	3	0	0	0	0	

Table 8 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from English Creek, 2006 to 2009.

Parameters	Units	Total						Spring						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		
Zinc	mg/L													
Total		27	25	1	1	0	3.7	8	6	0	0	0	0	0
Dissolved		14	11	2	2	0	14.3	5	4	0	0	0	0	0
Nutrients														
Nitrate	mg/L	48	19	1	1	0	3.8	8	5	0	0	0	0	0
Nitrite	mg/L	6	1	0	0	0	0	2	0	0	0	0	0	0
Field and Physical Parameters														
pH ⁷														
Field		22	0	1	1	0	4.5	6	0	0	0	0	0	0
Lab		27	27	0	0	0	0	8	8	0	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	6	0	2	2	0	33.3	2	0	0	0	0	0	0

Table 8 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from English Creek, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total				
Metals																			
Aluminum	mg/L																		
Total		9	9	2	2	0	22.2	4	4	0	0	0	0	6	6	0	0	0	0
Dissolved		5	5	0	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0
Arsenic	µg/L																		
Total		9	9	6	6	0	66.7	4	4	0	0	0	0	6	6	4	4	0	66.7
Dissolved		5	5	1	1	0	20	1	1	0	0	0	0	3	3	0	0	0	0
Cadmium	mg/L																		
Total		9	2	2	0	2	22.2	4	0	0	0	0	0	6	1	1	0	1	16.7
Dissolved		5	1	1	1	0	20	1	0	0	0	0	0	3	0	0	0	0	0
Chromium ⁵	mg/L																		
Total		9	4	2	2	0	22.2	4	1	1	1	0	25	6	3	3	0	3	50
Dissolved		5	3	3	2	1	60	1	1	1	0	1	100	3	3	2	2	0	66.7
Copper	mg/L																		
Total		9	8	0	0	0	0	4	4	0	0	0	0	6	6	0	0	0	0
Dissolved		5	5	1	1	0	20	1	1	0	0	0	0	3	3	0	0	0	0
Iron	mg/L																		
Total		9	9	9	9	0	100	4	4	4	4	0	100	6	6	6	6	0	100
Dissolved		5	5	1	1	0	20	1	1	0	0	0	0	3	3	1	1	0	33.3
Lead	mg/L																		
Total		9	4	0	0	0	0	4	1	0	0	0	0	6	4	0	0	0	0
Dissolved		5	5	0	0	0	0	1	0	0	0	0	0	3	1	0	0	0	0
Mercury ⁶	mg/L																		
Total		2	0	0	0	0	0	0	-	-	-	-	-	2	0	0	0	0	0
Dissolved		2	1	1	0	1	50	0	-	-	-	-	-	2	0	0	0	0	0
Molybdenum	mg/L																		
Total		9	9	0	0	0	0	4	4	0	0	0	0	6	5	0	0	0	0
Dissolved		5	5	0	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0
Nickel	mg/L																		
Total		9	9	0	0	0	0	4	4	0	0	0	0	6	6	0	0	0	0
Dissolved		5	5	0	0	0	0	1	1	0	0	0	0	3	3	0	0	0	0
Selenium	mg/L																		
Total		9	4	1	1	0	11.1	4	2	0	0	0	0	6	1	0	0	0	0
Dissolved		5	1	0	0	0	0	1	0	0	0	0	0	3	2	0	0	0	0
Silver	mg/L																		
Total		9	0	0	0	0	0	4	0	0	0	0	0	6	0	0	0	0	0
Dissolved		5	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0
Thallium	mg/L																		
Total		9	0	0	0	0	0	4	0	0	0	0	0	6	0	0	0	0	0
Dissolved		5	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0
Uranium	µg/L																		
Total		9	4	0	0	0	0	4	2	0	0	0	0	6	0	0	0	0	0

Table 8 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from English Creek, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Dissolved Zinc	mg/L	5	1	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	
Total		9	9	0	0	0	4	4	0	0	0	6	6	1	1	0	16.7		
Dissolved		5	3	1	1	20	1	1	0	0	0	3	3	1	1	0	33.3		
Nutrients																			
Nitrate	mg/L	8	5	0	0	0	4	4	0	0	0	6	6	1	1	0	16.7		
Nitrite	mg/L	2	0	0	0	0	0	-	-	-	-	2	1	0	0	0	0		
Field and Physical Parameters																			
pH ⁷																			
Field		7	0	0	0	0	4	0	0	0	0	5	0	1	1	0	20		
Lab		9	0	0	0	0	4	4	0	0	0	6	6	0	0	0	0		
Dissolved oxygen (field) ⁸	mg/L	2	0	2	2	100	2	0	0	0	0	0	-	-	-	-	-		

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 9 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River within the Project's LSA, 2006 to 2009.

Parameters	Units	Total						Spring						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Total	Exceeds GL by < Order of Magnitude				Exceeds GL by ≥ Order of Magnitude	Total		Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	
Metals														
Aluminum	mg/L													
Total		29	29	13	11	2	44.8	8	8	6	4	2	75	
Dissolved		9	9	0	0	0	0	2	2	0	0	0	0	
Arsenic	µg/L													
Total		30	29	0	0	0	0	8	8	0	0	0	0	
Dissolved		9	8	0	0	0	0	2	2	0	0	0	0	
Cadmium	mg/L													
Total		27	13	11	11	0	40.7	8	5	3	3	0	37.5	
Dissolved		9	2	2	2	0	22.2	2	0	0	0	0	0	
Chromium ⁵	mg/L													
Total		30	14	11	11	0	36.7	8	6	3	3	0	37.5	
Dissolved		9	7	7	5	2	77.8	2	2	2	2	0	100	
Copper	mg/L													
Total		30	30	5	5	0	16.7	8	8	4	4	0	50	
Dissolved		9	9	0	0	0	0	2	2	0	0	0	0	
Iron	mg/L													
Total		30	30	17	17	0	56.7	8	8	7	7	0	87.5	
Dissolved		9	9	0	0	0	0	2	2	0	0	0	0	
Lead	mg/L													
Total		30	26	0	0	0	0	8	8	0	0	0	0	
Dissolved		9	4	0	0	0	0	2	1	0	0	0	0	
Mercury ⁶	mg/L													
Total		3	0	0	0	0	0	2	0	0	0	0	0	
Dissolved		3	0	0	0	0	0	2	0	0	0	0	0	
Molybdenum	mg/L													
Total		30	30	0	0	0	0	8	8	0	0	0	0	
Dissolved		9	9	0	0	0	0	2	2	0	0	0	0	
Nickel	mg/L													
Total		30	30	0	0	0	0	8	8	0	0	0	0	
Dissolved		9	9	0	0	0	0	2	2	0	0	0	0	
Selenium	mg/L													
Total		30	28	0	0	0	0	8	7	0	0	0	0	
Dissolved		9	6	0	0	0	0	2	0	0	0	0	0	
Silver	mg/L													
Total		30	3	1	1	0	3.3	8	0	0	0	0	0	
Dissolved		9	2	0	0	0	0	2	0	0	0	0	0	
Thallium	mg/L													
Total		30	2	0	0	0	0	8	0	0	0	0	0	
Dissolved		9	2	0	0	0	0	2	0	0	0	0	0	
Uranium	µg/L													
Total		30	30	0	0	0	0	8	8	0	0	0	0	
Dissolved		9	9	0	0	0	0	2	2	0	0	0	0	

Table 9 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River within the Project's LSA, 2006 to 2009.

Parameters	Units	Total						Spring						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		
Zinc	mg/L													
Total		30	28	0	0	0	0	8	8	0	0	0	0	0
Dissolved		9	6	0	0	0	0	2	0	0	0	0	0	0
Nutrients														
Nitrate	mg/L	48	20	0	0	0	0	8	5	0	0	0	0	0
Nitrite	mg/L	3	0	0	0	0	0	2	0	0	0	0	0	0
Field and Physical Parameters														
pH ⁷														
Field		19	0	1	1	0	5.3	4	0	0	0	0	0	0
Lab		30	30	0	0	0	0	8	8	0	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	12	0	5	5	0	41.7	4	0	2	2	0	0	50

Table 9 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River within the Project's LSA, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance
				Total						Total						Total			
Metals																			
Aluminum	mg/L																		
Total		11	11	6	6	0	54.5	10	10	1	1	0	10	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	5	0	0	0	0	0	-	-	-	-	-
Arsenic	µg/L																		
Total		11	11	0	0	0	0	11	10	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	4	0	0	0	0	0	-	-	-	-	-
Cadmium	mg/L																		
Total		9	5	5	5	0	55.6	10	4	3	3	0	30	0	-	-	-	-	-
Dissolved		2	2	2	2	0	100	5	0	0	0	0	0	0	-	-	-	-	-
Chromium ⁵	mg/L																		
Total		11	6	6	6	0	54.5	11	2	2	2	0	18.2	0	-	-	-	-	-
Dissolved		2	2	2	1	1	100	5	3	3	2	1	60	0	-	-	-	-	-
Copper	mg/L																		
Total		11	11	1	1	0	9.1	11	11	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	5	0	0	0	0	0	-	-	-	-	-
Iron	mg/L																		
Total		11	11	8	8	0	72.7	11	11	2	2	0	18.2	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	5	0	0	0	0	0	-	-	-	-	-
Lead	mg/L																		
Total		11	9	0	0	0	0	11	9	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	1	0	0	0	0	0	-	-	-	-	-
Mercury ⁶	mg/L																		
Total		0	-	-	-	-	-	1	0	0	0	0	0	0	-	-	-	-	-
Dissolved		1	0	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	-
Molybdenum	mg/L																		
Total		11	11	0	0	0	0	11	11	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	5	0	0	0	0	0	-	-	-	-	-
Nickel	mg/L																		
Total		11	11	0	0	0	0	11	11	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	5	0	0	0	0	0	-	-	-	-	-
Selenium	mg/L																		
Total		11	11	0	0	0	0	11	10	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	4	0	0	0	0	0	-	-	-	-	-
Silver	mg/L																		
Total		11	3	1	1	0	9.1	11	0	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	0	0	0	0	0	0	-	-	-	-	-
Thallium	mg/L																		
Total		11	2	0	0	0	0	11	0	0	0	0	0	0	-	-	-	-	-
Dissolved		2	2	0	0	0	0	5	0	0	0	0	0	0	-	-	-	-	-
Uranium	µg/L																		
Total		11	11	0	0	0	0	11	11	0	0	0	0	0	-	-	-	-	-

Table 9 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River within the Project's LSA, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				
Dissolved Zinc	mg/L	2	2	0	0	0	5	5	0	0	0	0	0	-	-	-	-	-	
Total Zinc		11	10	0	0	0	11	10	0	0	0	0	0	-	-	-	-	-	
Dissolved Nutrients		2	2	0	0	0	5	4	0	0	0	0	0	-	-	-	-	-	
Nitrate	mg/L	11	5	0	0	0	11	10	0	0	0	0	0	-	-	-	-	-	
Nitrite	mg/L	0	-	-	-	-	1	0	0	0	0	0	0	-	-	-	-	-	
Field and Physical Parameters																			
pH ⁷																			
Field		7	0	0	0	0	8	0	1	1	0	12.5	0	-	-	-	-	-	
Lab		11	11	0	0	0	11	11	0	0	0	0	0	-	-	-	-	-	
Dissolved oxygen (field) ⁸	mg/L	4	0	3	3	0	4	0	0	0	0	0	0	-	-	-	-	-	

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 10 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River system within the Project's RSA, 2006 to 2009.

Parameters	Units	Total						Spring						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		
Metals														
Aluminum	mg/L													
		Total	28	28	10	8	2	35.7	4	4	2	2	0	50
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Arsenic	µg/L													
		Total	23	23	0	0	0	0	4	4	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Cadmium	mg/L													
		Total	28	2	2	1	1	7.1	4	0	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Chromium ⁵	mg/L													
		Total	28	9	4	2	2	14.3	4	1	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Copper	mg/L													
		Total	28	24	4	4	0	14.3	4	3	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Iron	mg/L													
		Total	28	28	12	9	3	42.9	4	4	3	2	1	75
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Lead	mg/L													
		Total	28	8	0	0	0	0	4	0	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Mercury ⁶	mg/L													
		Total	44	5	1	0	1	2.3	6	1	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Molybdenum	mg/L													
		Total	28	16	0	0	0	0	4	2	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Nickel	mg/L													
		Total	28	22	0	0	0	0	4	2	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Selenium	mg/L													
		Total	23	23	0	0	0	0	4	4	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Silver	mg/L													
		Total	28	1	0	0	0	0	4	0	0	0	0	0
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Thallium	mg/L													
		Total	6	0	0	0	0	0	0	-	-	-	-	-
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-
Uranium	µg/L													
		Total	6	6	0	0	0	0	0	-	-	-	-	-
		Dissolved	0	-	-	-	-	-	0	-	-	-	-	-

Table 10 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River system within the Project's RSA, 2006 to 2009.

Parameters	Units	Total						Spring						
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴			% Exceedance	
				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Total	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude		
Zinc	mg/L													
Total		28	11	2	2	0	7.1	4	1	0	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	-
Nutrients														
Dissolved nitrate	mg/L	56	36	0	0	0	0	7	2	0	0	0	0	0
Field and Physical Parameters														
pH ⁷														
Field		50	0	3	2	1	6	7	0	0	0	0	0	0
Lab		54	54	0	0	0	0	7	4	0	0	0	0	0
Dissolved oxygen (field) ⁸	mg/L	53	0	26	26	0	49.1	7	0	5	5	0	0	71.4

Table 10 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River system within the Project's RSA, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴	Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude	% Exceedance
				Total						Total						Total			
Metals																			
Aluminum	mg/L																		
Total		9	9	6	3	3	66.7	9	9	1	1	0	11.1	6	6	1	1	0	16.7
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Arsenic	µg/L																		
Total		5	5	0	0	0	0	8	8	0	0	0	0	6	6	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Cadmium	mg/L																		
Total		9	0	0	0	0	0	9	0	0	0	0	0	6	2	2	1	1	33.3
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Chromium ⁵	mg/L																		
Total		9	5	3	1	2	33.3	9	0	0	0	0	0	6	3	1	1	0	16.7
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Copper	mg/L																		
Total		9	9	2	2	0	22.2	9	7	0	0	0	0	6	4	2	2	0	33.3
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Iron	mg/L																		
Total		9	9	6	4	2	66.7	9	9	1	1	0	11.1	6	6	2	2	0	33.3
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Lead	mg/L																		
Total		9	4	0	0	0	0	9	2	0	0	0	0	6	2	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Mercury ⁶	mg/L																		
Total		13	1	0	0	0	0	15	3	1	0	1	6.7	10	0	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Molybdenum	mg/L																		
Total		9	5	0	0	0	0	9	3	0	0	0	0	6	5	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Nickel	mg/L																		
Total		9	8	0	0	0	0	9	7	0	0	0	0	6	5	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Selenium	mg/L																		
Total		5	5	0	0	0	0	8	8	0	0	0	0	6	6	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Silver	mg/L																		
Total		9	1	0	0	0	0	9	1	0	0	0	0	6	1	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Thallium	mg/L																		
Total		2	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0
Dissolved		0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Uranium	µg/L																		
Total		2	2	0	0	0	0	2	2	0	0	0	0	2	2	0	0	0	0

Table 10 Exceedances of SSWQO1 and/or CWQG2 guidelines for surface water quality samples from the Saskatchewan River system within the Project's RSA, 2006 to 2009.

Parameters	Units	Summer						Fall						Winter					
		Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance	Number of Sampling Events	N ≥ DL ³	Number of Exceedances ⁴		% Exceedance			
Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude			Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude				Exceeds GL by < Order of Magnitude	Exceeds GL by ≥ Order of Magnitude									
Dissolved		0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-	-	
Zinc	mg/L																		
Total		9	5	0	0	0	9	2	0	0	0	6	2	2	2	0	33.3		
Dissolved		0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-		
Nutrients																			
Dissolved nitrate	mg/L	20	8	0	0	0	17	11	0	0	0	12	12	0	0	0	0		
Field and Physical Parameters																			
pH ⁷																			
Field		18	0	2	1	1	11.1	0	1	1	0	7.7	0	0	0	0	0		
Lab		20	1	0	0	0	0	5	0	0	0	0	3	0	0	0	0		
Dissolved oxygen (field) ⁸	mg/L	19	0	14	14	0	73.7	0	0	0	0	0	0	7	7	0	63.6		

Notes: 1SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

2CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2007).

3Number of samples (N) ≥ analytical detection limit (DL).

4Guidelines (GL) for dissolved components of parameters are not available; therefore, concentrations were compared with guidelines for total concentrations to evaluate exceedances of bioavailable concentrations.

5SSWQO contain a guideline for only hexavalent chromium (Cr VI); comparisons of total chromium concentrations with this guideline are conservative.

6Mercury guideline is for inorganic mercury, rather than total mercury; therefore, exceedances err on the side of caution.

7Because pH is based on a log10 scale, values were considered an order of magnitude different from the guidelines if they were ≤ 5.5 or ≥ 10.

8Dissolved oxygen concentrations are problematic if they fall below the recommended values; thus values listed as exceedances are less than guideline values.

Table 11 Summary of particle size from sediments collected from eight tributaries in the Project LSA, October 2007 and November 2008.

Tributary	Sediment Composition by Particle Size (% weight) ¹				
	Clay	Coarse Sand	Fine Sand	Gravel	Silt
Caution Creek					
N ²	5	5	5	5	5
N < Detection Limit	0	0	0	5	0
Mean	3.8	50.8	40.6	<1	5.2
Standard Deviation	1.3	21.44	17.39	0	3.42
Median	4	42	49	<1	5
Minimum	2	32	16	<1	2
Maximum	5	79	57	<1	10
101 Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	2	0
Mean	2.6	84.8	7.2	4	2
Standard Deviation	1.52	8.61	3.27	4.64	0.71
Median	2	89	6	2	2
Minimum	1	75	4	<1	1
Maximum	5	93	12	12	3
West Perimeter Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	4	0
Mean	4.4	82.6	9.4	2	2.2
Standard Deviation	1.52	5.13	2.61	2.24	1.3
Median	4	81	9	<1	2
Minimum	3	77	6	<1	1
Maximum	7	88	12	6	4
West Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	4	0
Mean	3.2	72.6	19.4	3.4	2.6
Standard Deviation	1.3	12.7	10.97	5.37	1.52
Median	3	77	17	<1	2
Minimum	2	52	10	<1	1
Maximum	5	86	38	13	5
East Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	5	1
Mean	3.4	72.6	18.4	<1	5.8
Standard Deviation	3.36	28.4	16.65	0	8.58
Median	2	84	12	<1	2
Minimum	1	25	2	<1	<1
Maximum	9	96	45	<1	21
Duke Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	3	0
Mean	7.4	47.4	35	1.4	9.8
Standard Deviation	2.88	23.48	15.86	0.89	6.14
Median	7	42	36	<1	9
Minimum	5	17	19	<1	3
Maximum	12	73	53	3	19
FALC Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	4	0
Mean	11.8	61.4	21.8	1	4.6
Standard Deviation	3.19	9.32	8.26	0	2.51
Median	12	67	18	<1	4
Minimum	7	47	14	<1	3
Maximum	16	69	33	1	9
English Creek					
N	5	5	5	5	5
N < Detection Limit	0	0	0	5	0
Mean	9	22.4	51.4	<1	16.6
Standard Deviation	3.39	23.64	15.5	0	8.76
Median	10	18	55	<1	18
Minimum	5	3	26	<1	6
Maximum	13	63	65	<1	28

Notes: 1Values below the analytical detection limit were set to the detection limit (1% weight) for the calculation of means, and standard deviation could not be calculated. In this scenario, minimum values were unknown and reported as <1; if all values were below the detection limit the maximum value was also unknown and reported as <1.

2N = number of samples.

Table 12 Summary of particle size from sediments collected from the Saskatchewan River in the Project LSA, October 2007 and 2008.

Location in Saskatchewan River	Sediment Composition by Particle Size (% weight) ¹				
	Clay	Coarse Sand	Fine Sand	Gravel	Silt
Upstream of Caution Creek					
N	5	5	5	5	5
N < Detection Limit	0	0	0	5	0
Mean	11.8	1.8	59.4	<1	26.8
Standard Deviation	3.56	1.79	8.17	0	6.69
Median	13	1	56	<1	30
Minimum	6	1	52	<1	16
Maximum	15	5	72	<1	33
Downstream of Caution Creek					
N	5	5	5	5	5
N < Detection Limit	0	0	0	5	0
Mean	5.8	31	53.2	1	10
Standard Deviation	4.32	20.93	14.2	0	8.22
Median	5	29	48	<1	8
Minimum	1	5	39	<1	1
Maximum	12	59	74	<1	22
Downstream of 101 Ravine					
N	5	5	5	5	5
N < Detection Limit	1	1	0	5	0
Mean	2.6	21.4	73.6	1	2.8
Standard Deviation	1.14	17.39-	16.07	0	1.1
Median	3	27.5	76	<1	3
Minimum	<1	<1	56	<1	1
Maximum	4	40	94	<1	4
Downstream of West Perimeter Ravine					
N	5	5	5	5	5
N < Detection Limit	0	2	0	5	0
Mean	20.8	3.3	40.3	1	36.3
Standard Deviation	7.93	2.63	23.41	0	17.46
Median	23	5	35	<1	37
Minimum	9	<1	20	<1	12
Maximum	26	6	74	<1	53
Downstream of West Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	5	0
Mean	7	8.8	70.2	1	14.2
Standard Deviation	2.92	8.32	9.88	0	8.93
Median	8	10	72	<1	14
Minimum	3	1	54	<1	4
Maximum	10	21	79	<1	25
Downstream of East Ravine					
N	6	6	6	6	6
N < Detection Limit	0	0	0	6	1
Mean	2.3	36	60.3	1	1.5
Standard Deviation	0.52	27.03	26.26	0	0.55-
Median	2	36	59.5	<1	2
Minimum	2	5	21	<1	<1
Maximum	3	77	91	<1	2
Downstream of Duke Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	4	0
Mean	9.2	14	63.6	1	13
Standard Deviation	7.85	16.17	26.36	0	14.83
Median	6	8	79	<1	7
Minimum	4	2	31	<1	3
Maximum	23	42	85	1	39
Downstream of FALC Ravine					
N	5	5	5	5	5
N < Detection Limit	0	0	0	5	0
Mean	23.4	2.2	40.6	1	33.6
Standard Deviation	11.35	2.17	23.89	0	13.9
Median	23	1	40	<1	36
Minimum	12	1	10	<1	16
Maximum	40	6	70	<1	49
Downstream of Wapiti Ravine					
N	5	5	5	5	5
N < Detection Limit	0	3	0	5	0
Mean	22.2	1.2	39.8	1	37.6
Standard Deviation	7.16	0.45	20.49	0	13.67
Median	26	1.5	28	<1	44
Minimum	13	<1	22	<1	22
Maximum	28	2	65	<1	52
Downstream of English Creek					
N	5	5	5	5	5
N < Detection Limit	0	1	0	5	0
Mean	15.2	4	40.2	1	40.8
Standard Deviation	6.38	6.71	16.33	0	16.25
Median	17	1	33	<1	49

Table 12 Summary of particle size from sediments collected from the Saskatchewan River in the Project LSA, October 2007 and 2008.

Location in Saskatchewan River	Sediment Composition by Particle Size (% weight) ¹				
	Clay	Coarse Sand	Fine Sand	Gravel	Silt
Minimum	5	<1	26	<1	17
Maximum	22	16	62	<1	55

Note: ¹Values below the analytical detection limit were set to the detection limit (1% weight) for the calculation of means, and standard deviation could not be calculated. In this scenario, minimum values were unknown and reported as <1; if all values were below the detection limit the maximum value was also unknown and reported as <1.

Table 13 Sediment chemistry summary statistics for tributaries in the Project LSA, October 2007 and November 2008.

Tributary	Statistic	Inorganic Ions (µg/g)				Sulfate, acid soluble	Metals > Guidelines (µg/g)		Nutrients	
		Calcium	Magnesium	Potassium	Sodium		Arsenic	Vanadium	Organic carbon (%)	Phosphorus (µg/g)
	ISQG ¹						5.9			
	PEL ²						17.0			
	LEL ³						9.8	35.2		
Caution Creek	N ⁴	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	1	0	0	0	0	0
	N > guidelines	-	-	-	-	-	5	0	-	-
	Mean	3462	1640	514	105	208	11	18	0.08	242
	Standard deviation	1060.3	433.6	76.4	49.7	82.0	3.6	4.7	0.139	74.0
	Median	3280	1600	560	130	210	9.9	17	0.01	210
	Minimum	2160	1100	400	<50	130	7.9	13	0.01	190
	Maximum	5110	2300	570	150	340	17	25	0.33	370
101 Ravine	N	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	0	0	-	-
	Mean	11616	3700	620	190	234	3.5	11	0.04	168
	Standard deviation	4901.2	1408.9	153.0	38.1	83.2	0.76	3.1	0.029	59.7
	Median	11000	3200	600	180	180	3.3	10	0.06	140
	Minimum	5640	2300	480	150	170	2.6	7.8	0.01	120
	Maximum	18900	5300	860	250	330	4.6	15	0.07	270
West Perimeter Ravine	N	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	2	0	-	-
	Mean	9564	2460	966	144	168	5.9	13	0.12	180
	Standard deviation	1597.5	251.0	176.6	36.5	95.0	1.20	1.9	0.139	37.4
	Median	9000	2400	1000	140	150	5.6	12	0.07	180
	Minimum	8290	2300	710	100	90	4.4	11	0.01	140
	Maximum	12300	2900	1200	190	330	7.6	16	0.35	240
West Ravine	N	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	3	0	-	-
	Mean	8746	3760	1018	364	220	6.2	14	0.6	208
	Standard deviation	6452.9	3742.1	176.7	72.3	80.3	0.7	2.2	0.49	51.7
	Median	6940	2200	980	380	180	6.4	13	0.60	200
	Minimum	4150	1500	810	270	130	5.3	11	0.05	130
	Maximum	20000	10400	1200	460	310	7.1	17	1.32	260
East Ravine	N	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	4	0	-	-
	Mean	7316	2640	652	204	142	7	16	0.1	196
	Standard deviation	1961.3	709.2	147.5	59.0	82.3	2.4	9.5	0.14	81.7
	Median	6540	2400	630	170	100	6.3	12	0.02	160
	Minimum	5360	2000	540	150	70	5	8.9	0.01	140
	Maximum	10000	3700	900	290	250	11	32	0.3	340

Table 13 Sediment chemistry summary statistics for tributaries in the Project LSA, October 2007 and November 2008.

Tributary	Statistic	Inorganic Ions (µg/g)				Sulfate, acid soluble	Metals > Guidelines (µg/g)		Nutrients	
		Calcium	Magnesium	Potassium	Sodium		Arsenic	Vanadium	Organic carbon (%)	Phosphorus (µg/g)
Duke Ravine	N	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	5	0	-	-
	Mean	14720	5006	1588	98	244	8	24	0.9	286
	Standard deviation	6493.2	1890.3	464.2	33.8	76.4	1.8	6.2	0.55	82.0
	Median	11600	4680	1480	96	210	7.2	23	0.80	290
	Minimum	8300	3060	1030	57	200	6.5	17	0.3	190
FALC Ravine	Maximum	22300	8150	2310	150	380	11	34	1.8	410
	N	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	1	1	-	-
	Mean	5432	2868	2108	125	134	4.2	28	0.8	228
	Standard deviation	2893.9	1434.1	980.8	50.6	70.2	1.23	10.7	0.62	76.9
	Median	5230	2400	1820	110	100	3.8	26	0.70	190
English Creek	Minimum	2810	1720	1390	81	80	3.2	19	0.4	170
	Maximum	10200	5300	3800	200	250	6.2	46	1.9	360
	N	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	5	4	-	-
	Mean	20434	5260	856	144	610	18	37	1.52	428
	Standard deviation	6051.7	1232.1	171.0	18.2	338.7	8.9	12.6	1.325	121.5
English Creek	Median	23100	5600	900	140	650	19	42	1.09	460
	Minimum	9770	3200	560	120	180	6.9	15	0.04	240
	Maximum	24000	6400	990	170	980	27	46	2.92	560

Notes: 1ISQG = interim freshwater sediment quality guideline for the protection of freshwater life (CCME 2002).

2PEL = probable effect level (CCME 2002).

3LEL = lowest effect level (Thompson et al. 2005).

4N = number of samples.

Table 14 Sediment chemistry summary statistics for the Saskatchewan River in the Project LSA, October 2007 and November 2008.

Region in the Saskatchewan River	Statistic	Inorganic Ions (µg/g)				Sulfate, acid soluble	Metals > Guidelines (µg/g)	Nickel	Vanadium	Nutrients	
		Calcium	Magnesium	Potassium	Sodium		Arsenic			Organic carbon (%)	Phosphorus (µg/g)
	ISQG ¹						5.9				
	PEL ²						17				
	LEL ³						9.8	23.4	35.2		
Upstream of Caution Creek	N ⁴	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	4	0	5	-	-
	Mean	41440	11420	1420	224	548	6.2	21	44	0.59	504
	Standard deviation	2659.5	2310.2	277.5	37.8	290.5	1.00	2.5	3.8	0.359	47.2
	Median	43000	11000	1500	240	560	6.1	23	44	0.63	490
	Minimum	37600	8500	1000	170	220	4.7	18	38	0.11	440
	Maximum	43500	13900	1700	260	1000	7.3	23	48	0.95	560
Downstream of Caution Creek	N	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	2	1	1	-	-
	Mean	30800	6760	938	172	326	5.7	17	31	0.36	384
	Standard deviation	6157.5	1638.0	273.3	16.4	217.6	1.23	4.8	13.6	0.439	64.3
	Median	29000	6200	1000	170	300	5.7	16	28	0.07	380
	Minimum	25200	5000	550	160	90	4.4	11	15	0.01	300
	Maximum	39900	9300	1300	200	600	7.3	24	52	0.98	480
Downstream of 101 Ravine	N	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	1	0	0	-	-
	Mean	26660	5900	844	228	152	5	13	22	0.11	332
	Standard deviation	6052.5	1688.2	129.2	45.5	26.8	0.5	2.3	5.4	0.107	45.5
	Median	25800	5600	750	220	140	4.8	13	22	0.09	320
	Minimum	20900	4400	750	160	120	4.8	11	17	0.01	300
	Maximum	36300	8700	1000	270	180	6	17	31	0.27	410
Downstream of West Perimeter Ravine	N	6	6	6	6	6	6	6	6	6	6
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	4	2	5	-	-
	Mean	45920	13320	3700	364	1026	6.2	22	44	1.48	634
	Standard deviation	4335.6	2356.3	1286.5	70.6	335.2	0.50	3.8	12.7	0.607	94.2
	Median	46550	13900	3750	365	905	6.1	22.5	44.5	1.28	660
	Minimum	38600	10000	1700	250	620	5.4	16	24	0.78	470
	Maximum	49300	15700	5100	430	1500	6.7	26	55	2.39	710
Downstream of West Ravine	N	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	0	0	2	-	-
	Mean	37520	10420	1960	354	304	4.8	16	33	0.18	488
	Standard deviation	5492.4	2056.0	658.0	38.5	171.3	0.76	3.1	8.9	0.146	71.6
	Median	38200	10700	1900	340	280	4.6	16	34	0.16	530
	Minimum	30100	7600	1200	320	120	4	12	22	0.01	410

Table 14 Sediment chemistry summary statistics for the Saskatchewan River in the Project LSA, October 2007 and November 2008.

Region in the Saskatchewan River	Statistic	Inorganic Ions (µg/g)				Sulfate, acid soluble	Metals > Guidelines (µg/g)			Nutrients	
		Calcium	Magnesium	Potassium	Sodium		Arsenic	Nickel	Vanadium	Organic carbon (%)	Phosphorus (µg/g)
Downstream of East Ravine	Maximum	42900	12700	3000	400	560	5.9	19	43	0.4	550
	N	6	6	6	6	6	6	6	6	6	6
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	0	0	0	-	-
	Mean	23910	5533	683	198	110	4	10	20	0.03	290
	Standard deviation	9985.3	2057.8	91.1	31.3	31.6	0.7	3.8	8.2	0.0	81.5
	Median	28250	6300	685	185	95	4.4	12	24	0.02	320
Downstream of Duke Ravine	Minimum	6560	2000	550	180	90	3.5	4.6	8.5	0.01	150
	Maximum	32100	7300	780	260	170	5.7	14	29	0.1	360
	N	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	2	0	4	-	-
	Mean	37240	10828	3416	214	488	6.1	16	41	0.8	456
	Standard deviation	7139.9	1844.4	1225.6	40.4	358.5	2.24	4.2	13.2	0.67	75.7
Downstream of FALC Ravine	Median	37300	11200	3230	220	330	5.2	15	37	0.70	450
	Minimum	30200	8840	2240	170	230	4	12	28	0.4	390
	Maximum	48100	12900	5480	270	1100	8.7	23	63	2	580
	N	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	5	2	5	-	-
	Mean	47060	13680	5738	340	922	7.1	23	63	1.8	576
Downstream of Wapiti Ravine	Standard deviation	5080.6	1089.5	1227.4	48.0	390.8	1.07	4.1	13.2	0.70	75.0
	Median	45700	14000	5020	310	860	6.5	21	56	1.80	560
	Minimum	40800	12100	4690	300	560	6	20	52	1.1	480
	Maximum	53900	15000	7440	410	1500	8.4	29	80	2.7	670
	N	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
	N > guidelines	-	-	-	-	-	5	3	5	-	-
Downstream of English Creek	Mean	45920	14440	5784	330	852	7.1	25	64	2.1	584
	Standard deviation	3999.6	1436.3	1202.2	59.2	317.8	0.46	3.4	10.7	0.33	68.0
	Median	47400	15000	6180	320	910	7.3	26	70	2.2	620.0
	Minimum	41600	12900	4390	260	480	6.3	20	51	1.5	510
	Maximum	49900	15800	6990	400	1200	7.4	28	73	2.3	640
	N	5	5	5	5	5	5	5	5	5	5
	N < detection limit	0	0	0	0	0	0	0	0	0	0
Downstream of English Creek	N > guidelines	-	-	-	-	-	5	0	5	-	-
	Mean	45980	13840	3300	336	686	7.4	21	49	1.14	652
	Standard deviation	5034.6	2686.6	1274.8	110.8	130.9	1.45	0.4	3.1	0.419	95.2
	Median	47100	14700	3400	310	690	7	21	48	0.9	670.0
	Minimum	37500	9100	1200	190	500	6	20	44	0.75	500
	Maximum	50600	15600	4500	470	870	9.1	21	52	1.69	740

Notes: 1ISQG = interim freshwater sediment quality guideline for the protection of freshwater life (CCME 2002).

2PEL = probable effect level (CCME 2002).

Table 14 Sediment chemistry summary statistics for the Saskatchewan River in the Project LSA, October 2007 and November 2008.

3LEL = lowest effect level (Thompson et al. 2005).

4N = number of samples.