BAFFINLAND IRON MINES CORP – MARY RIVER PROJECT
WASTEWATER TREATMENT PLANT
H337697

Design Basis - Wastewater Treatment Plant

PERMIT TO PRACTICE
HATCH LTD.
Signature [signature]
Date SEPT 13, 2011
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

REGISTERED PROFESSIONAL ENGINEER
L1247
R. A. HALIM
LICENSEE
13 Sept, 2011
NWT/NU

2011-07-27	0	Issued for Use – Environmental Permit	R. Kapadia	A. Zlatic	J. Cleland	
DATE	REV.	STATUS	AUTHOR	CHECKED	APPROVED	APPROVED
HATCH						CLIENT

Table of Contents

1. General

1.1 Introduction

Baffinland Iron Mines Corporation is developing an Iron Ore Mine Site on Baffin Island named the Mary River Project. This design basis will be for the two new wastewater treatment plants (WWTP) that will support the mine. It is anticipated that there will be a four (4) year construction phase followed by approximately twenty (20) years of operation of the mine. These new systems will therefore be designed to accommodate the expected flows of wastewater from the various mine camps for both the construction and operation phases.

Wastewater will be collected and treated at wastewater treatment facilities located at each of the three (3) permanent camps:

- Milne Port
- Mary River (Mine Site), and
- Steensby Port

There is an existing wastewater treatment system at Milne Inlet and therefore only two (2) new wastewater treatment plants are required. One WWTP for the Mary River Mine Site, and one WWTP for Steensby Port. In order to offset the total fresh water demand of the facilities the treated wastewater shall be reused as wash water. This will also reduce the volume of water discharged.

The wastewater discharge criteria will be based on several appropriate guidelines including Nunavut territorial guidelines as well as Canadian federal guidelines as identified in section 4.4.

1.2 Description

This design criteria provides the basis for the engineering design of the wastewater treatment plants (WWTP).

Information relating to wastewater production and composition has been summarized in the subsequent sections.

The new WWTP shall be able to meet peak site needs during the construction phase as well the requirements during the operation phase of the mine.

The WWTP will be required to treat wastewater generated from vehicle maintenance and wash facilities (ie. truck wash, equipment and floor wash down water). The treated water shall be recycled and reused for wash down water, or discharged. The separated waste oil will be stored in a local tank. Periodically, the oil will be drained and sent for disposal.

Storm water, fuel tank hydro test water, rail engine wash, water from aggregate washing and exploration drilling will not be sent to these WWTPs. These water sources will be collected and then treated separately (if required) by other treatment systems. Run-off from tank fuel storage areas will have dedicated water treatment systems(by others). Additionally, it has been assumed that the emulsion plant shall be supplied with its own wastewater treatment plant (by others).

2. References

2.1 Codes and Standards

Unless specifically stated otherwise, the design of the sewage equipment will be in accordance with the latest revision of the following codes, standards and regulations. In addition, the design will comply with any laws or regulations of local authorities and Certificate of Approval.

Table 2-1: Applicable Regulations, Standards and Codes

Number / Acronym	Title
AWWA	*American Water Works Association*
IBC	*International Building Codes*
Nunavut Waters and Nunavut Surface Rights Tribunal Act, SC 2002, c 10	
Northwest Territories Water Act	
Northwest Territories Water Regulations (SOR/93-303)	
Canadian Fisheries Act	
Canadian Environmental Protection Act (1999)	
CCME Water Quality Guidelines for the Protection of Aquatic Life	
Guidelines: Industrial Waste Discharges in Nunavut (Environmental Protection Service, Department of Sustainable Development Government of the Nunavut, 2002)	
*Metal Mining Effluent Regulations (*Developed under section 36 of the *Fisheries Act, 2002)*	
OSHA	*Occupational Safety and Health Administration*

2.2 Other Reference Documents

Additional technical information is provided in the Technical Specification - Wastewater Treatment Plant, Document No. H337697-4000-10-123-0004.

3. Existing Equipment Description

As the project is already in the preliminary stages of development there is an existing wastewater treatment system at the Milne Inlet site. Descriptions of the existing system follows:

3.1 Existing Wastewater Treatment Systems (at Milne Inlet):

The existing system was designed to treat oil contaminated water from the fuel storage area at the Milne Inlet site. As stated in the document "Milnet Inlet Fuel Farm – Operations Plan, 2008", The Milne Inlet oil water separator is an FII "flow and plug" oil absorption system manufactured by Filter Innovations. It is a 3 phase oil & water separator consisting of:

- A particulate filter that pre-filters to effectively remove dirt and dust particles, followed by;
- Oil adsorbing media contained in two removable stainless steel canisters.
- The final polishing stage is an activated carbon filtering system to reduce effluent parameters to permitted discharge limits.

As noted by Hatch personnel during site visit in July 2011, the existing WWTP has been upgraded with additional technology, the new process includes the following treatment stages:

- Gravity type Oil Water Separator
- Dissoloved air flotation
- Reverse Osmosis
- Polishing filters (clay and activated carbon)

There will be no vehicle maintenance facilities at the Milne Inlet Site and no other oily waste water generation. As such the existing system capacity is sufficient for the Milne Inlet site and as such no new WWTP is required for this site.

3.2 Condition of Wastewater Treatment Systems:

- Milne Port: Operating

4. Design Parameters

The proposed new Wastewater treatment systems will be designed to meet the peak treatment requirements during the construction and operations phase.

4.1 Wastewater Characteristics from the Vehicle Maintenance Shop

In the previous phase of this project, there were no technical details presented for the wastewater treatment plant. As such, no wastewater qualities and characteristics were available.

For the current project, the anticipated quality of the vehicle wash wastewater to be used for the design of the WWTP is based upon several references as shown in the tables below.

Additional information may become available as the project develops into detailed engineering phase. When additional information is available the design basis will be updated accordingly.

Table 4-1: Vehicle Wash Wastewater Reference Sources

Source No.	Description
1	Chemical Truck facility wash water characteristics taken from "Final Development Document For Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category" (June 2000, US EPA).
2	Petroleum Truck facility wash water characteristics taken from "Final Development Document For Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category" (June 2000, US EPA).
3	Carwash waste water characteristics taken from "Carwash Wastewaters: Characteristics, Volumes, and Treatability by Gravity Oil Separation, Mexico" (2007, Prepared by University Autónoma Metropolitana – Iztapalapa)
4	Light Vehicle wash water characteristics taken from "Treatment of Automobile Service Station Wastewater by Coagulation and Activated Sludge Process", (2011, International Journal of Environmental Science and Development)
5	Truck wash water characteristics for trucks carrying a wide mix of chemical, petrochemical, food and waste products "Truck Washing Terminal Water Pollution Control" (1980, EPA)
6	Wash water from the area maintenance support activities (AMSA) facility associated with the highest level of maintenance on army equipment taken from "Designing Coalescing Oil/Water Separators for Use at Army Washracks" (December 2000, study was conducted for the U.S. Army Corps of Engineers).

Table 4-2: Summary of Average Vehicle Wash Wastewater Characterization Data

Parameter	Units	Source #1	Source #2	Source #3	Source #4	Source #5	Source #6	Design Basis
Benzene	μg/L	35	N/A	N/A	N/A	N/A	N/A	< 35
Toluene	μg/L	1600	20	N/A	N/A	N/A	N/A	< 20
Ethylbenzene	μg/L	440	N/A	N/A	N/A	N/A	N/A	< 440
Lead	μg/L	25	N/A	N/A	N/A	N/A	N/A	< 25
Oil and Grease	mg/L	1300	260	1099	150 – 700*	110 – 600*	478	< 1300
Total Suspended Solids	mg/L	1600	230	3561	600 – 750*	300 – 5000*	1272	< 3500
pH	---	N/A	N/A	7.5	7.1 – 7.6*	10.5 – 12.5*	N/A	7.1 – 12.5
Iron	μg/L	30,000	1400	N/A	N/A	N/A	N/A	< 1400

Notes:

1. The asterix (*) indicates that for these parameters average values were not available and as such ranges of values have been presented.
2. N/A: Not Available

4.2 Design Parameter Evaluation and Selection Basis

The values presented in Table 4- are those parameters for which data were available and are of interest because they are expected to be present in appreciable quantities or are regulated parameters. The table indicates a wide variation in some of the parameters of interest. As such specific design basis values have been selected based upon an examination of the validity and applicability of the various sources.

Source #1: This source was selected because it was the only available source to include data on Benzene, Ethylbenzene and Lead. The data comes from multiple truck wash facilities which handle trucks that carry chemicals. This is a broad category and we would expect that a portion of the contaminants present are there due to the chemical cargo of the trucks rather than other vehicle fluids. It is expected however that some level of these parameters will be present. Leaked fuel, for instance, does contain some levels of Benzene and Ethylbenzene. As such, these values were selected as limiting conservative estimates for these parameters. The oil and grease levels identified here is of the same magnitude as the other sources while being the highest and therefore most conservative. As such, the design value for oil and grease is based on this source.

Source #2: This source is of similar applicability to source #1 and includes data on Toluene and Iron. The values for Toluene and Iron are lower than for source #1 which indicates that the levels above this from source #1 are due to the cargo the trucks are carrying. As such, for Toluene and Iron, this is a more applicable value and was selected as a design value.

Sources #3, 4 and 5: These sources are included to add further data points for the selection of oil and grease and suspended solids content. It can be seen that they show a wide range of these parameters. Within the referenced papers themselves the authors discuss how various factors can affect the parameters. For instance, the typical state of repair of the vehicles. The quality of the roads they travel on. Source #3 would seem most applicable for a suspended solids level as this source is from a geographical area where gravel and dirt roads are common. In addition there is no cargo impacting the results. As such, the suspended solids level from this source was chosen for design basis purposes. Given that pH may be alkaline depending on the cleaning chemicals used we have deemed it is most appropriate to include the entire pH range in the design basis.

Source #6: This source has been included to show the impact of heavy vehicle and equipment washing. It is taken from US Army cleaning facilities and is associated with the highest level of maintenance on the equipment. It can be seen that these values are not appreciably higher than those from the other sources and as such we have deemed that preparing a separate design basis for heavy vehicle washing is not required.

4.3 Wastewater Generation Rates

The vehicle and equipment wash flowrates are based upon the flow estimates developed in "Design Basis for Fresh Water Distribution System for Mary River, Milne Inlet and Tote road construction" (November 2010, TDR 165926-6710-131-TDR-0001, AMEC). These values are summarized in tables 4-3 and 4-4.

Table 4-3: Mine Site Wastewater Flows

Source	Construction Phase			Operation Phase		
	Ave. (m3/hr)	Peak (m3/hr)	Peak Duration (hr)	Ave. (m3/hr)	Peak (m3/hr)	Peak Duration (hr)
Explosives Truck Wash	0.0078	1.3	0.5	0.0078	1.3	0.5
Ore transport Truck Wash	0.6			1.2		
Equipment / Floor wash down	4	11.4	8	4	11.4	8
Rail Engine Wash	-	-	-	-	-	-
Rail shop other uses	-	-	-	-	-	-
Total Flow, m3/hr:	5.1	14.6		5.7	14.6	

Table 4-4: Steensby Port Site Wastewater Flows

Source	Construction Phase			Operation Phase		
	Ave. (m3/hr)	Peak (m3/hr)	Peak Duration (hr)	Ave. (m3/hr)	Peak (m3/hr)	Peak Duration (hr)
Explosives Truck Wash	0.0078	1.3	0.5	0.0078	1.3	0.5
Ore transport Truck	0.6			1.2		

Wash						
Equipment / Floor wash down	4	11.4	8	4	11.4	8
Rail Engine Wash	-	-	-	1.2	1.3	0.5
Rail shop other uses	0.0064	1.3	0.5	0.0064	1.3	0.5
Total Flow, m3/hr:	5.1	16.1		7.1	17.7	

The wastewater design flows are presented in Table 4-5. These flows are based on the maximum flows for each site from both the construction and operation phases (Tables 4-3 and 4-4). The design flow also includes a safety allowance.

The minimum settling tank retention time has been estimated to accommodate the peak flow volumes using the flows and durations presented in Tables 4-3 and 4-4.

Table 4-5: Wastewater Design Flow Summary

Parameter	Mine Site	Steensby Port Site
Average Wastewater Flowrate (m3/hr)	6.5	8.25
Peak Wastewater Flowrate (m3/hr)	17	20.5
Minimum Settling Tank Retention Time (hr)	12	12

4.4 Average and Peak Flows

Wastewater flowrates have been calculated using the following factors. The data below provides peak and average flow data.

Table 4-6: Wastewater Flow Design Basis

Parameter	Design Value
Explosives Truck Wash	11 L/min for 30 mines 2 times a week Water trucked from Camp Lake to truck wash facility (Consider 2 truck, 52 weeks/year)
Ore Transport Truck Wash	Re-fill 200 m3 sump once per week (52 weeks/year and 365 days/year) During construction consider 50% water consumption of operation
Equipment / Floor Washdown	11.4 m3/h, 8 hours/day, 365 days/year at both Mine Site and Steensby Port
Rail Engine Wash	Re-fill 200 m3 sump once per week (consider 52 weeks/year & 365 days/year). Applies to Steensby Site only during operation phase.
Rail Shop other Uses	Parts washing etc. Estimate is 56 m3/year. Applies to Steensby Site only during operation phase.

Notes:

1. Source: Design Basis for sewage treatment system for Mary River, Milne Inlet and Tote road (issued for feasibility study) – Nov. 29, 2010 prepared by AMEC. Doc. No. 165926-6780-131-TDR-0001. Note
2. It has been assumed that the equipment / floor washdown characteristics will match those shown on Table 4-5. All the other sources will be assumed to have characteristics that match those shown on Table 4-1.

4.5 Treated Wastewater Effluent Quality

In the previous phase of this project no discharge requirements were provided for treated wash water from the vehicle maintenance facilities.

However the document “Mary River Project – Environmental Impact Statement – December 2010”, refers to the following applicable guideline for water contacted with fuel (for the fuel storage areas):

- Metal Mining Effluent Regulations (MMER)

The following document has also been identified as a guideline:

- Guidelines: Industrial Waste Discharges in Nunavut (GIWDN) - prepared by the Department of Sustainable Development Environmental Protection Service – Nunavut.

For this phase of the project the discharge criteria has been developed using a combination of the GIWDN and MMER guidelines. For conservatism the most stringent of the two criteria was adopted.

Once a new water licence has been prepared by the Nunavut Water Board the criteria may be modified.

Table 4-7: Wastewater Effluent Discharge Limits

Parameter	GIWDN	MMER	Design Basis
Aluminum	1		<1
Ammonia	10		<10
Arsenic	1	0.5	<0.5
Barium	1		<1
Cadmium	0.1		<0.1
Biochemical Oxygen Demand	15		<15
Chlorine	1		<1
Chromium	0.1		<0.1
Copper	1	0.3	<0.3
Cyanide	0.1	1.0	<0.1
Fluoride	2		<2
Grease, Fat, Oil	15		<15
Iron	1		<1
Lead	0.05	0.2	<0.05
Mercury	0.006		<0.006
Nickel	1	0.5	<0.5
pH Range	6 – 10.5	6 – 9.5	6 – 9.5
Phenolic Compounds	0.02		<0.02
Phosphorous	1		<1
Silver	0.1		<0.1
Suspended Solids	15	15	<15
Tin	1		<1
Zinc	0.5	0.5	<0.5

END OF SECTION