

North Dakota State Water Commission

900 EAST BOULEVARD AVENUE, DEPT 770 • BISMARCK, NORTH DAKOTA 58505-0850 701-328-2750 • TTY 800-366-6888 • FAX 701-328-3696 • INTERNET: http://swc.nd.gov

WATER DEVELOPMENT DIVISION (701) 328-2752

December 16, 2015

North Dakota Department of Health Division of Water Quality 918 East Divide Avenue Bismarck, ND 58501-1947

RE: November 2015 Devils Lake Outlets Monthly Discharge and Water Quality Report

Dear Division of Water Quality:

Enclosed are the monthly discharge reports for the Devils Lake Outlets for the month of November 2015. Discharges from the East Outlet were reduced due to water quality constraints. The West and East Outlets were operated for nine days before they were shutdown for the season. A graph of the outlet discharges, stream flows, conductance, and preliminary sulfate sample results is shown in **Figure 1**.

The attached tables contain average daily outlet discharges and water quality results from samples collected from the outlets and the corresponding upstream and downstream locations. Also included are average daily stream flow data and conductivity data obtained from the USGS gaging stations located upstream and downstream of the outlets.

If you have any questions, please contact me at (701) 328-4948.

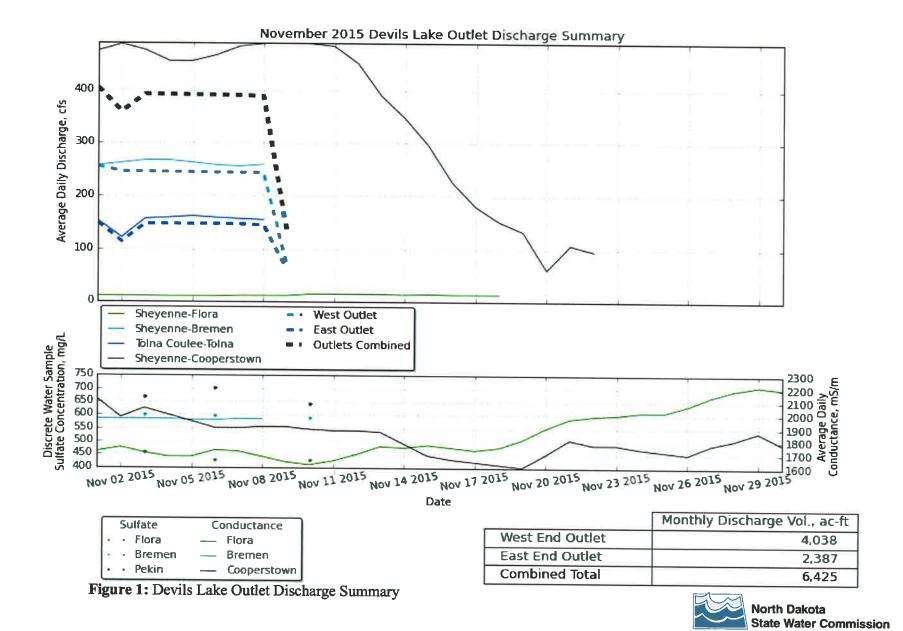
Sincerely,

Jonathan Kelsch P.E.

Section Chief of Construction

Jon Kelser

JK:JL/416-10 Enclosure



NAME:

ADDRESS:

ND State Water Commission

900 E Boulevard Avenue,

Bismarck ND 58505

MONTHLY DISCHARGE REPORT

LOCATION:

WEST END OUTLET

FACILITY: Devils Lake Outlet Project

MONITORING PERIOD START DATE END DATE 11/1/15 11/9/15

LOCATION: Benson Co, ND

Devils Lake West Outlet discharged

4,038 ac-ft over

Days 9

PARAMETER	MINIMUM	MAXIMUM	AVERAGE	UNITS	SAMPLING FREQUENCY	TYPE
рН	8.62	8.79	8.71	SU	2 x Week	GRAB
SPECIFIC CONDUCTANCE	NA	NA	NA	μS/cm	Continuous	Recorder
SULFATE	584	598	591	mg/L	2 x Week	GRAB
7 DAY AVERAGE OF SULFATE	591	599	595	mg/L	2 x Week	GRAB
OUTLET DISCHARGE	71	255	226	cfs	Continuous	Recorder
SIGNATURE	Jon	Kelser		12/16/15	701-328-	4948
NAME AND TITLE	JONATHAN KE	LSCH, HEAD, C SECTION		TELEPHONE		

COMMENT AND EXPLANATION OF ANY VIOLATIONS

Summary of individual sample results and flow data for outlet, upstream & downstream monitoring locations attached.

Notes:

ac-ft - Acre feet

SU - Standard Units

μS/cm - Microsiemens per Centimeter at 25 degrees Celsius

mg/L - Milligrams per liter or parts per million

cfs - Cubic feet per second

NA - Not available

ADDRESS:

NAME: ND State Water Commission

900 E Boulevard Avenue,

MONTHLY DISCHARGE REPORT

Bismarck ND 58505

LOCATION: **EAST END OUTLET**

FACILITY: Devils Lake Outlet Project

MONITORING PERIOD START DATE END DATE 11/1/15 11/9/15

LOCATION: Ramsey, Benson, Nelson, ND

Devils Lake East Outlet discharged

2,387 ac-ft over

9 **Days**

PARAMETER	MINIMUM	MAXIMUM	AVERAGE	UNITS	SAMPLING FREQUENCY	TYPE
рН	8.74	8.88	8.81	SU	2 x Week	GRAB
SPECIFIC CONDUCTANCE	NA	NA	NA	μS/cm	Continuous	Recorder
SULFATE	992	1010	1001	mg/L	2 x Week	GRAB
7 DAY AVERAGE OF SULFATE	1001	1010	1006	mg/L	2 x Week	GRAB
OUTLET DISCHARGE	62	149	134	cfs	Continuous	Recorder
SIGNATURE	Jon	Kelau	12/16/15	704 229	40.40	
NAME AND TITLE	JONATHAN KE	LSCH, HEAD, C SECTION	DATE	701-328- TELEPHONE		

COMMENT AND EXPLANATION OF ANY VIOLATIONS

Summary of individual sample results and flow data for outlet, upstream & downstream monitoring locations attached.

Notes:

ac-ft - Acre feet

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μS/cm - Microsiemens per Centimeter at 25 degrees Celsius

mg/L - Milligrams per liter or parts per million

cfs - Cubic feet per second

NA - Not available

NAME: ND State Water Commission

ADDRESS: 900 E Boulevard Avenue,

Bismarck ND 58505

MONTHLY DISCHARGE REPORT

LOCATION: UPSTREAM OF THE WEST END OUTLET (FLORA)

FACILITY: Devils Lake Outlet Project

MONITORING PERIOD

START DATE | END DATE

11/1/15 | 11/9/15

LOCATION: Benson Co, ND

PARAMETER	MINIMUM	MAXIMUM	AVERAGE	UNITS	SAMPLING FREQUENCY	TYPE
рН	8.55	8.61	8.58	SU	2 x Week	GRAB
SPECIFIC CONDUCTANCE	1,620	2,220	1,844	μS/cm	Continuous	Recorder
SULFATE	427	459	439	mg/L	2 x Week	GRAB
7 DAY AVERAGE OF SULFATE	429	455	443	mg/L	2 x Week	GRAB
FLOW, INSTREAM	9	14	12	cfs	Continuous	Recorder
SIGNATURE	Jon	Kelsel				
			12/16/15	701-328-	4948	
NAME AND TITLE	JONATHAN KE	LSCH, HEAD, C SECTION	ONSTRUCTION	DATE	TELEPHONE	NUMBER

COMMENT AND EXPLANATION OF ANY VIOLATIONS

Summary of individual sample results and flow data for outlet, upstream & downstream monitoring locations attached.

Notes:

SU - Standard Units

μS/cm - Microsiemens per Centimeter at 25 degrees Celsius

mg/L - Milligrams per liter or parts per million

cfs - Cubic feet per second

USGS streamflow and specific conductance data courtesy of the USGS

USGS data are provisional and subject to revision

NAME:

ND State Water Commission

ADDRESS:

900 E Boulevard Avenue,

Bismarck ND 58505

MONTHLY DISCHARGE REPORT

LOCATION:

DOWNSTREAM OF THE WEST END OUTLET (BREMEN)

UPSTREAM OF THE EAST END OUTLET

FACILITY: Devils Lake Outlet Project

LOCATION: Eddy Co, ND

MONITORING PERIOD START DATE **END DATE** 11/1/15 11/9/15

PARAMETER	MINIMUM	MAXIMUM	AVERAGE	UNITS	SAMPLING FREQUENCY	TYPE
рН	8.57	8.78	8.66	SU	2 x Week	GRAB
SPECIFIC CONDUCTANCE	1,960	1,970	1,968	μS/cm	Continuous	Recorder
SULFATE	592	601	597	mg/L	2 x Week	GRAB
7 DAY AVERAGE OF SULFATE	595	600	598	mg/L	2 x Week	GRAB
FLOW, INSTREAM	256	267	261	cfs	Continuous	Recorder
SIGNATURE	Jon	Helsel	_			
NAME AND TITLE	JONATHAN KE	LSCH, HEAD, C	ONSTRUCTION	12/16/15	701-328-	4948
TABLE AND THE	DATE	TELEPHONE	NUMBER			

COMMENT AND EXPLANATION OF ANY VIOLATIONS

Summary of individual sample results and flow data for outlet, upstream & downstream monitoring locations attached.

Notes:

SU - Standard Units

μS/cm - Microsiemens per Centimeter at 25 degrees Celsius

mg/L - Milligrams per liter or parts per million

cfs - Cubic feet per second

USGS streamflow and specific conductance data courtesy of the USGS

USGS data are provisional and subject to revision

NAME:

ND State Water Commission

ADDRESS:

900 E Boulevard Avenue,

Bismarck ND 58505

MONTHLY DISCHARGE REPORT

LOCATION:

DOWNSTREAM OF THE EAST END OUTLET (PEKIN)

FACILITY: Devils Lake Outlet Project

LOCATION: Nelson Co, ND

MONITORING PERIOD						
START DATE END DATE						
11/1/15 11/9/15						

PARAMETER	MINIMUM	MAXIMUM	AVERAGE	UNITS	SAMPLING FREQUENCY	TYPE
рН	8.59	8.68	8.62	SU	2 x Week	GRAB
SPECIFIC CONDUCTANCE	NA	NA	NA	μS/cm	Continuous	Recorder
SULFATE	642	703	671	mg/L	2 x Week	GRAB
7 DAY AVERAGE OF SULFATE	662	686	674	mg/L	2 x Week	GRAB
FLOW, INSTREAM	NA	NA	NA	cfs	Continuous	Recorder
SIGNATURE	Jon	Kelsel	12/16/15	701-328-	4049	
NAME AND TITLE	JONATHAN KE	LSCH, HEAD, C SECTION		TELEPHONE		

COMMENT AND EXPLANATION OF ANY VIOLATIONS

Summary of individual sample results and flow data for outlet, upstream & downstream monitoring locations attached.

Notes:

SU - Standard Units

µS/cm - Microsiemens per Centimeter at 25 degrees Celsius

mg/L - Milligrams per liter or parts per million

cfs - Cubic feet per second

NA - Not available

Daily Outlet Discharge and Upstream and Downstream Flows Devils Lake Outlets

		t End Outlet - iver near Flora	West E	nd Outlet	Outlet/Abo Outlet -Sheye	West End ove East End enne River near emen		d Outlet		End Outlet -	Sheyenne	End Outlet - River near	Sum of	Outline
		Average				Average	Lust Li	Cutiet	TOTAL COUR		Сооре		Sum of	Outlets
	Average	Specific	Average		Average	Specific	Average		Average	Average Specific	Augraga	Average Specific	A	
	Streamflow	Conductance	Daily Outlet		Streamflow	Conductance	Daily Outlet		Streamflow	Conductance	Average Streamflow	Conductance	Average Daily Outlet	1
	USGS Gage	USGS Gage	Discharge	Total Daily	USGS Gage	USGS Gage	Discharge	Total Daily	USGS Gage	USGS Gage	USGS Gage	USGS Gage	Discharge	Total Daily
Date	(cfs)	(µS/cm)	(cfs)	Volume (ft3)	(cfs)	(µS/cm)	(cfs)	Volume (ft³)	(cfs)	(µS/cm)	(cfs)	(µS/cm)	(cfs)	
11/1/15	10	1,720	255	22.062.000	257	1,970	149	12,857,000	153	2.880	474	2,120	404	Volume (ft ³ 34,919,000
11/2/15	10	1,750	245	21,179,000	262	1,970	113	9.803.000	121	2,000	487	1,980	359	30,982,000
11/3/15	10	1,710	245	21,184,000	267	1,970	147	12,704,000	157	2,900	475	2,050	392	33,888,000
11/4/15	9	1,680	244	21.112.000	267	1,970	147	12,701,000	159	2,880	455	2,000	392	33,813,000
11/5/15	10	1,680	244	21,077,000	263	1,960	147	12,696,000	162	2.850	455	1,950	391	33,773,000
11/6/15	10	1,730	244	21,052,000	258	1,960	147	12,698,000	159	2.870	466	1,900	391	33,773,000
11/7/15	11	1,720	243	21.032.000	256	1,970	147	12,661,000	157	2.800	483	1,900	391	
11/8/15	11	1,680	243	21,026,000	259	1,970	145	12,507,000	155	2,840	488	1,900	388	33,693,000
11/9/15	11	1,640	71	6,173,000	-	-	62	5,360,000	155	2,040	489	1,910	133	33,533,000
11/10/15	14	1,620	-			-	- 02	- 0,000,000		725	488	1,890		11,533,000
11/11/15	14	1,650	-		-	-	197	79	2 1		483	1,880	-	
11/12/15	14	1,700		-			= 1				451	1,880	- 0	- 5
11/13/15	14	1,760					20				389	1,870	- (5)	
11/14/15	13	1,750	-					-			347	1,780		
11/15/15	14	1,770	- 2	25	-						295	1,690		-
11/16/15	13	1,750						-			226	1,660		- 2
11/17/15	13	1,730	- 2					-		-	180	1,640	-	-
11/18/15	13	1,750	-				-		-	-	151	1,620	- :	
11/19/15		1,810	-	-				-			132	1,600		
11/20/15	100	1,900		-		-	-	-			60	1,700		_
11/21/15		1,970	-	(#)	8						107	1,810		
11/22/15		1,990	*	16:			74	100	- 2	-	95	1,770		- :
11/23/15	100	2,000		161		2	-				- 50	1,770	-	
11/24/15	(*)	2,020		7.6	¥ .	<u> </u>	<u> </u>	- 0				1.740		
11/25/15		2,020	-	D#1	- 2							1,720		1
11/26/15		2,070	- ¥	1726								1,700		102
11/27/15	(4)	2,140							-			1,770		-
11/28/15		2,190					-	(4)			-	1,810	-	72
11/29/15		2,220	-			-	*		-	349		1,870	2	-
11/30/15	20	2,200			-		-	140	- 1	-		1,780	-	
Minimum	9	1,620	71	6,173,000	256	1,960	62	5,360,000	121	2,800	60	1,600	133	44 500 000
Maximum	14	2,220	255	22,062,000	267	1,970	149	12.857.000	162	2,800	489	2,120		11,533,000
Average	12	1,844	226	19,544,111	261	1,968	134	11,554,111	153	2,860	349	1,822	404 360	34,919,000
lotes:			Total (Mgal)	1.316			Total (Mgal)	778	100	2,000	348	1,022		31,098,222
	c feet per seco	nd											Total (Mgal)	2,094
		na er Centimeter at	Total (Ac-ft)	4,038			Total (Ac-ft)	2,387					Total (Ac-ft)	6,425

µS/cm - Microsiemens per Centimeter at 25 degrees Celsius

ft3 - cubic feet

Mgal - Millions of Gallons

Ac ft - Acre Feet

USGS streamflow and specific conductance data are preliminary and courtesy of the USGS

NC - Not calculated



Sheyenne River Upstream of West End Outlet near Flora **Monthly Water Quality Summary Devils Lake Outlet Discharge Report**

Date	Time	Specific Conductance USGS Gage (μS/cm)	pH—	Sulfate (mg/L)	7 Day Rolling Average of Sulfate (mg/L)	Total Suspended Solids (mg/L)	No. of days included in the 7 day Rolling Average
11/1/15	*	*		*		2 7	
11/2/15	2	- E	4	¥	-		
11/3/15	8:25	1,720	8.55	459	455	12	7
11/4/15	-3	*	- 2	Ψ		2	120
11/5/15					a a	-	(2)
11/6/15	7:55	1,730	8.61	430	445	NA	7
11/7/15	V21					-	
11/8/15			i#	7	*		-
11/9/15	38:		μ	12	2	- 2	257
11/10/15	8:20	1,620	8.57	427	429	NA	7
11/11/15			-	*	2	2	341
11/12/15	1/2			- 8		-	
11/13/15	(*					-	-
11/14/15	(3 <u>#</u>)		- ×	2	2	2	-
11/15/15	07/	-	-	•			-
11/16/15	-		×	=		2	
11/17/15	- 141						-
11/18/15	(28)		-			*	-
11/19/15	297	Te:	-	101		9	
11/20/15		(8)	5:	-			*
11/21/15	3.6	760	¥	Pi	-	12	
11/22/15	- 6		-		-	-	-
11/23/15		(+)		10-1		- 4	-
11/24/15		TE .	=	72		- 4	
11/25/15		353	π.	3.54			
11/26/15		X80	-	7=		172	12
11/27/15	-			- 1-	-	1.0	
11/28/15	(#3	+	-	-		(E:	-
11/29/15	- F						
11/30/15		- 19		0.5		(-)	
Minimum		1,620	8.55	427	429	12	
Maximum		1,730	8.61	459	455	12	
Average		1,690	8.58	439	443	12	

Notes:

μS/cm - Microsiemens per Centimeter at 25 degrees Celsius

mg/L - Milligrams per liter or parts per million NA - Not Analyzed

USGS specific conductance data courtesy of the USGS USGS data are provisional and subject to revision Italic font denotes preliminary result



West End Outlet Monthly Water Quality Summary Devils Lake Outlet Discharge Report

Date	Time	pН	Sulfate (mg/L)	7 Day Rolling Average of Sulfate (mg/L)	Total Suspended Solids (mg/L)	No. of days included in the 7 day Rolling Average
11/1/15	#	, ,	-			
11/2/15			5		5 - 2	7.5
11/3/15	8:35	8.62	584	599	13	7
11/4/15	- 2	-			1972	1982
11/5/15		=		*	(+)	(34)
11/6/15	7:40	8.79	598	591	NA	7
11/7/15		5	I.E.	-	S#1	(<u>*</u>)
11/8/15	*	*	2.0		297	
11/9/15	-		-			
11/10/15	=	=	-	-		:=:
11/11/15	28	2	024	-		
11/12/15	5	5	S.E.S.			
11/13/15	-	-	1046	2		320
11/14/15		-	-			150
11/15/15	-	-	:-:)=:		(a)
11/16/15	5	= 1	747	72	•	
11/17/15	=	[7:	3*2	3.5		
11/18/15	- 1		22	: **	145	120
11/19/15	-	-	-	(15:		
11/20/15	-	-		(#2	(4)	-
11/21/15	-	72		25-		
11/22/15		1.0	•	Nes .		·
11/23/15	(#)	:=	- 8	- SE	=20	- 2
11/24/15	-		1.5	989	3-23	(*)
11/25/15	1.0	-	(=1	(4)	140	2.5
11/26/15		-				15.1
11/27/15	5 ± ?	1.e2	3-5	1991	:=):	
11/28/15	7.50	74 J		74	200	
11/29/15	.=	ue.	e e			
11/30/15		(4)		(4)	:=:	2
Minimum		8.62	584	591	13	
Maximum		8.79	598	599	13	
Average		8.71	591	595	13	

mg/L - Milligrams per liter or parts per million NA - Not Analyzed Italic font denotes preliminary result

Sheyenne River Downstream of West End Outlet/Upstream of East End Outlet near Bremen Monthly Water Quality Summary Devils Lake Outlet Discharge Report

Date	Time	Specific Conductance USGS Gage (µS/cm)	ρH	Sulfate (mg/L)	7 Day Rolling Average of Sulfate (mg/L)	Total Suspended Solids (mg/L)	No. of days included in the 7 day Rolling Average
11/1/15	-						E
11/2/15	9		, a .				-
11/3/15	8:00	1,970	8.63	601	600	19	7
11/4/15	•	*	×	#	20	4	72
11/5/15						-	1.5
11/6/15	8:35	1,960	8.78	598	600	NA	7
11/7/15				=======================================	-		
11/8/15	-		=	=	-	*	
11/9/15				-	2	핕	049
11/10/15	7:55		8.57	592	595	NA	7
11/11/15	1.00	-	*	-	2	2	
11/12/15	16:		- 2	2	2		
11/13/15	0.54	5			-	*	
11/14/15	(e:	¥	-		2	8	
11/15/15	24				-	-	
11/16/15	Ties .	•	8	-	4	4	
11/17/15			2	-			
11/18/15	(# #)	= =	-	*	*	+	
11/19/15	9#1	-		22	2	ш	52
11/20/15				5		-	(#C
11/21/15	(#)	-	-		-		
11/22/15	-	1	-	- 3		-	2#0
11/23/15	3.55		E	-	-		(#V
11/24/15	¥4		12			2	
11/25/15				18	-	-	
11/26/15	•	- IF	#	(44)	-	-	(4)
11/27/15	520	VE				-	
11/28/15	-	(*)	-	1.5	+	-	(4)
11/29/15	596	12	- 2	Te.			
11/30/15	i t s		5	(E)		-	
Minimum		1,960	8.57	592	595	19	
Maximum		1,970	8.78	601	600	19	
Average		1,965	8.66	597	598	19	

Notes:

 $\mu \text{S/cm}$ - Microsiemens per Centimeter at 25 degrees Celsius

mg/L - Milligrams per liter or parts per million

NA - Not Analyzed

USGS specific conductance data courtesy of the USGS

USGS data are provisional and subject to revision

Italic font denotes preliminary result



East End Outlet Monthly Water Quality Summary Devils Lake Outlet Discharge Report

Date	Time	рН	Sulfate (mg/L)	7 Day Rolling Average of Sulfate (mg/L)	Total Suspended Solids (mg/L)	No. of days included in the 7 day Rolling Average
11/1/15	14 8				-	
11/2/15		372	- 15		-	(⊕ :
11/3/15	10:15	8.74	1010	1010	56	
11/4/15		-	- 5	(2)	-	(6)
11/5/15	100	-		(4):	-	220
11/6/15	11:25	8.88	992	1001	NA	ne:
11/7/15	27		-		-	- 00
11/8/15	- 4	14	2		2	
11/9/15				-		-
11/10/15		-	*	-		
11/11/15		- 2	-			
11/12/15	-		-	-	8	
11/13/15	-	-			8	
11/14/15		_ =	5.			· ·
11/15/15	*	*	×		ш	*
11/16/15	-				-	
11/17/15	-		-			347
11/18/15	2	-	-		<u> </u>	
11/19/15			5		-	
11/20/15	8	*		-	2	=0
11/21/15	2			-	±.	
11/22/15	=	-			-	30
11/23/15	2		1.0	0		-
11/24/15		5.				
11/25/15	*		-		145	27
11/26/15					ь:	
11/27/15	5	*	3-		241	2
11/28/15	2	2	02			
11/29/15		5	675		18. 0	
11/30/15	*	¥	REI	1	₹ 8 6	2
Minimum		8.74	992	1001	56	
Maximum		8.88	1010	1010	56	
Average		8.81	1001	1006	56	

mg/L - Milligrams per liter or parts per million NA - Not Analyzed due to operation constraints Italic font denotes preliminary result

Sheyenne River Downstream of East End Outlet near Pekin **Monthly Water Quality Summary Devils Lake Outlet Discharge Report**

Date	Time	Нq	Sulfate (mg/L)	7 Day Rolling Average of Sulfate (mg/L)	Total Suspended Solids (mg/L)	No. of days included in the 7 day Rolling Average
11/1/15	7.	-	-			
11/2/15	(4)	(4)		(*)		-
11/3/15	10:40	8.59	669	662	23	7
11/4/15	27	(2)	æ	500		- 5
11/5/15	(*)		¥	(4.)		
11/6/15	10:50	8.68	703	686	NA	7
11/7/15	200	-	-	140.		
11/8/15	-	- 3	2	JEV J		- F
11/9/15	3,		5	-		160
11/10/15	9:48	8.59	642	673	NA	7
11/11/15	-	-	- 3			
11/12/15		=	-		*	100
11/13/15	8	· · · · · · ·		-	=======================================	77.€
11/14/15	=		-			7 2
11/15/15	~	:2		4	·	100
11/16/15					-	0.50
11/17/15			¥		₩	
11/18/15	-	4	2		8	
11/19/15		*	ь.		*	15
11/20/15		22	1	-	9	
11/21/15				-		
11/22/15	-	-	*		×	(S#)
11/23/15	<u>u</u>	3				
11/24/15	: *	*	*	*		:=:
11/25/15	-	×	•	<u>u</u>	-	-
11/26/15	-	-		<u></u>		3 .
11/27/15	- ÷	-	*		-	5#1
11/28/15			-	9		
11/29/15	Ħ		5.		-	2€7
11/30/15		ų	*	*	-	
Minimum		8.59	642	662	23	
Maximum		8.68	703	686	23	
Average		8.62	671	674	23	

Notes:

mg/L - Milligrams per liter or parts per million NA - Not Analyzed Italic font denotes preliminary result

Bold font denotes sample sulfate concentration exceeds 750 mg/L