MACKENZIE
PULP MILL CORPORATION
A PAPER EXCELLENCE COMPANY

April 30, 2020

Mr. Peter Lawrie
Mr. Neil Bailey

Environmental Management Section Head
Authorizations - North
BC Ministry of Environment & Climate Change Strategy

Dear Sirs:

Re: March 2020 - Effluent Monitoring Report

Attached is the effluent monitoring results for the current reporting period according to Permit PE-01138.

Please note that quarter one testing for the Ashpond effluent was not completed due to frozen conditions of the pond.

Sincerely,

Randeep Sandhu
Environmental Supervisor

Mackenzie Pulp Mill Corp.

16/04/2020 12:26:20 PM

Water Effluent Comparison To Regulation

Permit: PE01138 **Period Starting:** ***Mar 01, 2020***

Period Ending: ***Mar 31, 2020***

FLOW	Actual Daily Avg (E3M3/D)	57.2
90_EFF	90th Percentile (Previous 100 Days)	59
PROD	Actual Daily Avg (ADT/D)	522
90_PROD	90th Percentile (Previous 100 Days)	621
BL	Actual Daily Avg (ADT/D)	522
90_CBPROD	90th Percentile (Previous 100 Days)	621
PRODUCTION	Reference Production Rate (RPR)	705
TSS	Permitted Max (mg/l)	197
	Permitted Avg (mg/l)	118
	Actual Daily Max (mg/l)	119
	Actual Daily Avg (mg/l)	74.6
BOD	Permitted Max (mg/l)	79
	Actual Daily Max (mg/l)	63.4
	Actual Daily Avg (mg/l)	32.7
AOX	Permitted Avg (KG/ADT)	0.60
	Actual Daily Avg. (KG/ADT)	0.32
	Actual Daily Avg (mg/l)	4.2

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Mackenzie Pulp Mill Corporation
Biobasin #2 - Temperature (°C)
March 2020

DATE	Minimum Temperature	Maximum Temperature
01-Mar	21.8	26.6
02-Mar	21.8	25.8
03-Mar	21.2	26.5
04-Mar	23.7	26.5
05-Mar	23.9	27.4
06-Mar	19.0	28.1
07-Mar	19.4	26.8
08-Mar	24.8	28.6
09-Mar	23.7	29.3
10-Mar	22.9	28.1
11-Mar	24.6	28.8
12-Mar	22.4	28.4
13-Mar	18.9	28.0
14-Mar	17.8	23.6
15-Mar	21.2	27.7
16-Mar	26.2	28.4
17-Mar	21.8	28.3
18-Mar	26.0	29.0
19-Mar	21.1	28.4
20-Mar	26.6	29.9
21-Mar	26.5	29.1
22-Mar	27.3	29.5
23-Mar	22.8	28.9
24-Mar	21.1	27.4
25-Mar	26.6	28.9
26-Mar	24.4	28.4
27-Mar	24.2	28.7
28-Mar	19.0	24.6
29-Mar	19.3	23.9
Monthly Min./Max.	17.8	29.9
Monthly Average	25.3	

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Biobasin #2
pH & Temperature
Mar-20

	Field		Laboratory	
Date	pH	Temperature (°C)	pH	Temperature (°C)
01-Mar	6.98	26.5	7.21	22.7
02-Mar	7.02	22.8	7.20	20.8
03-Mar	7.00	22.9	7.18	21.4
04-Mar	6.99	24.3	7.17	22.2
05-Mar	6.99	24.3	7.39	22.5
06-Mar	6.95	27.1	7.19	25.0
07-Mar	6.98	20.5	7.25	19.1
08-Mar	6.88	27.0	7.33	25.0
09-Mar	6.90	28.7	7.13	28.2
10-Mar	6.93	25.8	7.16	24.0
11-Mar	6.92	27.5	7.09	26.8
12-Mar	6.91	25.0	7.10	23.5
13-Mar	6.95	22.5	7.11	19.4
14-Mar	6.98	23.0	7.11	18.9
15-Mar	6.91	25.1	7.05	22.9
16-Mar	6.94	27.8	7.09	24.0
17-Mar	6.96	25.0	7.08	21.4
18-Mar	6.96	27.8	7.16	25.1
19-Mar	6.94	25.7	7.65	23.0
20-Mar	6.89	29.4	7.04	26.8
21-Mar	6.94	27.6	7.28	24.7
22-Mar	6.95	28.0	7.23	22.2
23-Mar	6.93	24.8	7.21	22.0
24-Mar	6.92	22.7	7.18	21.0
25-Mar	6.88	27.2	7.00	23.6
26-Mar	6.97	25.6	7.15	23.4
27-Mar	6.94	27.3	7.08	21.0
28-Mar	6.93	23.6	7.59	21.8
29-Mar	6.92	20.8	7.57	23.4
30-Mar	6.91	20.9	7.07	18.7
31-Mar	6.95	20.2	7.04	18.7

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Biobasin #2 Conductivity
March 2020

Date	#2BO-24 hr-Conductivity (µS/cm)	
01-Mar	2,040	
02-Mar	2,120	
03-Mar	2,120	
04-Mar	2050	
05-Mar	2150	
06-Mar	2150	
07-Mar	2100	
08-Mar	2030	
09-Mar	2020	
10-Mar	2050	
11-Mar	1999	
12-Mar	2010	
13-Mar	1832	
14-Mar	1673	
15-Mar	1780	
16-Mar	1788	
17-Mar	1773	
18-Mar	1764	
19-Mar	1764	
20-Mar	1746	
21-Mar	1759	
22-Mar	1777	
23-Mar	1781	
24-Mar	1780	
25-Mar	1804	
26-Mar	1763	
27-Mar	1760	
28-Mar	1771	
29-Mar	1759	
30-Mar	1753	
31-Mar	1748	
Monthly Min/Max	**1673**	**2150**
Monthly Average	**1884**	

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Biobasin #2 Chemical Oxygen Demand (COD)
March 2020

Date	#2BO-24hr COD (mg/L)	
01-Mar	590	
02-Mar	710	
03-Mar	870	
04-Mar	540	
05-Mar	590	
06-Mar	830	
07-Mar	870	
08-Mar	840	
09-Mar	780	
10-Mar	540	
11-Mar	750	
12-Mar	760	
13-Mar	740	
14-Mar	730	
15-Mar	810	
16-Mar	700	
17-Mar	600	
18-Mar	666	
19-Mar	729	
20-Mar	799	
21-Mar	784	
22-Mar	781	
23-Mar	794	
24-Mar	793	
25-Mar	772	
26-Mar	789	
27-Mar	740	
28-Mar	777	
29-Mar	751	
30-Mar	955	
31-Mar	819	
Monthly Min/Max	**540**	**955**
Monthly Average	**748**	

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Biobasin #2 - Nutrients (mg/L)
March 2020

	Tested In-house	Tested by ALS Environmental					
DATE	**Ammonia NH_4 - N**	**Ammonia NH_4 - N**	**Nitrate NO_3 - N**	**Nitrite NO_2 - N**	**Total Kjeldahl Nitrogen**	**Phosphorus**	
						Dissolved PO_4 - P	**Total PO_4 - P**
01-Mar	2.56						
02-Mar	3.52						
03-Mar	1.52						
04-Mar	2.45	0.957	6.710	<0.100	<0.0200	0.0439	0.507
05-Mar	2.04						
06-Mar	1.76						
07-Mar	1.95						
08-Mar	1.32						
09-Mar	1.52						
10-Mar	1.70						
11-Mar	1.53						
12-Mar	2.08						
13-Mar	4.08						
14-Mar	1.13						
15-Mar	0.04						
16-Mar	0.75						
17-Mar	0.84						
18-Mar	0.81						
19-Mar	0.91						
20-Mar	0.49						
21-Mar	0.49						
22-Mar	0.56						
23-Mar	0.67						
24-Mar	0.80						
25-Mar	0.39						
26-Mar	0.83						
27-Mar	0.35						
28-Mar	0.67						
29-Mar	1.11						
30-Mar	1.71						
31-Mar	0.48						

Acute Toxicity Test Results

Sample #2BO – GRAB – 3/3/2020,
collected March 03, 2020

Final Report

March 18, 2020

Submitted to: **Mackenzie Pulp Mill Corporation**
Mackenzie, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates				Receipt temp.
	Collected	Received	Rainbow trout test initiation	*Daphnia magna* test initiation	
#2BO – GRAB – 3/3/2020	03-Mar-20 at 0730h	04-Mar-20 at 1140h	05-Mar-20 at 1310h	04-Mar-20 at 1430h	11.6-12.5°C

TESTS

- Rainbow trout 96-h LC50 test
- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)	
	Rainbow trout	*Daphnia magna*
#2BO – GRAB – 3/3/2020	>100	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	Rainbow trout	*Daphnia magna*
Reference toxicant LC50 (95% CL)	201.0 (146.3 – 284.6) µg/L Zn[1]	4.8 (4.0 – 5.9) g/L NaCl[2]
Reference toxicant historical mean (2 SD range)	94.6 (41.2 – 217.6) µg/L Zn	6.1 (4.4 – 8.5) g/L NaCl
Reference toxicant CV	44%	17%
Organism health history	Acceptable	Acceptable
Protocol deviations	None	None
Water quality range deviations	None	None
Control performance	Acceptable	Acceptable
Test performance	Valid	Valid

[1]Test Date: March 05, 2020; [2] Test Date: March 04, 2020; LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation

Report By:
Ditty Kakkassery, R.P. Bio
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 96-h rainbow trout (*Oncorhynchus mykiss*) LC50 test.

Test species	*Oncorhynchus mykiss*
Organism source	Hatchery
Organism age	Juvenile
Test type	Static
Test duration	96 hours
Test vessel	20-L glass aquarium
Test volume	10 to 20 L (depending on size of fish)
Test solution depth	≥15 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	None
Test temperature	15 ± 1°C
Feeding	None
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	6.5 ± 1 mL/min/L
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/13, with 2007 & 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (96-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Zinc (added as $ZnSO_4$)

Table 2. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Rainbow Trout Summary Sheet

Client: Mackenzie Pulp Mill Corporation Start Date/Time: March 05, 2020; 1310h

Work Order No.: 200352 Test Species: *Oncorhynchus mykiss*

Test Validity Criteria:
≥ 90% control survival
WQ Ranges:
T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

Sample Information:

Sample ID: #280 - GRAB - 3/3/2020
Sample Date: March 3, 2020
Date Received: March 04, 2020
Sample Volume: 2x20L
Other: -

Dilution Water:

Type: Dechlorinated Municipal Tap Water
Hardness (mg/L $CaCO_3$): 4
Alkalinity (mg/L $CaCO_3$): 7

Test Organism Information:

Batch No.: 010820b
Source: Lyndon Fish Hatcheries
No. Fish/Volume (L): 10/12L
Loading Density (g/L): 0.36
Mean Length ± SD (mm): 37 ± 1 Range: 35 - 39
Mean Weight ± SD (g): 0.44 ± 0.04 Range: 0.34 - 0.49

Zinc Reference Toxicant Results:

Reference Toxicant ID: RTZnL044
Stock Solution ID: 192n05
Date Initiated: March 05, 2020
96-h LC50 (95% CL): 201.0 (146.3 - 284.6) mg/L Zn

Reference Toxicant Mean and Historical Range: 94.6 (41.2 - 217.6) mg/L Zn
Reference Toxicant CV (%): 44%

Test Results: The 96 hour LC50 is estimated to be >100% (v/v).

Reviewed by: Date reviewed: March 13, 2020

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#: Mackenzie Pulp Mill Corporation
Sample I.D. #2BD-GRAB-3/3/2020
W.O. # 200352
RBT Batch #: 01082020
Date Collected/Time: Mar 3/20 @ 07:30h
Date Setup/Time: Mar 5/20 @ 13:10h
CER #: 2
Sample Setup By:

Thermometer: Cer-2
D.O. meter/probe: 5 / DS
Cond./Salinity meter/probe: 5 / CPS
pH meter/probe: 5 / PS

Number Fish/Volume: 10 / 12L
7-d % Mortality: 0.2%
Total Pre-aeration Time (mins): 80
Aeration rate adjusted to 6.5 ± 1 mL/min/L? (Y/N): Y

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	14.0		14.0
D.O. (mg/L)	2.9		~~2.60~~ 5.0
pH	7.4		7.6
Cond. (µS/cm)	2130		2130
Salinity (ppt)	1.1		1.1

Concentration	# Survivors							Temperature (°C)					Dissolved Oxygen (mg/L)					pH					Conductivity (µS/cm)	
(% v/v)	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Ctrl				10	10	10	10	14.0	14.0	14.5	15.0	15.0	10.1	10.0	9.7	9.3	9.4	7.0	7.1	7.2	7.2	7.1	24	30
6.25				10	10	10	10	14.0	14.0	14.5	15.0	15.0	10.1	10.0	9.7	9.3	9.4	7.2	7.4	7.3	7.5	7.3	99	105
12.5				10	10	10	10	14.0	14.0	14.5	15.0	15.0	10.1	10.0	9.8	9.4	9.5	7.3	7.7	7.7	7.6	7.5	277	285
25				10	10	10	10	14.0	14.0	14.5	15.0	15.0	10.0	10.0	9.8	9.5	9.5	7.4	8.0	7.8	7.9	7.7	582	609
50				10	10	10	10	14.0	14.0	14.5	15.0	15.0	9.9	9.9	9.8	9.4	9.3	7.5	8.2	8.1	8.1	8.0	1079	1089
100				10	10	10	10	14.0	14.0	14.5	15.0	15.0	7.3	9.5	9.8	9.5	9.3	7.7	8.5	8.5	8.5	8.4	2130	2150
Initials																								

Sample Description/Comments: Turbid dark brown liquid with particulates and pulp mill odour

Fish Description at 96 h: All fish appear normal Number of Stressed Fish at 96 h: 0

Other Observations:

Reviewed by: Date Reviewed: March 13, 2020

Daphnia magna Summary Sheet

Client: Mackenzie Pulp Mill Corporation
Work Order No.: 200351
Start Date/Time: Mar 4/2020 @ 1430h
Test Species: *Daphnia magna*
Set up by: MJE

Sample Information:

Sample ID: #280 - Grab - 3/3/2020
Sample Date: Mar 3/2020
Date Received: Mar 4/2020
Sample Volume: 2x 20L

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 021220A
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 15
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: Dm DC47
Stock Solution ID: 20 NaCl
Date Initiated: Mar 4/2020
48-h LC50 (95% CL): 4.8 (4.0-5.9) g/LNaCL

Reference Toxicant Mean and Historical Range: 6.1 (4.4-8.5) g/L NaCL
Reference Toxicant CV (%): 17

Test Results: The 48h LC50 is estimated to be >100% (v/v).

Reviewed by: [signature]
Date reviewed: March 13, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: Mackenzie Pulp Mill Corporation
Sample ID: #280-Grab-3/3/2020
Work Order No.: 200351

Start Date/Time: Mar 4/2020 @1430h
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: D.magna
Set up by: MMF

Thermometer: CER#5 pH meter/probe: 6 / 6 DO meter/probe: 6 / 6 Cond./Salinity meter/probe: 6 / 6

Concentration % (v/v)	Rep	Number of Live Organisms 24	48	No. Immobilized 48	Temperature (°C) 0	24	48	Dissolved oxygen (mg/L) 0	24	48	pH 0	24	48	Conductivity (µS/cm) 0	48
CTRL	A	10	10	0	19.0	19.5	19.5	8.8	8.6	8.6	8.1	8.0	8.1	346	350
	B														
	C														
	D														
6.25	A	10	10	0	19.5	19.5	19.5	8.7	8.4	8.5	8.0	7.9	8.1	469	469
	B														
	C														
	D														
12.5	A	10	10	0	19.5	19.5	19.5	8.6	8.2	8.3	8.0	7.9	8.1	590	589
	B														
	C														
	D														
25	A	10	10	0	19.5	19.5	19.5	8.5	7.8	8.0	7.9	7.9	8.1	815	811
	B														
	C														
	D														
50	A	10	10	0	20.0	19.5	19.5	8.0	5.2	6.5	7.9	7.7	8.0	1289	1279
	B														
	C														
	D														
100	A	10	10	0	20.5	19.5	19.5	4.5	2.6	4.6	7.7	7.5	8.0	2210	2190
	B														
	C														
	D														
Technician Initials		MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF

	Hardness*	Alkalinity*
Concentration	*(mg/L as CaCo3)	
Control (MHW)	96	70
Highest conc.	180	330
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	21.0		20.5
DO (mg/L)	3.2	aerated for 5 mins	4.5
pH	7.6		7.7
Cond (µS/cm)	2220		2210
Salinity (ppt)	1.1		1.1

Comments: _____ Mortality: Heartbeat checked under microscope last neg 12.

Sample Description: Turbid dark brown liquid with particulates and pulp mill odour

Batch#: 021220SA 7-d previous # young/brood: 15 Previous 7-d Mortality (%): 0 Day of 1st Brood: 9

Reviewed by: _____ Date reviewed: March 13, 2020

APPENDIX C – Chain-of-custody form

TESTING LOCATION (Please Circle)

Burnaby 8664
Commerce Court Burnaby, British
Columbia, Canada V5A 4N7
Phone 604.420.8773

NAUTILUS ENVIRONMENTAL

Chain of Custody

1 of 2

Date_____Page__of__

Report to:		**Invoice To:**	
Company	Mackenzie Pulp Mill Corporation	**Company**	Mackenzie Pulp Mill Corporation
Address	PO Box 2609, 1000 Coquiwaldi Rd.	**Address**	PO Box 2609, 1000 Coquiwaldi Rd.
City/State/Zip	Mackenzie, BC, V0J 2C0	**City/State/Zip**	Mackenzie, BC, V0J 2C0
Contact	Randeep Sandhu	**Contact**	Kim Hornett
Phone	250-997-2444	**Phone**	250-997-2473
Email	see comments section	**Email**	AP@mackenziepulp.com
		PO No.	43011427

Sample Collection By: JV **Sample Type:** Grab X **OR** Composite ○

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 48-h D. magna LC50	96-h RBT LC50	48-h D. magna screening (pass/fail)	96-h RBT screening (pass/fail)	RISS Data Entry						Receipt Temperature (°C)
1	#2BO - GRAB - ~~25/2~~ 3/3/2020	~~25-Feb-20~~ 03-Mar-20	~~7:30~~ 8:30	water	2 x 20 L		X	X			X						11.6 -12.5
2																	
3																	
4																	
5																	
6																	
7																	
8							20 03 S1	20 03 S2									
9																	
10																	

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Sample confirmation reciept, mortality update and report to required:

MK_Technical@mackenziepulp.com

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	2	4. Ice Present in Cooler?	(Y)/N
2. Courier	Loomis	5. Seal Present on Cooler?	Y/(N)
3. Good Condition?	(Y)/N	6. Initials Present on Seal?	Y/(N)

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

Client confirmed sample collection date/time via text message

RELINQUISHED BY (CLIENT)

(Print Name) (Signature)

(Company) (Date/Time)

RECEIVED BY (LABORATORY)

Tyrone TH
(Printed Name) (Signature)

Nautilus Mar. 4/20 @ 11:40
(Company) (Date and Time)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT

Acute Toxicity Test Results

Sample #2BO – GRAB – 10/3/2020,
collected March 10, 2020

Final Report

March 25, 2020

Submitted to: **Mackenzie Pulp Mill Corporation**
Mackenzie, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
#2BO – GRAB – 10/3/2020	10-Mar-20 at 0730h	11-Mar-20 at 1338h	11-Mar-20 at 1555h	5.0-6.2°C

TEST

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
#2BO – GRAB – 10/3/2020	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	4.8 (4.0 – 5.9) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.1 (4.4 – 8.5) g/L NaCl
Reference toxicant CV	17%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: March 4, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist

Reviewed By:
Julianna Kalocai, M.Sc., R.P.Bio
QA Manager

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: Mackenzie Pulp Mill Corporation
Work Order No.: 200395
Start Date/Time: Mar 11/2020 @ 1555h
Test Species: *Daphnia magna*
Set up by:

Sample Information:

Sample ID: #2180-Grab 10/03/2020
Sample Date: Mar 10/2020
Date Received: Mar 11/2020
Sample Volume: 2 x 1L

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 021920ATC
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 21
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: DmDC47
Stock Solution ID: 20 NaCl
Date Initiated: Mar 4/2020
48-h LC50 (95% CL): 4.8 (4.0 - 5.9) g/L NaCL

Reference Toxicant Mean and Historical Range: 6.1 (4.4 - 8.5) g/L NaCL
Reference Toxicant CV (%): 17

Test Results: The 48h LC50 is estimated to be >100% (v/v).

Reviewed by:
Date reviewed: March 17, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: Mackenzie Pulp Mill Corporation
Sample ID: #280 – Grab – 10/03/2020
Work Order No.: 200345

Start Date/Time: Mar 11/2020 @ 1055 h
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: D.magna
Set up by: [illegible]

Thermometer: CER#5 pH meter/probe: 6 2 / 2 6 DO meter/probe: 6 2 / 2 6 Cond./Salinity meter/probe: 6 2 / 2 6

Concentration %, (V/V)	Rep	Number of Live Organisms 24	48	No. Immobilized 48	Temperature (°C) 0	24	48	Dissolved oxygen (mg/L) 0	24	48	pH 0	24	48	Conductivity (µS/cm) 0	48
CTRL	A	10	10	0	19.0	19.5	19.5	8.7	8.4	8.6	8.1	8.1	8.1	341	347
	B														
	C														
	D														
6.25	A	10	10	0	19.0	19.5	19.5	8.5	8.1	8.4	8.0	8.0	8.1	452	456
	B														
	C														
	D								[illegible]						
12.5	A	10	10	0	19.5	19.5	19.5	8.4	~~8~~ 7.8	8.2	7.9	8.0	8.1	565	568
	B														
	C														
	D								[illegible]						
25	A	10	10	0	19.5	19.5	19.5	8.2	~~7.4~~ 7.2	7.7	7.8	7.9	8.0	787	786
	B														
	C														
	D														
50	A	10	10	0	19.5	19.5	19.5	7.8	6.2	6.7	7.6	7.8	8.0	1225	1221
	B														
	C														
	D														
100	A	10	10	0	21.0	19.5	19.5	5.9	4.8	5.1	7.4	7.8	8.0	2100	2100
	B														
	C														
	D					[illegible]									
Technician Initials		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Hardness*	Alkalinity*
Concentration	*(mg/L as CaCo3)	
Control (MHW)	94	68
Highest conc.	140	280
Hardness adjusted	—	

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	21.0		
DO (mg/L)	5.9		
pH	7.4		
Cond (µS/cm)	2100		
Salinity (ppt)	1.1		

Comments: _____ Mortality: Heartbeat checked under microscope No 1 req'd.

Sample Description: Thick brown liquid, pulpy odour, some particulates

Batch#: 021920A-EC 7-d previous # young/brood: 21 Previous 7-d Mortality (%): 0 Day of 1st Brood: 9

Reviewed by: [signature] Date reviewed: March 17 2020

APPENDIX C – Chain-of-custody form

TESTING LOCATION (Please Circle)

Chain of Custody

NAUTILUS ENVIRONMENTAL

Burnaby 8664
Commerce Court Burnaby, British
Columbia, Canada V5A 4N7
Phone 604.420.8773

Date_____Page___of___

Report to:		**Invoice To:**	
Company	Mackenzie Pulp Mill Corporation	**Company**	Mackenzie Pulp Mill Corporation
Address	PO Box 2609, 1000 Coquiwaldi Rd.	**Address**	PO Box 2609, 1000 Coquiwaldi Rd.
City/State/Zip	Mackenzie, BC, V0J 2C0	**City/State/Zip**	Mackenzie, BC, V0J 2C0
Contact	Randeep Sandhu	**Contact**	Kim Hornett
Phone	250-997-2444	**Phone**	250-997-2473
Email	see comments section	**Email**	AP@mackenziepulp.com
		PO No.	43011427

Sample Collection By: JV **Sample Type:** **Grab X** **OR** **Composite ○**

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 48-h D. magna LC50	96-h RBT LC50	48-h D. magna screening (pass/fail)	96-h RBT screening (pass/fail)	RISS Data Entry					Receipt Temperature (°C)
1	#2BO - GRAB - 10/03/2020	10-Mar-20	7:30	water	2 x 1 L	Z00395	X				X					5.0-6.2°C
2																
3																
4																
5																
6																
7																
8																
9																
10																

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Sample confirmation reciept, mortality update and report to required:

MK_Technical@mackenziepulp.com

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	2	4. Ice Present In Cooler?	(Y) / N
2. Courier	Loomis	5. Seal Present on Cooler?	Y / (N)
3. Good Condition?	(Y) / N	6. Initials Present on Seal?	Y / (N)

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

Jennifer vanderHorst (Print Name) (Signature)

Mackenzie Pulp (Company) 0735 Mar 10/2020 (Date/Time)

RECEIVED BY (LABORATORY)

Tyrone (Printed Name) (Signature)

(Company) Mar 11/20 @ 13:38 (Date and Time)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT

Acute Toxicity Test Results

Sample #2BO – GRAB – 17/3/2020,
collected March 17, 2020

Final Report

April 1, 2020

Submitted to: **Mackenzie Pulp Mill Corporation**
Mackenzie, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
#2BO – GRAB – 17/3/2020	17-Mar-20 at 0830h	18-Mar-20 at 0932h	18-Mar-20 at 1245h	6.4°C

TEST

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
#2BO – GRAB – 17/3/2020	>100

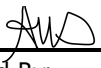
LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	4.8 (4.0 – 5.9) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.1 (4.4 – 8.5) g/L NaCl
Reference toxicant CV	17%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: March 4, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist



Reviewed By:
Andy Diewald, B.Sc.
Senior Analyst

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APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: Mackenzie Pulp Mill Corporation
Work Order No.: 200434
Start Date/Time: Mar 18/2020 @ 1245h
Test Species: *Daphnia magna*
Set up by: MF

Sample Information:

Sample ID: #280 - Grab - 17/03/2020
Sample Date: Mar 17/2020
Date Received: Mar 18/2020
Sample Volume: 2 x 1L

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 022620 A + C
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 20
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: DmDC 47
Stock Solution ID: 20 NaCl 2
Date Initiated: Mar 4/2020
48-h LC50 (95% CL): 4.8 (4.0 - 5.9) g/L NaCL

Reference Toxicant Mean and Historical Range: 6.1 (4.4 - 8.5) g/L NaCL
Reference Toxicant CV (%): 17

Test Results: The 48h LC50 is estimated to be. >100% (v/v).

Reviewed by: AT
Date reviewed: Mar 26/20

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: Mackenzie Pulp Mill Corporation
Sample ID: #280 - Grab - 17/03/2020
Work Order No.: 200434

Start Date/Time: Mar 18/2020 @ 1245 L
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: D.magna
Set up by: MWF

Thermometer: CER45 pH meter/probe: 63 / 26 DO meter/probe: 63 / 26 Cond./Salinity meter/probe: 63 / 26

Concentration %/(v/v)	Rep	Number of Live Organisms		No. Immobilized	Temperature (°C)			Dissolved oxygen (mg/L)			pH			Conductivity (µS/cm)	
		24	48	48	0	24	48	0	24	48	0	24	48	0	48
CTRL	A	10	10	0	19.5	20.0	20.5	8.7	8.4	8.5	8.1	8.1	8.0	348	351
	B														
	C														
	D														
6.25	A	10	10	0	19.5	20.0	20.5	8.5	8.1	8.3	8.0	8.0	8.0	453	451
	B														
	C														
	D														
12.5	A	10	10	0	19.5	20.0	20.5	8.3	7.9	8.0	7.9	8.0	8.0	559	564
	B														
	C														
	D														
25	A	10	10	0	19.5	20.0	20.5	8.2	7.4	7.6	7.8	8.0	8.0	768	765
	B														
	C														
	D														
50	A	10	10	0	19.5	20.0	20.5	7.9	6.3	7.1	7.6	7.9	8.1	1145	1139
	B														
	C														
	D														
100	A	10	10	0	19.5	20.0	20.5	5.6	4.1	5.3	7.5	7.8	8.1	1979	1972
	B														
	C														
	D														
Technician Initials		MWF	MWF	MWF	MWF	MWF	MWF	MWF	MWF	MWF	MWF	MWF	MWF	MWF	MWF

Concentration	Hardness*	Alkalinity*
	*(mg/L as CaCO3)	
Control (MHW)	98	74
Highest conc.	160	280
Hardness adjusted		

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	19.5		
DO (mg/L)	5.6		
pH	7.5		
Cond (µS/cm)	1979		
Salinity (ppt)	1.0		

Comments: _____ Mortality: Heartbeat checked under microscope Not Rq'd.

Sample Description: Turbid, brown liquid, pulpy odour, some pp in water

Batch#: 022620AtC 7-d previous # young/brood: 20 Previous 7-d Mortality (%): 0 Day of 1st Brood: 9

Reviewed by: _____ Date reviewed: Mar 26/20

APPENDIX C – Chain-of-custody form

TESTING LOCATION (Please Circle)

Chain of Custody

NAUTILUS ENVIRONMENTAL

Burnaby 8664
Commerce Court Burnaby, British
Columbia, Canada V5A 4N7
Phone 604.420.8773

Date_____Page___of___

Report to:		**Invoice To:**	
Company	Mackenzie Pulp Mill Corporation	**Company**	Mackenzie Pulp Mill Corporation
Address	PO Box 2609, 1000 Coquiwaldi Rd.	**Address**	PO Box 2609, 1000 Coquiwaldi Rd.
City/State/Zip	Mackenzie, BC, V0J 2C0	**City/State/Zip**	Mackenzie, BC, V0J 2C0
Contact	Randeep Sandhu	**Contact**	Kim Hornett
Phone	250-997-2444	**Phone**	250-997-2473
Email	see comments section	**Email**	AP@mackenziepulp.com
		PO No.	43011427

Sample Collection By: KV/CA **Sample Type:** **Grab X** **OR** **Composite ○**

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 48-h D. magna LC50	96-h RBT LC50	48-h D. magna screening (pass/fail)	96-h RBT screening (pass/fail)	RISS Data Entry					Receipt Temperature (°C)
1	#2BO - GRAB - 17/03/2020	17-Mar-20	8:30	water	2 x 1 L	WO# 200434	X				X					6.4
2																
3																
4																
5																
6																
7																
8																
9																
10																

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Sample confirmation reciept, mortality update and report to required:

MK_Technical@mackenziepulp.com

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	2	4. Ice Present in Cooler?	(Y) / N
2. Courier	Loomis	5. Seal Present on Cooler?	Y / (N)
3. Good Condition?	(Y) / N	6. Initials Present on Seal?	Y / (N)

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)		**RECEIVED BY (LABORATORY)**	
Khevinder Nandra (Print Name)	(Signature)	Tyme (Printed Name)	TM (Signature)
Mack. pulp (Company)	Mar 17/20 @ 10:51 (Date/Time)	Nautilus (Company)	Mar. 18/20 @ 9:32 (Date and Time)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT

Acute Toxicity Test Results

Sample #2BO – GRAB – 24/03/2020,
collected March 24, 2020

Final Report

April 8, 2020

Submitted to: **Mackenzie Pulp Mill Corporation**
Mackenzie, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
#2BO – GRAB – 24/03/2020	24-Mar-20 at 0830h	25-Mar-20 at 1025h	25-Mar-20 at 1355h	6.8°C

TEST

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
#2BO – GRAB – 24/03/2020	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	7.3 (6.4 – 8.3) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.0 (4.3 – 8.4) g/L NaCl
Reference toxicant CV	17%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: March 24, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio.
Senior Analyst

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APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: Marbourie Pulp Mill Corporation Start Date/Time: Mar 25/2020 @ 1355h
Work Order No.: 200480 Test Species: *Daphnia magna*
Set up by: YYC

Sample Information:

Sample ID: #280 - Grab - 24/03/2020
Sample Date: Mar 24/2020
Date Received: Mar 25/2020
Sample Volume: 2x1L

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 031120A
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 17
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: DmDC48
Stock Solution ID: 20 NaCl
Date Initiated: Mar 24/2020
48-h LC50 (95% CL): 7.3 (6.4 - 8.3) g/L NaCL

Reference Toxicant Mean and Historical Range: 6.0 (4.3 - 8.4) g/L NaCL
Reference Toxicant CV (%): 17.

Test Results: The 48h LC50 is estimated to be. >100% (v/v).

Reviewed by: [signature] Date reviewed: March 31, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: Mackenzie Pulp Mill Corporation
Start Date/Time: March 25, 2020 @ 1355h
Sample ID: #280-Grab-24/03/2020
CER #: 5
Work Order No.: 200480
No. Organisms/volume: 10/200mL
Test Organism: *D.magna*
Set up by: YH

Thermometer: CER#5 pH meter/probe: 6 B / 6 B DO meter/probe: 6 B / 6 B Cond./Salinity meter/probe: 6 B / 6 B

Concentration %. (v/v)	Rep	Number of Live Organisms 24	48	No. Immobilized 48	Temperature (°C) 0	24	48	Dissolved oxygen (mg/L) 0	24	48	pH 0	24	48	Conductivity (µS/cm) 0	48
CTRL	A	10	10	0	20.0	20.5	20.0	8.5	8.3	8.6	8.2	8.2	8.1	350	355
	B														
	C														
	D														
6.25	A	10	10	0	20.0	20.5	20.0	8.4	8.0	8.4	8.1	8.0	8.0	462	462
	B														
	C														
	D														
12.5	A	10	10	0	20.0	20.5	20.0	8.2	7.6	8.0	7.9	8.0	8.0	563	565
	B														
	C														
	D												MHF		
25	A	10	10	0	20.0	20.5	20.0	7.9	6.1	6.8	7.8	7.8	~~7.8~~ 7.9	773	772
	B														
	C														
	D														
50	A	10	10	0	20.0	20.5	20.0	6.9	4.9	5.7	7.6	7.7	7.9	1172	1169
	B														
	C														
	D														
100	A	10	10	0	20.0	20.5	20.0	4.1	2.9	3.8	7.5	7.7	8.0	1958	1958
	B														
	C														
	D														
Technician Initials		MHF	MHF	MHF	MH	MHF	MHF	MH	MHF	MHF	MH	MHF	MHF	MH	MHF

	Hardness*	Alkalinity*
Concentration	*(mg/L as CaCo3)	
Control (MHW)	100	72
Highest conc.	200	380
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	20.0		
DO (mg/L)	4.1		
pH	7.5		
Cond (µS/cm)	1958		
Salinity (ppt)	1.0		

Comments: _____ Mortality: Heartbeat checked under microscope not req'd.

Sample Description: brown, turbid, oily odour, some particulates

Batch#: 031120A 7-d previous # young/brood: 17 Previous 7-d Mortality (%): 0 Day of 1st Brood: 9

Reviewed by: _____ Date reviewed: March 31, 2020

APPENDIX C – Chain-of-custody form

TESTING LOCATION (Please Circle)

Chain of Custody

NAUTILUS ENVIRONMENTAL

Burnaby 8664
Commerce Court Burnaby, British
Columbia, Canada V5A 4N7
Phone 604.420.8773

Date_____Page___of___

Report to:		**Invoice To:**	
Company	Mackenzie Pulp Mill Corporation	**Company**	Mackenzie Pulp Mill Corporation
Address	PO Box 2609, 1000 Coquiwaldi Rd.	**Address**	PO Box 2609, 1000 Coquiwaldi Rd.
City/State/Zip	Mackenzie, BC, V0J 2C0	**City/State/Zip**	Mackenzie, BC, V0J 2C0
Contact	Randeep Sandhu	**Contact**	Kim Hornett
Phone	250-997-2444	**Phone**	250-997-2473
Email	rsandhu@mackenziepulp.com kvandara@mackenziepulp.com; cabbott@mackenziepulp.com	**Email**	AP@mackenziepulp.com
		PO No.	43011427

Sample Collection By: KV/CA **Sample Type:** **Grab X** **OR** **Composite ○**

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 48-h D. magna LC50	96-h RBT LC50	48-h D. magna screening (pass/fail)	96-h RBT screening (pass/fail)	RJSS Data Entry					Receipt Temperature (°C)
1	#2BO - GRAB - 24/03/2020	24-Mar-20	8:30	water	2 x 1 L	200480	X				X					6.8
2																
3																
4																
5																
6																
7																
8																
9																
10																

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Sample confirmation reciept, mortality update and report to required:

MK_Technical@mackenziepulp.com

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	2	4. Ice Present in Cooler?	Y/N
2. Courier	Loomis	5. Seal Present on Cooler?	Y/N
3. Good Condition?	Y/N	6. Initials Present on Seal?	Y/N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

(Print Name) Claire Abbott (Signature) [signature]

(Company) Mack Pulp (Date/Time) March 24, 2020

RECEIVED BY (LABORATORY)

(Printed Name) Tyrus (Signature) [signature]

(Company) [illegible] (Date and Time) Mar. 25/2020 10:25

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT

Acute Toxicity Test Results

Sample #2BO – GRAB – 31/03/2020,
collected March 31, 2020

Final Report

April 8, 2020

Submitted to: **Mackenzie Pulp Mill Corporation**
Mackenzie, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
#2BO – GRAB – 31/03/2020	31-Mar-20 at 0830h	01-Apr-20 at 0906h	01-Apr-20 at 1415h	4.1°C

TEST

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
#2BO – GRAB – 31/03/2020	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	7.3 (6.4 – 8.3) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.0 (4.3 – 8.4) g/L NaCl
Reference toxicant CV	17%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: March 24, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio.
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: Mackenzie Pulp Mill Corporation
Work Order No.: 200512
Start Date/Time: Apr 01/2020 @ 1415 h
Test Species: *Daphnia magna*
Set up by: MM

Sample Information:

Sample ID: #280 - Grab - 31/03/2020
Sample Date: Mar 31/2020
Date Received: Apr 01/2020
Sample Volume: 2 x 1L.

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 030420B
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 15
Mortality (%) in previous 7 d: 0
Days to first brood: 11

NaCl Reference Toxicant Results:

Reference Toxicant ID: DmDC48
Stock Solution ID: 20Na02
Date Initiated: Mar 24/2020.
48-h LC50 (95% CL): 7.3 (6.4 - 8.3) g/L NaCL

Reference Toxicant Mean and Historical Range: 6.0 (4.3 - 8.4) g/L NaCL
Reference Toxicant CV (%): 19

Test Results: The 48h LC50 is estimated to be > 100% (v/v)

Reviewed by: [signature]
Date reviewed: April 6, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: Mackenzie Pulp Mill Corporation
Sample ID: #280 - Grab - 31/03/2020
Work Order No.: 200512

Start Date/Time: Apr 01/2020 @1405 L
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: D.magna
Set up by: MMF

Thermometer: CER#5 pH meter/probe: 6 7 8 / MMF MMF 6 DO meter/probe: 6 7 8 / MMF MMF 6 Cond./Salinity meter/probe: 6 7 8 / MMF MMF 6

Concentration %, (V/V)	Rep	Number of Live Organisms		No. Immobilized	Temperature (°C)			Dissolved oxygen (mg/L)			pH			Conductivity (µS/cm)	
		24	48	48	0	24	48	0	24	48	0	24	48	0	48
CTRL	A	10	10	0	18.5	19.0	19.0	8.8	8.7	8.7	8.2	8.0	8.0	348	353
	B														
	C														
	D								MMF						
6.25	A	10	10	0	18.5	19.0	19.0	8.7	~~8.5~~ 8.3	8.4	8.0	7.9	7.9	450	452
	B														
	C														
	D								MMF						
12.5	A	10	10	0	18.5	19.0	19.0	8.6	~~8.3~~ 7.8	7.8	7.9	7.8	7.9	552	555
	B														
	C														
	D								MMF						
25	A	10	10	0	18.5	19.0	19.0	8.5	~~7.9~~ 7.1	7.1	7.8	7.8	7.9	752	755
	B														
	C														
	D								MMF				MMF		
50	A	10	10	0	19.0	19.0	19.5	8.3	~~7.2~~ 3.8	5.1	~~17 MMF~~ 7.7	7.5	~~7.7~~ 7.8	1152	1150
	B														
	C														
	D								MMF						
100	A	10	10	0	19.5	19.0	19.5	7.4	~~8.9~~ 2.6	3.7	7.5	7.6	7.9	1943	1947
	B														
	C														
	D														
Technician Initials		MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF	MMF

	Hardness*	Alkalinity*
Concentration	*(mg/L as CaCo3)	
Control (MHW)	98	72
Highest conc.	180	340
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	19.5		
DO (mg/L)	7.4		
pH	7.5		
Cond (µS/cm)	1943		
Salinity (ppt)	1.0		

Comments: _____ Mortality: Heartbeat checked under microscope last day if.

Sample Description: Turbid brown liquid, pulpy odour, some particulates.

Batch#: 030420B 7-d previous # young/brood: 15 Previous 7-d Mortality (%): 0 Day of 1st Brood: 11

Reviewed by: _____ Date reviewed: April 6, 2020

APPENDIX C – Chain-of-custody form

TESTING LOCATION (Please Circle)

Chain of Custody

NAUTILUS ENVIRONMENTAL

Burnaby 8664
Commerce Court Burnaby, British
Columbia, Canada V5A 4N7
Phone 604.420.8773

Date_____Page__of__

Report to:		**Invoice To:**	
Company	Mackenzie Pulp Mill Corporation	**Company**	Mackenzie Pulp Mill Corporation
Address	PO Box 2609, 1000 Coquiwaldi Rd.	**Address**	PO Box 2609, 1000 Coquiwaldi Rd.
City/State/Zip	Mackenzie, BC, V0J 2C0	**City/State/Zip**	Mackenzie, BC, V0J 2C0
Contact	Randeep Sandhu	**Contact**	Kim Hornett
Phone	250-997-2444	**Phone**	250-997-2473
Email	rsandhu@mackenziepulp.com kvandara@mackenziepulp.com; cabbott@mackenziepulp.com	**Email**	AP@mackenziepulp.com
		PO No.	43011427

Sample Collection By: KV/CA **Sample Type:** **Grab X** **OR** **Composite ○**

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 48-h D. magna LC50	96-h RBT LC50	48-h D. magna screening (pass/fail)	96-h RBT screening (pass/fail)	RISS Data Entry						Receipt Temperature (°C)
1	#2BO - GRAB - 31/03/2020	31-Mar-20	8:30	water	2 x 1 L		X				X						4.1
2																	
3																	
4																	
5																	
6																	
7							2005i2										
8																	
9																	
10																	

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Sample confirmation reciept, mortality update and report to required:

MK_Technical@mackenziepulp.com

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	2	4. Ice Present in Cooler?	Y / N
2. Courier	Loomis	5. Seal Present on Cooler?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

(Print Name) Claire Abbott (Signature) Claire A.

(Company) Mack Pulp 31-Mar-2020 (Date/Time)

RECEIVED BY (LABORATORY)

Tyma (Printed Name) TH (Signature)

(Company) Mar. 1/20 @ 9:06 (Date and Time)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT

MACKENZIE PULP MILL CORPORATION
A PAPER EXCELLENCE COMPANY

Quality Assurance Data
March 2020

Precision					Accuracy					Blanks		
Date	Test Results	Average	% Deviation from Average	Acceptance Criteria	Date	Std. Value	Test Result	% Deviation from Standard	Acceptance Criteria	Date	Test Results mg/l	Acceptance Criteria
A) Non-Filterable Residue (TSS)												
03-Mar-20	60.20	62.3	3.4	15.0								< 2.0 mg/l
	64.45									03-Mar-20	-6.30	
10-Mar-20	65.35	68.6	4.7							10-Mar-20	-3.30	
	71.75									17-Mar-20	-4.30	
17-Mar-20	73.35	72.2	1.6							24-Mar-20	-3.70	
	71.05									31-Mar-20	-6.20	
24-Mar-20	103.40	103.2	0.2									
	102.95											
31-Mar-20	107.55	108.8	1.2									
	110.10											
*Note: extremely low concentrations represent greater deviation possibilities												
B) pH												
03-Mar-20	7.18	7.09	1.3	15.0						Not applicable for pH test.		
	7.00											
10-Mar-20	7.16	7.04	1.6									
	6.93											
17-Mar-20	7.08	7.02	0.8									
	6.96											
24-Mar-20	7.18	7.05	1.8									
	6.92											
C) Nutrients (TESTING DONE BY ALS Environmental) **D) BOD** (TESTING DONE BY ALS Environmental) **E) AOX** (TESTING DONE BY ECONOTECH SERVICES LTD.) See attached Certificate of Accreditation and Final Scope of Testing documentation for Econotech Services Ltd & ALS Environmental issued by the Canadian Association for Laboratory Accreditation Inc. (CALA). Subsequent submissions will refer to this documentation. See also last PT test done by Mackenzie Pulp Mill.													

LABORATORY NAME: Mackenzie Pulp Mill - Internal Compliance Lab
STUDY DATE: October 2019 Study
MATRIX: Water (Inorganic)

PARTICIPANT NO.: 3033

SAMPLE	CODE	APP	ANALYTE	METHOD	N	UNITS	ASSIGNED	±U	REPORTED	S	Z SCORE	SCORE	BIAS	SUMMARY
TEST GROUP: Solids														
C04A-1	033246		Total Suspended Solids	GRAVIMETRIC	211	mg/L	17	.2	18	2	.5			
C04A-2	033246		Total Suspended Solids	GRAVIMETRIC	211	mg/L	69	.6	66	7	-.429			
C04A-3	033246		Total Suspended Solids	GRAVIMETRIC	215	mg/L	131	2	113	23	-.783			
C04A-4	033246		Total Suspended Solids	GRAVIMETRIC	210	mg/L	215	2	220	22	.227	93		Acceptable
C04A-1	050850		Volatile Suspended Solids	GRAVIMETRIC	63	mg/L	15	.3	18	2	1.5			
C04A-2	050850		Volatile Suspended Solids	GRAVIMETRIC	61	mg/L	55.6	1	55	7	-.086			
C04A-3	050850		Volatile Suspended Solids	GRAVIMETRIC	63	mg/L	111	2	103	13.9	-.576			
C04A-4	050850		Volatile Suspended Solids	GRAVIMETRIC	61	mg/L	175	4	181	21.9	.274	91		Acceptable
TEST GROUP: BOD/CBOD														
C04B-1	033247		BOD (5 day)	D.O. METER	111	mg/L	44	.9	42	8	-.25			
C04B-2	033247		BOD (5 day)	D.O. METER	111	mg/L	73	2	58	13	-1.154			
C04B-3	033247		BOD (5 day)	D.O. METER	111	mg/L	167	3	136	29	-1.069			
C04B-4	033247		BOD (5 day)	D.O. METER	111	mg/L	184	4	150	32	-1.063	87		Acceptable
TEST GROUP: COD														
C04D-1	044972		COD	COLORIMETRIC	98	mg/L	42	.6	47	4	1.25			
C04D-2	044972		COD	COLORIMETRIC	102	mg/L	252	1	261	11	.818			
C04D-3	044972		COD	COLORIMETRIC	101	mg/L	349	2	363	14	1			
C04D-4	044972		COD	COLORIMETRIC	101	mg/L	481	2	509	18	1.556	83	H	Acceptable
TEST GROUP: pH														
C15-1	033248		pH	pH METER	258	pH units	4.2	.008	4.09	.1	-1.1			
C15-2	033248		pH	pH METER	259	pH units	7.74	.008	7.55	.1	-1.9			
C15-3	033248		pH	pH METER	258	pH units	9.31	.008	8.98	.1	-3.3			

*DNS = Did Not Submit Results ± U = uncertainty of the Assigned Value

Canadian Association for Laboratory Accreditation Inc.

CALA

Certificate of Accreditation

Nautilus Environmental Inc.
8664 Commerce Court
Burnaby, British Columbia

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

CALA

Accreditation No.: A3525
Issued On: August 28, 2017
Accreditation Date: June 7, 2003
Expiry Date: February 26, 2020

Andrew M. Adams
President & CEO

CALA

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request; reproduction must follow policy in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca.

Canadian Association for Laboratory Accreditation Inc.

CALA

Certificate of Accreditation

ALS Environmental (Vancouver)
ALS Canada Ltd.
8081 Lougheed Highway
Suite 100
Burnaby, British Columbia

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

CALA

Accreditation No.: A1719
Issued On: December 12, 2018
Accreditation Date: January 3, 2005
Expiry Date: June 11, 2021

Andrew M. Adams
President & CEO

CALA

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request; reproduction must follow policy in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca.

Canadian Association for Laboratory Accreditation Inc.

CALA

Certificate of Accreditation

Econotech Services Limited
852 Derwent Way
Delta, British Columbia

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

Accreditation No: A2454
Issued On: February 9, 2018
Accreditation Date: January 3, 2005
Expiry Date: August 9, 2020

Andrew M. Adams
President & CEO

CALA

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request; reproduction must follow policy in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca