2018 ᓄᓘᔾᒃ ᓄᓇᖓᓂ ᐊᕙᑎᖓᓄᑦ ᐊᕐᕌᒍᒥ ᒥᐊᓂᕆᔾᔭᑕᐅᔭᓄᑦ ᐅᓂᒃᑳᖅ - ᐊᐅᓚᑦᑎᔨᓄᑦ ᓇᐃᓈᖅᓯᒪᔭᖅ

ᑎᑎᕋᖅᑕᐅᔭᖅ ᐅᕗᖓ
ᒪᐃᒐᓐ ᓗᐊᑦ-Hᐃᐅᓪ
ᐸᕕᓐᓃᓐᑦ ᓴᕕᕋᔭᒃᓴᓂᒃ ᐅᔭᕋᖕᓂᐊᖅᑎᑦ ᑯᐊᐳᕆᓴᓐ
2275 Upper Middle Road East, Suite 300
ᐅᒃᕕᐅ, ᐋᓐᑎᐅᕆᐅ
L6H 0C3

ᑎᑎᕋᖅᑕᖓ
ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑎᒥᖓ
2195- 2nd Avenue
ᒍᐃᑦHᐅᐊᔅ, ᔫᑳᓐ 1A 3T8

ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑎᒥᖓ ᐅᖃᖃᑎᒋᔪᒍ
ᒪᐃᒃ ᓯᑐᓕᖕᑕᓐ, R.P ᐆᒪᔪᓕᕆᔨᕐᔪᐊᖅ
ᖃᐅᔨᓴᖅᑎᒻᒪᕆᒃ
ᐊᖓᔪᖅᑳᖓᑦ ᓄᓇᒥ ᐆᒪᔪᓕᕆᓂᕐᒧᑦ
ᖃᐅᔨᓴᖅᑎᒻᒪᕆᒃ

ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑎᒥᖓᑕ ᐱᓕᕆᐊᖓᑦ
18Y0203
ᒫᑦᓯ 2019

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ᓇᐃᓈᖅᓯᒪᔭᖅ

ᐅᓇ ᓄᓘᔾᒃ ᐅᔭᕆᓐᓂᐊᕐᕕᐅᔭᖅ ᓴᕕᕋᔾᔭᒃᓴᒥᒃ ᐅᔭᕆᓐᓂᐊᖅᑐᖅ ᐃᓂᖃᖅᑐᑦ ᕿᑭᖅᑖᓗᒃ ᓄᓇᖓᓐᓂ ᖁᑎᒃᑐᕐᒥᐅᓂ, ᓄᓇᕗᑦ. ᐅᓇ ᐅᔭᕆᓐᓂᐊᖅᑐᖅ ᐃᓚᖃᖅᑐᖅ ᐃᒡᓗᓕᐅᖅᓭᑎᒃ ᓴᓚᔾᔭᐅᓪᓗᓂ, ᒪᑐᕕᒃᓴᖓ, ᐊᒻᒪᓗ ᐃᓂᑐᖃᖓᓄᑦ ᐋᕿᒃᓱᖅᑕᐅᓂᖓ ᓄᓇ 22.2 ᒥᓕᐊᓐ ᑖᓐᓵ ᐊᕐᕌᒍᑕᒫᑦ ᓄᓇᐅᑉ ᖄᖓᓂ ᒪᑐᐃᖓᔭᖅ ᐅᔭᕆᓐᓂᐊᕐᕕᒃ ᐃᖏᕐᕋᓕᖅᑐᖅ 21 ᐅᑭᐅᓄ. ᓴᕕᕋᔾᔭᒃᓴᓪᓚᕆᒃ ᐱᐅᓛᖑᔭᖅ ᐱᔭᐅᔭᒪᔭᖅ ᓄᓇᕐᔭᐊᕐᒧᑦ ᐅᓯᒃᖃᖅᑕᐅᔭᖅ ᓯᖃᓕᓯᒪᔭᖅ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᓯᒪᔭᖅ ᑭᓯᓂᒃ ᐃᓚᓂᕐᓗᒃᓯᒪᓐᖏᒃᑲᓗᐊᕐᒪᖔᑦ ᑕᐃᑲᓂ ᓯᕐᑯᓕᕕᖏ. ᓴᓇᔭᑦ ᐅᔭᕆᓐᓂᐊᕐᕕᖏ ᐊᒻᒪᓗ ᑕᐃᑯᖓ ᐊᑕᔪᓂᒃ ᐱᒋᐊᓚᐅᖅᑐᖅ 2013, ᐊᒻᒪᓗ ᐅᔭᕆᓐᓂᐊᕐᓂᖅ ᐱᒋᐊᖅᓱᓂ ᓯᑎᐱᕆ 2014. ᒫᓐᓇ, ᑎᑭᓪᓗᒍ 4.2 ᑖᓐᓵ ᐊᕐᕌᒍᒧᑦ ᓯᕐᑯᑦᑎᖅᓯᒪᔭᖅ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᓯᒪᔭᖅ ᓴᕕᕋᔾᔭᒃᓴᖅ ᐊᐧᔭᖅᑐᖅᑕᐅᔭᖅ ᕿᓐᖑᐊᓄᑦ ᐊᕐᕌᒍᓕᒫᖅ, ᖃᓕᓃᓕᖅᓯᒪᐅᔭ, ᐊᒻᒪᓗ ᐊᐧᔭᖅᑕᐅᓪᓗᑎᒃ ᓯᑯᖃᐳᓐᓃᕐᒪᑦ. ᐊᓐᓂᖅᑕᐅᔭᖅ ᓄᓇᓯᐅᑎᑯᑖᖃᕐᕕᒃᓴᖅ ᐅᓯᒃᑦᑕᕐᓗᓂ 18 ᒥᑐᓕᒃ ᑖᓐᓵ ᐊᕐᕌᒍᒥ ᓴᕕᕋᔾᔭᒃᓴᒥᒃ ᐅᔭᕆᓐᓂᐊᕐᕕᖓᒥᑦ ᐊᕐᕌᒍᓕᒫᒧᑦ ᐃᑎᔪᒧᑦ ᐃᒃᓴᕐᕕᒃ ᑕᐃᑲᓂ ᐃᒃᐱᑭᑦᑐᕐᔭᐊᖅ ᑕᐃᑲᓂᓗ ᓴᕕᕋᔾᔭᒃᓴᖅ ᐃᓗᓪᓕᖅᓴᐅᖅᑕᐅᓗᓂ ᐅᓯᔭᐅᓕᕐᓗᓂ ᑲᓇᑕᐅᑉ ᐊᓯᐊᓄᑦ ᐊᑐᕐᓗᒍ ᓴᓂᕋᔭᐅᑉ ᑕᕆᐅᖓᒍᑦ. ᐅᔭᕆᓐᓂᐊᕐᕕᒃ ᑐᓂᔭᐅᓪᓗᓂ ᐋᕿᖏᐊᕈᑎᒥᖕᓄᑦ 1 ᐅᔾᔪᓐᓂᐊᕈᑎᒃᓴᒧᑦ ᓈᓴᐅᑖ 005 ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦᑲᑲᑎᒪᔨᖏᑦ ᒪᐃ 28, 2014-ᒥ. ᒫᓐᓇᐅᔭᖅ ᐱᓕᕆᔭᐅᔭᖅ ᑭᓯᐊᓂ ᓄᓇᓯᐅᑎᑦᑎᒍᑦ ᓴᕕᕋᔾᔭᒃᓴᖅ ᐅᓯᒃᖃᖅᑕᐅᔭᖅ ᑮᓐᖑᐊᓄᑦ ᓯᑯᖃᓐᖏᑎᓪᓗᒍ ᐅᒥᐊᕐᔭᓂᑦ ᐅᓯᒃᖃᖅᑕᐅᓂᐊᕐᒪᑕ.

ᒪᓕᖏᐊᖃᖅᑐᑦ ᐱᓪᓗᒋᑦ ᐱᔭᕆᔭᐅᔭᒪᔭᖅ ᐊᓐᖏᖅᑕᐅᔭᕆᐊᖃᕐᒪᑕ, ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦᑲ ᑲᑎᒪᔨᖏᑦ ᐅᔭᕆᓐᓂᐊᕈᓐᓇᐅᑎᑦ #005 ᐃᓚᖃᖅᑐᖅ ᐊᒥᓯᓂᒃ ᒪᓕᒋᐊᖃᖅᑐᓂᒃ ᐅᑯᐊᓗ ᑕᐃᒪᓐᓇᐅᔭᕆᐊᖃᖅᑎᑦᑎᔭᑦ ᐸᕙᓐᓀᓐᑦ ᐊᒃᑐᐃᔭᓂᒃ ᖃᐅᔨᓇᓱᙵᓂᐊᕐᓗᑎᒃ ᒥᐊᓂᕆᓂᐊᕐᓗᑎᒃ ᓄᓇᐅᑉ ᐊᕙᑖᓂ. ᐱᓕᕆᔭᐅᔭᑦ ᓄᓇᐅᑉ ᐊᕙᑎᒥᒃ ᐊᒃᑐᓗᐊᖅᑕᐅᓕᑎᑦᑎᔾᔭᑕᐅᔭᑦ ᐊᒻᒪᓗ ᒥᐊᓂᕆᔾᔭᑕᐅᔭᑦ ᐸᕐᓇᐅᑎᑦ (TEMMPl (ᐸᕙᓐᓀᓐᑦ ᓴᕕᕋᔾᔭᒃᓴᒥᒃ ᐅᔭᕆᓐᓂᐊᖅᑎᑦ ᑯᐊᐳᕇᓴᓐ 2017) ᐊᒻᒪᓗ ᐱᓕᕆᐊᖃᖅᑐᑦ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᓴᓇᖃᑎᒌᑦ ᑲᑎᒪᔩᑦ (TEWG) ᑖᒃᑯᓇᖔᖅᑐᑦ ᐸᕙᓐᓀᓐᑦ, ᕿᑭᖅᑕᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ, ᓄᓇᕗᑦ ᒐᕙᒪᒃᑯᑦ, ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᐊᒻᒪᓗ ᓯᓚᐅᑉ ᐅᖁᓂᖓᑕ ᐊᓯᑦᔨᕐᓂᖓᓄᑦ ᑲᓇᑕ (ECCC), ᐊᒻᒪᓗ ᒥᑦᑎᒪᑕᓕᖕᒥ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ (MHTO). ᐅᓇᐅᑉ ᓯᓚᖓᓂᒃ ᒥᐊᓂᕆᔾᔭᑕᐅᔭᑦ ᐱᒋᐊᓚᐅᖅᑐᑦ 2012 ᐊᒻᒪᓗ ᑲᔪᓯᓪᓗᑎᒃ ᑎᑭᓪᓗᒍ 2018 ᓱᖏᐅᓴᐅᑎᒃᓴᐃᑦ ᐱᓕᕆᑎᑦᑎᔾᔭᑎᒃᓴᓄᑦ ᐊᕐᕌᒍᓄᑦ.

ᐸᕙᓐᓀᓐᑦ ᓂᕆᐅᒃᑐᑦ ᐅᑯᐊ ᐱᓕᕆᑎᑦᑎᔾᔭᑕᐅᔭᑦ ᑲᔪᓯᓂᐊᖅᑐᑦ ᓯᕗᓂᑦᑎᓂ. ᑕᐃᒪᓐᓇᐅᒐᓗᐊᖅᑎᓪᓗᒍ, ᑕᒪᕐᒥᒃ ᓂᕿᑐᓘᑦ ᒥᐊᓂᕆᔭᐅᔾᔭᑎᖏᑦ ᐱᔭᕇᕐᒪᑕ ᓄᕋᖅᑎᑕᐅᓚᐅᖅᑐᑦ 2015-ᒥ ᑕᐃᒪᓗ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᓴᓇᖃᑎᒌᑦ ᑲᑎᒪᔩᑦ ᐃᓱᒪᒋᓚᐅᖅᑕᖓ ᐅᑯᐊ ᖃᐅᔨᓴᕈᑎᑦ ᓈᓴᐃᓗᓂ ᐊᑐᕆᐊᖃᕈᓐᓃᖅᑐᑦ ᐅᓄᖏᓗᐊᕐᓂᖏᓐᓄᑦ ᐊᒪᕈᐃᑦ. ᐅᑯᐊ ᐃᓕᑕᐅᓇᓱᒃᑐᑦ ᐃᖏᕐᕋᓯᑎᑕᐅᓂᐊᖅᑐᑦ ᓯᕗᓂᒃᓴᑦᑎᓂ ᐊᓯᑦᔨᖅᐸᑦ ᐊᒪᕈᖃᓐᓂᖅᓴᐅᓕᖅᐸᑦ ᐊᒻᒪᓗ ᐅᖃᖃᑎᒋᒃᑲᓂᓚᐅᕐᓗᒋᑦ ᓄᓇᕗᑦ ᒐᕙᒪᒃᑯᑦ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᓴᓇᖃᑎᒌᑦ ᑲᑎᒪᔩᑦ.

ᐅᓇ ᐅᓂᒃᑳᖅ ᓇᐃᓈᖅᓯᒪᔭᖅ ᖃᐅᔨᓴᕈᑎᓂᒃ ᓄᐊᑦᑎᓯᒪᔭᑦ ᐊᒻᒪᓗ ᒥᐊᓕᕆᔾᔭᑎᑦ ᐱᓕᕆᔭᐅᓪᓗᑎᒃ 2018 ᑕᒪᑐᒨᖓ ᐱᓕᕆᐊᖑᔭᕐᒧᑦ, ᐃᓚᒋᔭᐅᓪᓗᑎᒃ ᐊᑖᓂ ᑎᑎᕋᖅᓯᒪᔭᑦ ᓈᓴᖅᓯᔾᔭᑎᓂ ᐱᓕᕆᑎᑦᑎᔾᔭᑕᐅᔭᖅ (ᓇᐃᓈᖅᓯᒪᔭᑦ ᑎᑎᕋᖅᓯᒪᔭᑦ ᓇᓗᓇᐃᕈᑎ 1):

- ᓱᕈᑦ ᑲᑕᒐᖅᑐᑦ ᒥᐊᓂᕆᔭᐅᓗᑎᒃ;
- ᐱᕈᖅᑐᑦ ᐊᒥᓱᑦ ᒥᐊᓂᕆᔭᐅᓗᑎᒃ;
- ᐱᕈᖅᑐᑐᖃᖏᑦᑐᑦ ᐊᓯᖃᓐᖏᑦᑐᑦ ᑕᑯᔭᐅᑦᑎᐊᕋᓱᒡᓗᑎᒃ (ᓇᓂᔭᐅᖃᑦᑕᖅᑐᑦ ᐱᔮᕆᓇᑎᒃ);
- ᖁᓕᒥᕐᒎᓂᒃ ᖃᓄᖅ ᖁᓚᐅᓐᓂᖃᖃᑦᑕᖅᐸ ᑕᒪᓐᓇ ᖃᐅᔨᔭᐅᓇᓱᑦᑎᐊᕐᓗᓂ;
- ᐊᐱᕋᓪᓕᐊᑎᓪᓗᒍ ᖃᐅᔨᔭᐅᓇᓱᑦᐊᑎᕐᓗᑎᒃ;
- ᐊᐳᔾᔭᓇᒃᑐᑦ ᐳᖅᑐᓂᖏ ᒥᐊᓂᕆᔭᐅᓗᑎᒃ;
- ᐳᖅᑐᓂᖓ ᓄᓇᒥ ᑐᒃᑐᖃᖅᑐᖅ ᖃᐅᔨᓴᖅᑕᐅᓗᑎᒃ;
- ᐃᕙᕕᖕᖏᓐᓂᒃ ᐲᔭᕐᓂᐊᕐᓗᒋᑦ ᖃᐅᔨᓴᕈᑎᑦ; ᐊᒻᒪᓗ
- ᖃᐃᖅᓯᒥ ᐃᕙᕕᑦ ᓂᕿᑐᖅᑎᑦ ᑎᖕᒥᐊᑦ ᐃᓂᖏ ᐊᒻᒪᓗ ᑎᖕᒥᐊᑦ ᑐᑭᓵᕐᓂᑯᑦ ᖃᐅᔨᓴᖅᑕᐅᓗᑎᒃ.

ᐋᖅᑭᐅᑎᔪᑦ 2018 ᒥᐊᓂᕆᔾᔪᑎᓄᑦ ᐱᓕᕆᑎᑦᑎᔾᔪᑕᐅᔪᑦ ᐊᑖᓂ ᑎᑎᕋᖅᓯᒪᔪᑦ:

ᓯᓚᐅᑉ ᐅᖁᓐᓂᖓ, ᓱᕈᖅ ᑲᑕᒐᖅᑐᖅ ᐊᒻᒪᓗ ᐃᖏᕐᕋᔭᒃᑐᑦ:

- ᓯᓚᐅᑉ ᐅᖁᓐᓂᖓᓂᒃ ᑎᑎᕋᖅᓯᒪᔪᑦ ᓇᓗᓇᐃᖅᓯᓯᒪᔪᑦ ᐊᐅᔭᖅ ᓂᓪᓚᓯᓛᖑᓚᐅᕐᒪᑦ ᐅᖁᓯᒪᓛᑐᐃᓐᓇᖅᓗᓂ ᐅᑭᐅᖅ 2018. ᐊᖁᓂ ᐅᓪᓗᓄᑦ ᒪᖁᓚᐅᖅᑎᓪᓗᒍ ᑕᐃᑲᓂ ᕿᓐᖑᐊᓂ ᐃᒪᐃᓐᓇᐅᓚᐅᕐᒪᑦ ᐱᒋᐊᖅᕕᒃᓯᖕᒪᓄᑦ ᖃᐅᔨᓴᕈᑎᑦ ᓄᐊᑦᑎᕖᒃᓯᒧᑦ, ᑕᐃᑲᓂᓗ ᓄᓘᔮᖕᓂ ᑎᑎᕋᖅᑕᐅᕙᓪᓕᐊᔪᕕᓂᑦ ᐅᓪᓗᑦ ᒪᖁᑦ ᓱᕋᖅᓯᖃᑦᑕᓚᐅᖅᓂᖓᓂ ᐅᔭᕋᖕᓂᐊᖅᑐᓕᕆᔾᔪᑎᖏᓐᓂᒃ.
- ᐅᓄᖅᓯᕆᐊᓚᐅᕐᒪᑕ ᒥᑭᔫᓗᐊᕐᒥᒃ ᖃᐅᑕᒫᑦ ᐅᓄᕐᓂᖏᑦ ᑲᓕᑕᐅᔪ 2018-ᒥ ᒪᓕᒃᓱᒋᑦ 2017-ᒥᑦ. ᐊᓯᖏᑦ ᑲᓕᑕᐅᖕᖏᑦᑐᑦ ᐃᖏᕐᕋᔭᒃᑐᑦ ᐊᕐᕌᒍᒥ ᖃᓂᒋᔭᖓ 37.3 ᓄᓇᓯᐅᑎᑦ ᖃᐅᑕᒫᑦ, ᐅᓇᓗ ᐅᓄᕐᓂᖅᓴᐅᔪᑦ ᑕᐃᑲᖓᑦ 2017-ᒥᑦ (32.2 ᓄᓇᓯᐅᑎᑦ ᓄᒃᑕᖅᑐᑦ ᖃᐅᑕᒫᑦ).
- ᐊᕐᕌᒍᒥ ᓱᕈᖅ ᑲᑕᒐᖅᑐᖅ ᑕᐃᑲᓂ ᖄᖑᐊᓂ ᖃᐅᔨᓴᕈᑖ ᓇᑭᖕᖑᕐᒪᖕᖑᑕ ᑲᑕᒐᖅᑐᑦ ᐃᓗᐊᓂ ᓂᕆᐅᓇᖅᑐᖅ ᐳᖅᑐᓯᑎᒋᓂᖓ; 2018-ᒥ ᐊᐅᔭᒃᑯᑦ ᓱᕈᖅ ᑲᑕᒐᖅᑐᖅ ᐅᓄᖕᒋᓂᖅᓴᐅᔪᖅ ᐅᑭᐅᒥᑦ, ᐊᓯᑦᔨᖅᑕᖅᓂᖃᔾᔭ ᐊᖏᓗᐊᖕᒋᓂᖅᓴᐅᖕᒪᑦ ᐊᐅᔭᒃᑯᑦ ᓱᕈᖅ ᑲᑕᒐᖅᑐᑦ.
- ᓱᕈᖅ ᑲᑕᒐᖅᑐᖅ ᑕᐃᑲᓂ ᖄᖑᐊᓂ ᐃᑉᓯᕙᖕᒥ ᑲᔪᓯᔪᒥᒃ ᐅᖓᑖᓄᐊᖃᑦᑕᖅᑐᖅ ᓂᕆᐅᒋᔭᒥᑦ ᐃᓂᖓᓂ ᑕᒪᕐᒥᒃ ᐃᓂᖕᒥᑦ ᐱᔭᐅᓕᓂ DF-P-07. ᑕᑯᔭᐅᔪᑦ ᑕᐃᑲᓂ ᖄᖑᐊᓂ ᐃᓂᖓᓂ ᓱᕈᖅ ᑲᑕᒐᖅᑐᖅ ᑲᑕᒐᓗᐊᖕᖏᓂᖅᓴᐅᓚᐅᖅᑐᖅ ᑕᐃᑲᓂ 2018-ᒥ ᑲᑕᒐᖅᑐᑦ ᓱᕈᖅ ᑲᑎᑉᐸᓪᓕᐊᔪᖅ ᐊᐅᔭᒃᑯᑦ ᒥᑭᓂᖅᓴᐅᓚᐅᖅᑐᑦ ᐅᑭᐅᒥᑦ; ᑕᐃᒪᖓᓕ 2016 ᓱᕈᖅᐸᓪᓕᐊᔪᑦ ᐊᐅᔭᖓᓂ ᐅᓄᕈᓅᖅᐸᓪᓕᐊᖏᓐᓇᖃᒥᒃ ᐅᑭᐅᓂᑦ ᑕᐃᒪᓗ ᐅᑭᐅᒃᑯᑦ ᐊᖕᖏᓂᖅᓴᐅᓂᐊᖃᒥᒃ.
- ᓱᖃᑦ ᑲᑕᒐᖅᑐᑦ ᐱᓯᒪᔪᖅ ᐅᖁᒪᐃᑦᑐᓄᑦ ᐊᖁᑎᖓᓂ ᑕᐃᑲᖓᑦ ᐅᐊᖕᓇᖓᓂᑦ ᐊᒻᒪᓗ ᓂᒋᐊᓂᑦ ᐃᑳᕐᕕᖓ ᒥᑭᓂᖅᓴᐅᓚᐅᖅᑐᖅ 2018-ᒥ ᑕᐃᑲᖓᓂᓕᓂ 2017. ᐊᓯᔩᖏᑦ ᐊᓯᑦᔩᖃᑦᑕᖅᑐᑦ ᓇᓗᓇᐃᓚᐅᖅᑐᑦ ᑕᒪᐃᓐᓂᑦ ᐅᐊᖕᓇᖓᓂᑦ ᐊᒻᒪᓗ ᓂᒋᐊᓂᑦ ᐃᑳᕐᕕᖏᑦ. ᐅᓇ ᐊᖕᖏᓛᒥᒃ ᑲᑕᒐᓗᐊᖕᖏᓂᖅᓴᐅᓯᖅᑐᖅ ᓱᕈᖅ ᐅᑭᐊᒃᓴᒍᑦ ᒥᐊᓂᕆᔭᐅᓯᒪᔪᖅ 30 ᒦᑕ ᐅᖓᓯᒃᑎᒋᔪᒥᑦ ᐊᖁᒥᑦ. ᒥᑭᔪᒥᒃ ᐅᓄᓗᐊᕈᓐᓇᐅᓚᐅᖅᖢᓗᐊᑦ ᑲᑕᒐᖅᑐᑦ ᓱᕈᐃᑦ ᓇᓗᓇᐃᖅᑕᐅᔪᑦ ᑕᐃᑲᓂ 100 ᒦᑕ ᐅᖓᓯᖕᓂᖓᓂᑦ ᖃᐅᔨᓇᓱᒃᐸᐅᔪᒥᑦ. ᐅᓇ ᑲᔪᓯᔪᒥᒃ ᐅᓄᕈᓅᖅᐸᓪᓕᐊᑦᑎᓂᐊᖅᑐᖅ ᓱᕈᕐᓂᒃ

ᑲᑕᒐᖅᑐᓂᒃ ᖃᐅᔨᓇᓱᒍᑕᐅᓯᒪᔪᖅ ᑕᐃᒪᓐᓇᐅᓗᐊᖃᑦᑕᕐᓂᖓᓄᑦ ᐊᐅᔾᒃᑯᑦ, ᑕᐃᒪᓗ ᓱᕈᖅ ᑲᑕᒐᔾᖃᑦᑕᖅᑐᖅ ᓯᓚᒥ ᐊᐅᔾᒃᑯᑦ ᑲᑕᒐᓗᐊᓐᖏᓂᖅᓴᐅᓚᐅᖅᑐᖅ 2016-ᒥ.

- ᓱᕈᖅ ᑲᑕᒐᖅᐸᒃᑐᖅ ᑲᑕᒐᓗᐊᕈᓐᓃᖅᐸᓪᓕᐊᔪᖅ ᐃᓚᖓᓐᓂ ᐊᕐᕌᒍᒥ ᖃᐅᔨᓴᕐᕕᐅᖃᑦᑕᖅᑐᓂ ᓇᓂᑐᐃᓐᓇᖅ ᐅᔾᕋᖕᓂᐊᕐᕕᖓᒥ ᓴᓇᕖᐅᔪᓂ. ᐅᓇ ᐅᓄᓗᐊᕈᓐᓃᖅᑎᑦᑎᓯᒪᔪᑦ ᐊᑏᑎᖃᕐᓂᖅᓴᐅᓕᕐᒪᑕ ᓱᕈᓗᐊᖅᑕᐃᓕᑎᑦᑎᔾᔪᑏᑦ ᖃᓄᐃᓕᐅᕈᑕᐅᔪᑦ, ᐱᓗᐊᖅᑐᒥᒃ ᓴᓂᖓᓂ ᐅᑯᒪᐃᑦᑐᓂᑦ ᐊᑐᖅᑕᐅᔪᖅ ᐊᕐᑯᑎᖓᑦ, ᑲᑎᓪᓗᒍ ᓂᒡᓚᓱᐃᓐᓇᕐᒪᑦ, ᒥᓃᓐᓇᖃᑦᑕᖅᓗᓂ ᐊᐅᔾᖅ.

ᓯᓚᐅᑉ ᐅᕐᑑᓂᖓ, ᓱᕈᖅ ᑲᑕᒐᖅᑐᖅ ᐊᒻᒪᓗ ᐃᖏᕐᕋᔾᒃᑐᑦ ᖃᐅᔨᔾᐅᓇᓱᖕᓂᖕᒋ ᑲᔪᓯᔪᖅ 2019.

ᐱᕈᖅᑐᑦ:

- ᐅᑯᐊ ᐱᕈᖅᑐᑦ ᐊᒥᓲᔪᑦ ᒥᐊᓂᕆᔾᐅᔪᑦ ᓴᓇᓯᒪᓂᐊᕐᓂᖓ ᐱᔾᓃᓚᐅᖅᑐᖅ 2016 ᐊᒻᒪᓗ ᑐᓂᓯᓗᑎᒃ ᐱᕈᖅᐸᓪᓕᐊᑎᐊᕈᑎᒃᓴᐅᓂᐊᖅᑐᓄᑦ ᐅᑯᐊᓗ ᖃᐅᔨᔾᔪᑕᐅᓂᐊᖅᑐᑦ ᐱᓕᕆᐊᖑᔪᒧᑦ-ᐃᓯᒪᔪᓄᑦ ᐊᓯᑦᓵᒍᑎᔪᖃᕐᓂᕈᓂ ᐊᓐᖏᔪᒥ ᑕᐃᒪᓗ ᐊᒃᑐᐃᒐᔾᖅᐹᑦ.
- ᑕᒪᕐᒥᒃ ᐱᕈᖅᑐᑦ ᐅᓄᖅᑐᑦ ᐆᒃᑐᕋᖅᑕᐅᓯᒪᔪᑦ ᐊᑯᓚᐃᑦᑐᒥᒃ ᐱᖓᓱᓄᑦ ᐅᑭᐅᓄᑦ, ᐊᒻᒪᓗ ᐃᓚᖏᑦ ᑎᓴᒪᓄᑦ ᐅᑭᐅᓄᑦ.
- ᐅᓪᓗᒥᒧᑦ, ᐊᕐᕌᒍᒥ ᐊᓯᑦᔨᖅᑐᑦ ᐱᕈᖅᑐᑦ ᐅᓄᓚᐅᖅᑐᑦ ᐅᔾᕋᖕᓂᐊᕐᕕᐅᔪᑉ ᓄᓇᖓᓂ ᑕᑯᔾᐅᓯᒪᕗᑦ, ᖃᐅᔨᒪᓇᖕᒋᑦᑐᖅ ᐊᓯᑦᔨᖕᒪᖔᑕ ᐱᕈᖅᑐᑦ ᐅᓄᕐᓂᖕᒋᓐᓂᒃ ᐱᔾᔪᑎᒋᓪᓗᒍ ᑕᒪᓐᓇ ᐱᓕᕆᔪᓂᑦ ᐊᒃᑐᖅᑕᐅᓯᒪᖕᒪᖕᖔᑦ.
- ᑕᐃᑲᓂ 2018, ᐆᒃᑐᐃᓚᐅᖅᑐᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓄ ᐱᕈᖅᑐᓂᒃ ᐅᓄᖅᓯᑎᑦᑎᕚᓪᓕᐊᒐᓱᐊᕐᓂᕐᒧᑦ ᖃᐅᔨᓇᓱᒍᑕᐅᓯᒪᔪ ᖃᐅᔨᔭᐅᓇᓱᒍᓐᓇᕐᓗᑎᒃ. ᖃᐅᔨᓇᓱᒍᑕᐅᔪᑦ ᐱᕈᖅᑐᑦ ᐅᓄᕐᓂᖕᒋᓐᓂᒃ ᖃᐅᔨᓴᕈᑎᒃᓴᖓ ᑕᑯᑎᑦᑎᓚᐅᖅᑐᖅ ᐅᓇ ᐊᑐᖅᑕᖓ ᖃᐅᔨᓴᖅᓯᔾᔪᑎᒥᖕᓄᑦ ᐆᒃᑐᕋᖅᑐᖅ ᐱᕈᖅᑐᓄᑦ ᑐᑭᓕᐅᕆᕚᓪᓕᐊᓕᓅᕈᓐᓇᖅᑐᖅ ᐊᒻᒪᓗ ᒪᓕᒃᓴᐅᖕᒋᓐᓇᕋᔭᖅᓗᓂ, ᓇᓗᓇᐃᕐᓗᒍ ᑕᒪᒃᑯᐊ ᐊᑏᑎᔪᑦ ᐱᓕᕆᓂᐊᕐᓗᒋᑦ ᑐᑭᓕᐅᕈᑕᐅᕚᓪᓕᐊᓂᐊᖅᑐᑦ ᐱᕈᖅᑐᓄᑦ ᐅᓄᖅᓯᕚᓪᓕᐊᖕᒪᖕᖔᑕ ᒥᐊᓂᕆᔾᔪᑕᐅᔪᖅ.
- ᐱᕈᖅᑐᑦ ᐊᒻᒪᓗ ᐃᔾᔪᖅ ᓴᕕᖃᔾᒃᓴᖃᕐᒪᖕᖔᑦ ᖃᐅᔨᐅᓇᓱᓚᐅᖅᓯᒪᓐᖏᑦᑐᖅ 2018-ᒥ ᑭᓯᐊᓂ ᐃᓂᖃᖅᑐᖅ 2019-ᒥ.
- ᐃᓚᖏᑦ ᐅᖃᐅᓯᐅᓚᐅᖅᑐᑦ ᐱᑕᖃᕋᓐᖏᑦᑐᑦ ᐱᕈᖅᑐᑦ ᓇᓂᔭᐅᖃᑦᑕᓚᐅᖅᑐᑦ ᐃᓕᑕᐅᓇᓱᒃᑐᑦ ᓄᓇᒥ, ᐊᒻᒪᓗ ᓇᓗᓇᖏᑦᑐᖅ ᓇᓂᔭᐅᒃᑳᓂᖃᑦᑕᕐᓂᐊᖅᑐᑦ ᐱᕈᖅᑐᓂᒃ ᖃᐅᔨᓴᖅᑎᓪᓗᒋᑦ ᑲᔪᓯᓗᓂ ᑕᐃᑲᓂ ᐅᔾᕋᖕᓂᐊᕐᕕᐅᔪᒥ ᐱᓕᕆᕕᐅᔪᒥ. ᖃᐅᔨᒪᔭᐅᔪᑦ ᐱᕈᖅᑐᖏᑦ ᑲᔪᓯᓂᐊᖅᑐᑦ ᒥᐊᓂᕆᔭᐅᖏᓐᓇᕐᓗᑎᒃ ᑖᒃᑯᓇᓂ ᐱᓕᕆᕖᐅᔪᒥ ᐅᔾᕋᖕᓂᐊᕐᕕᐅᔪᒧᑦ ᐊᒻᒪᓗ ᓄᑖᑦ ᓇᓂᔭᐅᔪᑦ ᐱᕈᖅᑐᑦ ᑎᑎᕋᖅᑕᐅᓗᑎᒃ ᓇᓂᔭᐅᔾᔪᑦᖓᒥᒃ ᓈᒻᒪᓈᖅᓯᒪᔾᔪᑦᖓᒥᒃ ᑭᓯᐊᓂ. ᐱᑕᖃᓐᖏᑦᑐᖅ ᑕᐃᒪᓐᓇᐅᓇᔾᕐᒪᖕᖔᑦ ᓄᓚᔮᖕᓂ ᐅᔾᕋᖕᓂᐊᖅᑐᑦ ᐊᒃᑐᐃᓗᑎᒃ ᐱᕈᖅᑐᓂᒃ.

ᐱᕈᖅᑐᑦ ᒥᐊᓂᕆᕐᐅᓂᖓ ᑐᑭᑖᖅᑎᑕᐅᓇᓱᖕᓂᖓ ᑲᔪᓯᓂᐊᖅᑐᖅ, ᑭᓯᐊᓂ ᐊᑯᓚᐃᑦᑐᒥᒃ ᓇᓗᓇᐃᕐᑎᖅᓯᒪᔪᓂᒃ ᐃᓕᑦᑎᓇᓱᒍᑎᖃᕐᓗᑎᒃ (ᓃᕐᓗ ᐱᕈᖅᑐᑦ ᐅᓄᕐᓂᖏᑦ) ᓱᓕ ᐃᓱᒪᒋᕐᐅᓂᐊᖅᐸᑦ ᑖᒃᑯᓇᖓᑦ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᓴᓇᖃᑎᒌᑦ ᑲᑎᒪᔨᑦ ᐊᒻᒪᓗ ᐸᕕᓀᓐᑦ.

ᓂᕿᑎᑦ:

- ᓄᓇᒥ-ᐱᓯᒪᔪᑦ ᖃᐅᔨᓴᕈᑎᑦ ᑲᔪᓯᑎᑕᐅᓂᐊᖅᑐᑦ ᐊᑐᖅᑕᐅᓗᓂ ᖃᐅᔨᓇᓱᒍᖃᑦᑕᕐᓂᐊᕐᒪᑕ ᓂᕿᑎᑦ ᖄᓄᖅ ᐃᒻᒥᖕᓄᑦ ᐱᓕᕐᒪᖔᑕ ᐱᓪᓗᒍ ᐅᕐᕿᖕᓂᐊᕐᕕᒃ. ᐅᑯᐊ ᐃᓚᕋᖅᑐᖅ ᐳᖅᑐᔪᓂᑦ ᓄᓇᓂᑦ ᖃᐅᔨᓇᓱᑦᑎᐊᖅᓱᑎᒃ, ᐊᐳᑎᒃᑯᑦ ᐃᓂᖏᑦ ᖃᐅᔨᕐᐅᓇᓱᑦᑎᐊᖅᓱᑎᒃ, ᐊᐳᙱᕆᒃᑐᑦ ᖃᐅᔨᕐᐅᓇᓱᑦᑎᐊᕐᓗᑎᒃ ᐊᒻᒪᓗ ᖃᖓᒃᑯᑦ ᑕᑯᕐᕕᓃᑦ ᐅᖃᐅᓯᐅᓗᑎᒃ ᐅᕐᕿ ᙵᓂᐊᕐᕕᖕᒥ ᓴᓇᔨᖏᓐᓄᑦ.
- ᑕᐃᑲᓂ ᔩᓐ 2013, ᑲᑎᖓᐅᖅᑐᑦ ᑕᓪᓕᒪᑦ ᑐᒃᑐᐃᑦ ᑕᑯᕐᐅᓚᐅᖅᑐᑦ ᐃᓗᐊᓂ ᐅᕐᕿᖕᓂᐊᕐᕕᐅᔪᑉ ᓴᓇᕕᕆᕐᖏᓐᓂᒃ ᓄᓇᐅᑉ ᒪᔪᕐᓂᖓᓂ ᖃᐅᔨᓴᕐᕕᐅᓗᑎᒃ; ᑕᐃᒪᓐᓇᐅᒐᓗᐊᖅᑎᓪᓗᒍ, ᑐᒃᑐᐃᑦ ᑕᑯᕐᐅᖃᑦᑕᓐᖏᑦᑐᑦ ᑕᐃᑲᓂ ᖃᐅᔨᓇᓱᒃᑕᐅᑎᐊᕋᓗᐊᕋᒥᒃ ᐊᕙᑖᓂᑦ 2014 ᐊᒻᒪᓗ 2018. ᑕᑯᔪᖃᖅᓯᒪᓐᖏᑦᑐᖅ ᑐᒃᑐᓂ ᐃᓂᖓᓂ ᐊᓯᑦᔨᖅᑕᖃᑦᑕᓚᐅᖅᑎᓪᓗᒍ ᐊᒥᕈᔫᖅᓯᒪᑎᓪᓗᑎᑦ ᐅᓄᕈᓐᓃᖅᓯᒪᑎᓪᓗᑎᑦ ᐊᕕᒃᑐᖅᓯᒪᔪᓂ ᑕᑯᕐᐅᖃᑦᑕᖅᑐᑦ ᐊᒻᒪᓗ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᓚᐅᖅᑐᖅ ᑕᒪᓇ ᐃᑲᔪᖃᑎᒋᓪᓗᒋᑦ ᓄᓇᕗᑦ ᒐᕙᒪᒃᑯᑦ ᐱᓕᕆᓚᐅᖅᑐᑦ ᐅᑯᐊᓗ ᖃᖓᑦᑕᖅᑎᑦᑎᓯᓪᓗᑎᒃ ᐊᔾᔨᓕᐅᕈᑎᓂᒃ ᓈᓴᐃᔪᑦ ᑐᒃᑐᓂᒃ ᐊᒻᒪᓗ ᓄᓇᓖᑦ ᑕᑯᕐᑲᑦᑕᖅᑕᖕᒋᑦ ᒪᓕᒃᓗᒋᑦ ᐱᓕᕆᔾᐅᓚᐅᖅᑐᑦ ᐃᓕᓐᓂᐊᖅᓗᑎᒃ ᑲᑎᒪᓪᓗᑎᒃ ᓄᕕᐱᕆ 2015 ᐊᒻᒪᓗ ᐊᐃᕆᓕ 2016. ᐅᐱᕐᖓᒃᑯᑦ ᑐᒃᑐᐃᑦ ᓈᓴᖅᑕᐅᓯᒪᔪᑦ ᖁᑎᒃᑐᕐᒥᐅᑦ ᓄᓇᖓᓂ ᓄᓇᕗᑦ ᒐᕙᒪᒃᑯᓐᓂᑦ 2018. ᓄᓘᔾᓕᕆᔨᒃᑯᑦ ᐸᕕᓀᓐᑦ ᑐᓴᕐᑎᑦᑎᓚᐅᖅᑐᑦ ᓄᓇᕗᑦ ᒐᕙᒪᒃᑯᑦ ᑕᒪᓐᓇ ᐅᑭᐊᒃᓵᒥᒃ ᖃᐅᔨᓇᓱᓚᐅᓐᖏᓂᕐᒥᖕᓂᒃ.
- ᐅᓄᓐᖏᓪᒪᑕ ᑕᑯᔭᐅᓯᒪᔪᑦ ᑐᒃᑐᐃᑦ ᐊᕙᑖᓂ ᐅᔾᔪᖕᓂᐊᕐᕕᐅᔪᖅ ᐃᓂᖓ ᐊᒻᒪᓗ ᕿᕐᖑᐊᓂ ᐊᕙᑖᓂᑦ 2013 ᐊᒻᒪᓗ 2018 ᐅᑯᐊᓗ ᒪᓕᑦᑎᐊᑐᐃᓐᓇᖅᑐᑦ ᑐᒃᑐᑭᑑᓐᓂᓚᐅᕐᒪᑕ ᑕᑯᔭᐅᔪᓂ ᑕᐃᑰᓇ ᓄᓇᐅᑉ ᒪᔪᕐᓂᖓᓂ ᐅᖓᓯᒃᑐᒧᑦ ᓵᕿᔾᔭᖅᑐᖅ ᓄᓇᖓ ᖃᐅᔨᓴᕈᑕᐅᔪᑦ.
- ᑐᒃᑐᑕᖃᓐᖏᑦᑐᖅ, ᐊᒪᕈᖅᑕᖃᓐᖏᑦᑐᖅ ᐅᑉᐸᓘᓐᓃᑦ ᐊᓯᖏᓐᓂᒃ ᐊᖕᖏᔪᓂᒃ ᓂᕐᔩᑦ ᑐᒥᖏᓐᓂᒃ ᐱᑕᖃᓐᖏᑦᑐᖅ ᑕᐃᑲᓂ 201ᓐ ᐊᐅᓪᒥ ᑐᒥᖓᓂᒃ ᖃᐅᔨᓴᖅᑎᓪᓗᒋᑦ; ᑕᐃᒪᓐᓇᐅᒐᓗᐊᖅᑎᓪᓗᒍ, ᑎᑎᖓᓂᐊᑦ ᐊᒻᒪᓗ ᐅᑲᓖᑦ ᑐᒥᖏᑦ ᑕᑯᔭᐅᖃᑦᑕᓚᐅᖅᑐᑦ ᑕᐃᒪᓐᓇᑐᐃᓐᓇᖅ ᐅᓄᕐᓂᖏᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᓂᑦ.
- 2018-ᒥ ᐊᐳᙱᕆᖕᓂᑦ ᐳᖅᑐᓂᖏ ᖃᐅᔨᓴᐅᓇᓱᑦᑎᐊᖅᐳᑦ ᖃᓂᒋᔭᖓᓃᑦᑐᑦ ᑕᕿᑕᒫᑦ (ᑎᓴᒪᓂᒃ ᖃᐅᔨᓇᓱᐃᓐᓇᖅᓱᑎᒃ) ᑭᓯᐊᓂ ᐊᑕᐅᓯᐊᖃᑦᑕᕋᑎᒃ ᐊᕐᕌᒍᒥ, ᐊᒻᒪᓗ ᑕᐃᒪᓐᓇᐅᓚᐅᕋᓗᐊᖅᑎᓪᓗᒍ ᑭᖑᓂᑦᑎᓐᓂ ᐊᕐᕌᒍᓂ. ᐳᓴᑎᖓ ᒪᓕᑦᑎᐊᕐᒪᖔᑕ ᑕᒪᐃᓐᓂ ᖃᐅᔨᓇᓱᒃᑕᐅᓯᒪᔪᓂᒃ ᑲᑎᓪᓗᒋᑦ 2018-ᒥ ᑕᐃᒪᓗ 87%, ᑕᐃᒫᑐᐃᓐᓇᖅ ᐊᕐᕌᒍᓚᐅᖅᑐᓂ, ᑭᓯᐊᓂ 2017, ᑕᐃᑉᓱᒪᓂᓕ 66%-ᖑᓚᐅᖅᑐᖅ.

ᓄᓇᐅᑉ ᒪᔪᕐᓂᖓᓂ ᐅᖓᓯᒃᑐᒧᑦ ᓵᕿᔾᔭᖅᑐᖅ ᓄᓇᖓᓂᒃ, ᐊᐳᑎᓂ ᐃᓃᑦ, ᐊᐳᙱᕆᖕᓂᖏᓐᓂᒃ ᐆᒃᑐᕋᕐᓂᖅ, ᐊᒻᒪᓗ ᖃᓄᐃᓕᐅᔪᓂᒃ ᑕᑯᕐᑲᑦᑕᖅᑕᒥᒍᑦ ᑕᒪᒃᑯᐊ ᑲᔪᓯᓂᐊᖅᑐᑦ 2019-ᒥ.

ᑎᖕᒥᐊᑦ:

- ᐸᕙᓖᓐᑦ ᑐᓂᓯᓚᐅᖅᑐᖅ ᑮᓇᐅᔾᔮᓂᒃ ᐊᒻᒪᓗ ᖃᓄᐃᓕᐅᕆᐊᖃᖅᑐᓄᑦ ᐃᑲᔪᖅᓱᑎᒃ ᐊᕙᒃᑐᖅᓯᒪᔪᓂ ᑕᕆᐅᑉ ᑎᖕᒥᐊᖏᓐᓂᒃ ᖃᐅᔨᓇᓱᑦᑎᐊᖅᑐᑦ 2018-ᒥ, ᐱᓕᕆᔾᔭᐅᓚᐅᖅᑐᖅ ᑲᓇᑕᒥ ᓂᕐᔪᑎᓕᕆᓂᕐᒧᑦ ᐱᔨᑦᑎᕋᖅᑐᑦ. ᐅᑯᐊ ᑲᓇᑕᒥ ᓂᕐᔪᑎᓕᕆᓂᕐᒧᑦ ᐱᔨᑦᑎᕋᖅᑐᑦ ᖃᐅᔨᓇᓲᒃᓯᒪᔪᑦ 14 ᓯᕿᓂᕐᒥᑦ ᖃᐅᒪᓂᖕᒐᓂ ᖃᐅᔨᓴᖅᑐᑦ ᐃᓗᐊᓂ 100 ᑭᓚᒦᑕ ᐊᕙᓗᐊᓂ ᓄᓇᕗᒻᒥ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒐᑕ ᐃᓂᖕᒐᓂ, ᐊᒻᒪᓗ ᐊᓯᖕᒥᑦ 24 ᐊᓯᐊᓂ ᐃᓂᓕᐅᖅᓯᒪᔪᑦ ᖁᑎᒃᑐᕐᒥᐅᓂ. ᐅᑯᐊ ᐱᒋᓇᔾᔪᑎᖃᖅᑐᑦ ᓈᓚᒡᓗᒋᑦ ᓂᐱᓕᐅᖅᓯᒪᔪᑦ ᖃᐅᔨᒐᓱᐊᖅᑐᒋᑦ ᓯᒡᔭᕆᐊᕐᔪᐃᑦ ᐋᕿᒃᑕᐅᓯᒪᓚᐅᕐᒥᔪᖅ ᐃᓂᖃᖅᑎᑕᐅᓗᓂ 2018-ᒥ ᑭᓯᐊᓂ ᑭᖑᕙᕆᐊᖅᑎᑕᐅᓚᐅᖅᑐᖅ 2019/2020-ᒧᑦ.
- ᒫᓐᓇ ᐊᑐᖅᑕᐅᔪᑦ ᓱᓕ ᑎᑭᐸᒃᑐᓄᑦ ᑎᖕᒥᐊᓄᑦ ᐃᕙᕖᖕᒋᓐᓂᒃ ᕿᓂᖅᓱᑎᒃ ᐱᓕᕆᔭᐅᓚᐅᖅᑐᖅ ᑕᐃᒪᖕᒐᓂ ᑲᔪᓯᔪᖅ 2013-ᒥᑦ ᐊᖕᖏᖅᑕᐅᓇᓱᓚᐅᖅᓯᒪᑎᓐᓇᒋᑦ ᓱᓕ ᓄᓇᒥ ᐸᒡᕕᒐᔭᕐᒪᖔᑦ ᐊᒻᒪᓗ/ᐅᒡᕙᓘᓐᓃᑦ ᓄᖃᖕᒐᓚᐅᑲᖃᑦᑕᕈᑎᒃᓴᓂᒃ ᑎᖕᒥᐊᑦ ᓄᓕᐅᖅᑎᓪᓗᒋᑦ (ᒪᐃ 31 - ᐋᒍᓯ 15). ᑕᐃᑲᓂ 2018, ᒪᕐᕈᒃ ᐃᕙᕖᒃ ᐃᓂᖃᖅᑐᑦ ᒫᓐ ᓇ ᐊᑐᖅᑕᐅᔪᑦ ᑎᑭᐸᒃᑐᓄᑦ ᑎᖕᒥᐊᓄᑦ ᐃᕙᕖᖕᒋᓐᓂᒃ ᕿᓂᖅᑐᑦ, ᑕᒪᐃᓐᓂ ᖃᓂᒋᔭᖕᒐᓂ ᕿᓐᖑᐊ. ᐊᑐᓂ ᐃᓂᖕᒋᑦ, ᓴᓇᔭᐅᔪᑦ ᑭᖑᕙᖅᓯᒪᓚᐅᖅᑐᑦ ᑭᓯᐊᓂ ᑲᖕᒐᑦᑕᕈᓐᓇᖅᓯᖕᒪᑕ.
- ᑕᐃᑲᓂ 2018, ᐃᓂᖕᒐᓃᓚᐅᖅᑐᑦ ᐃᓅᒃᐸᓪᓕᐊᓕᖅᑎᓪᓗᒋᑦ, ᐊᒻᒪᓗ ᐃᕙᔭᐅᔭᕇᖅᑎᓪᓗᒋᑦ ᒥᐊᓂᕆᔭᐅᔪᑦ ᑕᒪᐃᓐᓂᑦ ᐃᕙᕖᐅᔪᓂ ᐃᓗᐊᓂ 10 ᑭᓚᒦᑕ ᐅᔭᕋᖕᓂᐊᕐᕕᐅᔪᐸ ᓴᓇᕖᒋᔭᖕᒋᓐᓂ (ᐅᑯᐊ ᓂᕿᑐᓰᖅ ᑎᖕᒥᐊᓂᒃ ᒥᐊᓂᕆᕖᐅᔪᑦ).
- ᑲᑎᓪᓗᒋᑦ 166 ᐊᔾᔨᐅᓐᖏᑦᑐᓂ ᐃᕙᕖᐅᔪᑦ ᐃᓂᖕᒋᑦ ᖃᐅᔨᔭᐅᓇᓱᑦᑎᐊᖃᑦᑕᓚᐅᖅᑐᖅ ᑕᐃᑲᓂ RMA. ᓲᕐᖃᐃᒻᒪ ᐅᑯᐊ, 61 ᐃᓂᖕᒋᑦ ᐃᓂᒋᔭᐅᓪᓗᑎᒃ ᓂᕿᑐᓰᓂᑦ ᑎᖕᒥᐊᓂᑦ ᑕᐃᑲᓂ 2018; 48-ᖕᒋᑦ ᑭᒡᒐᕕᐊᕐᔪᐃᑦ, 11 ᑳᔩᖅ, ᐊᑕᐅᓯᖅ ᑭᒡᒐᕖ, ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᑐᓗᒐᖅ.
- ᑕᐃᒪᓐᓇᐅᒐᓗᐊᖅᑎᓪᓗᒍ ᐊᕐᕌᒍᒥ ᐊᔾᔨᒌᖃᑦᑕᓐᖏᑦᑐᑦ ᕿᑐᕐᖏᐅᖅᑐᑦ ᑭᒡᒐᕕᐊᕐᔪᐃᑦ ᐊᒻᒪᓗ ᑭᒡᒐᕚᑦ ᐊᒻᒪᓗ ᑳᔩᖅ ᐱᑕᖃᐃᓐᓇᖅᑐᑦ, ᒪᓕᒃᑐᑦ ᐊᔾᔨᒌᖃᑕᓐᖏᓂᖕᒐᓄ ᓄᓇᖕᒐ ᐊᔾᔨᒌᖃᑦᑕᓐᖏᓂᖕᒋᓪᓗ ᓂᕆᕖᒋᕙᒃᑕᖕᒋᑦ ᐊᒻᒪᓗ ᓯᓚ ᐱᔾᔪᑕᐅᔪᖅ ᐸᒡᕕᔭᐅᓂᕐᒥᖕᒐᕋᑎᒃ.
- ᐅᑯᐊ ᑳᔩᑦ, ᓴᕿᑕᓇᐊᖃᓕᕋᖕᒐᒥᒃ ᑭᓯᐊᓂ ᓴᕿᐸᒃᑐᑦ (ᖃᓂᑦᔨᓂ ᑎᓴᒪᑦ-ᐅᑭᐅᓄᑦ ᐅᑎᖅᑕᕋᒥᒃ), ᐊᒻᒪᓗ ᖃᐅᔨᓇᖅᓯᑦᑎᐊᖅᑐᑦ ᐅᐸᖃᑦᑕᖅᑕᑎᒃ ᐊᑕᔪᖅ ᓄᓇᒧᑦ ᐊᒻᒪᓗ ᒥᑭᔪᓄᑦ ᓂᕐᔪᑎᓄᑦ ᑎᑭᐸᒃᑐᓄᑦᑕᐅᖅ, ᐅᑯᐊᓗ ᖃᐅᔨᒪᐅᒃᑐᑦ ᐅᑎᖅᐸᒃᑐᑦ ᐊᓂᒍᕋᖕᒐᑕ ᑎᓴᒪᑦ ᐅᑭᐅᑦ ᑕᐃᒪᖕᒐᓕᒫᖅ. ᑕᐃᑲᓂ 2018, ᒥᑭᔪᑦ ᓂᕐᔪᑎᑦ ᐅᓄᓚᐅᖅᑐᑦ ᒥᐊᓂᕆᔭᐅᔪᑦ ᐃᓚᓕᐅᑎᓯᒪᒋ9ᓗᑎᒃ ᓂᕿᑐᓰᓄᑦ ᑎᖕᒥᐊᓄᑦ ᖃᐅᓐᓇᓱᒍᑕᐅᔪᓂ ᑕᒪᓐᓇ ᐅᖃᐅᓯᐅᓂᐊᖅᑎᓪᓗᒍ. ᒥᑭᔪᓂᒃ ᓂᕐᔪᑎᓂᒃ ᐱᔪᖃᓚᐅᓐᖏᑦᑐᖅ ᑕᐃᑲᓂ ᐱᓕᕆᑎᑦᑎᔾ-ᔪᑎᑦᑎᒍᑦ 2018-ᒥ.
- ᐅᐸᒃᓯᒪᖃᑦᑕᖅᑕᖕᒋᑦ ᐃᕙᔪᓇᕋᒥᒃ ᑭᒡᒐᕕᐊᕐᔪᐃᑦ ᑕᐃᑲᓂ RMA ᐊᑦᑎᓗᐊᓚᐅᕐᒪᑕ ᒥᐊᓂᕆᓯᐊᒃᓴᒥᒃ ᐊᕐᕌᒍᒥ ᖃᓄᖅ ᐊᓯᑦᔨᖅᓯᒪᖕᒪᖔᑕ ᖃᓄᐃᓕᖕᒐᓂᕐᒪᖔᑕ.
- ᓇᓗᓇᕈᓐᓂᓚᐅᖅᑐᑦ ᑕᒪᒃᑯᐊ ᐅᖕᒐᓯᒋᔭᖕᒐᓃᖃᑦᑕᖅᑐᑦ ᐸᒡᕕᔪᓂᑦ ᐊᒻᒪᓗ ᖃᓂᒋᔭᖕᒐᓃᓕᖅᓱᑎᒃ ᓴᓂᓕᒥᖕᓄᑦ (ᐊᑕᐅᓯᖅ ᐊᒻᒪᓗ ᐊᑕᐅᓯᕐᒦᓕᖃᑦᑕᖅᓱᑎᒃ) ᐱᐅᓐᖏᑦᑐᓂᒃ ᓴᕿᑐᖃᓚᐅᓐᖏᑦᑐᖅ ᐃᓂᖕᒋᓐᓂ ᐅᒡᕙᓘᓐᓃᑦ ᕿᑐᕐᖏᐅᕐᓂᖕᒋᓐᓂ ᓂᕿᑐᓰᑦ ᑎᖕᒥᐊᑦ ᐊᓯᖕᒥᓪᓗ ᑕᐃᒪᓇᐃᑦᑑᔪᑦ ᑳᔩᑦ.

ᑕᐃᒪᓐᓇᐅᓚᓗᐊᖅᑎᓪᓗᒍ, ᑕᑯᔪᖃᖅᓯᒪᔪᖅ (p=0.05) ᐅᓚᓯᒃᑎᒋᓂᓚ ᐸᕝᕕᒐᔭᖅᑐᓂᒃ ᖄᑐᖅᒋᐅᖅᑐᓄᑦ ᑭᒡᓚᕕᐊᖅᔪᐃᑦ ᐃᕙᕕᖏᑦᑕ ᐃᓂᓚᓂ ᖃᓂᒋᔭᓚᓂ ᐅᔭᕋᓂᐊᖅᕕᒃ ᓇᐸᖅᓯᒪᔭᖏᓂ 2018-ᒍᑎᓪᓗᒍ.

ᐸᕕᓀᓐ ᑲᔪᓯᓂᐊᖅᑐᖅ ᐃᑲᔫᑎᓄᑦ ᓄᓇᓚᓂ ᖃᐅᔨᓴᕐᑐᑕᐅᔪᓄᑦ ᓯᕗᐅᑉ ᑎᒥᐊᒋᓂᒃ, ᐃᓚᒋᔭᐅᓗᑎᒃ ᐆᒪᔪᑦ ᓄᖑᑕᐅᓕᖅᑐᑦ ᒪᓕᒃᓱᒋᑦ ᑲᓇᑕᒥ ᓂᖅᔪᑎᓕᓇᓂᖅᒧᑦ ᐱᔨᑦᑎᖃᖅᑎᑦ, ᓖᓇ ᐊᑐᖅᑕᐅᔪᑦ ᑎᑭᐸᒃᑐᓄᑦ ᑎᒥᐊᓄᑦ ᐃᕙᕕᖏᓂᒃ ᕿᓂᖅᓱᑎᒃ ᖃᐅᔨᓴᖅᑐᑦ ᑲᔪᓯᓂᐊᖅᑐᖅ ᓯᕗᓂᒃᓴᑦᑎᓄᑦ ᓯᕗᓂᑐᖃᓚᓕ ᐊᓐᓂᖅᑕᐅᔪᒪᔾᔪᑎᑦ ᓄᓇᒥᒃ ᐸᕕᓴᐃᓂᐊᖅᑐᓂ ᐊᒻᒪᓗ/ᐅᕝᕙᓘᓃᑦ ᓄᖃᓚᖃᑦᑕᖅᑐᑎᒃ ᑎᒋᔦᓇᖅᓯᓂᒋᓄᑦ ᑎᒥᐊᑦ, ᐊᒻᒪᓗ ᓂᖄᑐᓰᑦ ᑎᒥᐊᑦ ᒥᐊᓂᕆᔭᐅᓗᑎᒃ ᖃᐅᔨᓴᐅᓇᓯᑎᐊᖅᑐᑎᒃ ᑲᔪᓯᓗᓂ ᐊᐅᓪᓗᑎᓗᒋᑦ ᐃᕙᕕᐅᔪᓂᒃ ᐅᐸᒃᑕᖅᑐᒋᑦ 2019-ᒥ.

ᖁᓕᒥᒎᓕᒃ ᖁᓚᐅᓂᓚᑕ ᐅᓚᓯᓂᓚ:

- ᖁᓕᒥᒎᓕᑦ ᖃᓚᑕᔪᑦ ᐊᑦᑎᓈᓇᐊᖅᑳᓚᑕ ᐊᑐᖅᑕᐅᕗᑦ ᖃᐅᔨᓴᕐᑐᑕᐅᔪᓄᑦ ᐸᕝᕕᒍᓇᖅᑐᑦ ᑎᒥᐊᓂᒃ ᐊᒻᒪᓗ ᐊᒥᖏᓂᒃ ᓂᖅᔪᑎᓂᒃ ᐃᓗᐊᓂ ᐊᒻᒪᓗ ᓯᓚᑖᓂ ᑲᒍᐃᑦ ᓇᔪᖅᐸᒃᑕᖏᓂ.
- ᑕᐃᑲᓂ 2018, ᖁᓕᒥᒎᓕᑦ ᐊᑦᑎᓈᖅᓂᓚᑕ ᐃᓗᐊᓂ ᑲᒍᖃᖅᑐᓂᒃ ᒪᓖᖅᑎᓪᓗᒋᑦ 94%, ᐊᒻᒪᓗ ᒪᓕᑦᑎᐊᖅᓗᑎᒃ ᐃᓗᐊᓂ ᐊᒻᒪᓗ ᓯᓚᑖᓂ ᑲᒍᖃᖅᑐᑦ ᑕᒪᐃᓐᓂ ᑕᕿᓕ 98%-ᒍᓚᐅᖅᑐᖅ.
- 2018 ᐱᖃᑎᒋᓕᖅᑕᓚ ᐊᕐᖁᒧᒥ ᖃᐅᔨᓴᕐᑕᐅᑲᓂᓇᐊᖃᖅᑐᑎᒃ, ᐅᑯᐊᓗ ᐃᓯᒪᒋᑦᑎᐊᓇᐊᓕᑦ ᐃᒪᓐᓇᐅᓇᓯᒋᔭᐅᔪᑦ ᖃᓚᑕᓲᖅᑎᓂᑦ ᐊᒥᓯᓂ ᐃᓐᒋᖃᔾᒃᑐᑎᒃ ᓇᒧᑐᐃᓐᓇᖅ ᖃᓚᑕᔭᖁᓚᒥᒃ ᐊᑦᑎᓈᖅᓂᓐᒋᑦ ᒪᓕᒋᐊᖃᕐᒥᔪᑦ. ᖃᐅᔨᓇᓯᑦᑎᐊᖁᒥᒃ ᑕᒪᓐᓇ ᐱᔾᔪᑖ, ᖃᓚᑕᓲᑦ ᐊᑦᑎᓈᖅᓂᓐᒋ ᐊᑐᖁᔭᐅᓯᒪᔪᑦ ᒪᓕᒃᓱᒋᑦ "ᐱᐅᒃᓴᓐᒋᑦᑐᓂᑦ ᐅᖃᖁᔭᖅᑐᑦ" ᖃᓚᑕᔭᓇᐊᖃᖅᑕᑎᑦ ᐳᖅᑐᓈᖅᓂᓚᓄ ᑎᑭᐅᑎᓯᒪᓪᓗᑎᒃ, ᐅᕝᕙᓘᓃᑦ ᑕᐃᑲᓂ ᖃᓚᑕᓲᖅᑎ ᐃᓯᒪᓯᒥᓂᒃ ᕿᒪᐃᑎᓪᓗᒍ ᐳᖅᑐᓇᓇᐊᖃᖅᑕᒥᓂᒃ. ᖃᐅᔨᓴᕈᑎᑖᑦ ᐱᓯᒪᔪᓂᑦ "ᐅᖃᖁᔭᓐᒋᑦᑐᑦ" ᑎᑭᐅᑎᓐᒋᐸᑕ ᐊᑦᑎᓈᓇᐊᖃᕈᑎᒥᓐᓂᒃ, ᐊᒻᒪᓗ ᓇᓗᓇᐃᔭᖅᑐᖃᓐᒋᓪᓗᓂ.
- ᐅᓇ ᖃᐅᔨᓴᕐᑐᑎᒃᑲᓂᖅ ᑕᑯᑎᑦᑎᓯᒪᔪᖅ ᖃᓚᒃᑯᑦ ᑕᐃᒪᓐᓇᐅᔭᓇᐊᖃᖅᓯᒪᔪᓂᒃ ᑐᓂᔭᐅᔪᑦ ᖃᓚᑕᓲᖅᑎᓂᑦ ᐊᑦᑎᓈᕈᑎᒥᓐᓄᑦ, ᑕᒪᖁᒥᒃ ᐊᑦᑎᓈᖅᑐᑦ ᓈᒻᒪᒋᔭᐅᓚᑎᒃ ᐅᖃᐅᓯᐅᓯᒪᑎᓪᓗᒋᑦ. ᐅᓇ ᐆᒃᑑᑎᒋᓪᓗᒍ, ᑖᒃᑯᐊᑐᐊᖅ 8% ᐊᑲᐅᒃᓴᓐᒋᑦᑐᑦ ᐅᖃᓚᐅᖅᑐᑦ ᐃᓗᐊᓂ ᑲᒍᖃᖅᑎᓪᓗᒍ ᐊᑐᓇᐊᖃᖅᑎᓪᓗᒋᑦ ᐊᑦᑎᓈᓗᐊᓇᐊᖃᖅᓇᐅᓐᒋᑎᓪᓗᒍ, ᐊᒻᒪᓗ ᐊᓯᖏᑦ 92% ᐊᑦᑎᓈᖅᓯᒪᔪᑦ ᐅᖃᖅᓯᒪᓪᓗᑎᒃ ᖃᓚᑕᓲᖅᑐᑦ. ᑕᐃᓖᒃᑕᐅᖅ, ᑖᒃᑯᐊᑐᐊᖅ 6% ᐊᑲᐅᒃᓴᖁᑎᒃ ᐅᖃᖅᓯᒪᔪᑦ ᓯᓚᑖᓂ ᑲᒍᖃᖅᓂᐅᑉ ᑎᑭᐅᑎᓯᒪᓕᑎᓪᓗᒋᑦ ᖃᓚᑕᔭᓇᐊᖃᖅᓂᓚᓂ ᖁᑎᓈᖅᓂᓚᓂᒃ, ᐊᒻᒪᓗ ᐊᓯᖏᑦ 94% ᖃᓄᐃᒻᒪᑦ ᐊᑦᑎᓈᓚᐅᕈᑎᒥᓂᒃ ᐅᖃᖅᓯᒪᔪᑦ ᐱᔾᔪᑎᖃᑦᑎᐊᖅᓂᖁᒥᓂᒃ ᖃᓚᑕᓲᖅᑎᑦ
- ᐳᖅᑐᓚᐅᖅᑐᖅ ᐳᓴᑎᓚ ᐊᑦᑎᓈᖅᑐᓂᒃ ᐊᑲᐅᒃᓴᖃᑎᒃ ᐅᖃᖅᓯᒪᔪᑦ ᑕᒪᐃᓐᓂ ᑕᑯᔭᐅᔪᑦ 2017, ᐊᒻᒪᓗ ᑲᔪᓯᓂᐊᖅᑐᖅ ᓯᔪᓂᒃᓴᑦᑎᓂ ᐅᓄᖅᑐᑦ ᖁᓕᒥᒎᓕᑦ ᓴᓇᓂᐊᖅᑐᑦ ᓄᓘᔾᓂ ᐊᑦᑎᓈᖅᑎᑦᑎᖃᑦᑕᓇᐊᖃᖅᓂᐊᖅᑐᑦ ᐱᖁᓗᐊᖃᓐᓇᖅᑐᖃᖅᑎᓇᒍ / ᐊᐅᓚᑦᑕᓇᐊᓕᑦᖅ ᐱᔾᔪᑎᒋᓪᓗᒋᑦ (ᓲᖅᓗ ᑲᓕᑦᑕᓇᐊᓕᑦ, ᖃᐅᔨᓴᕈᑎᑦ) ᐅᕝᕙᓘᓃᑦ ᐃᓚᖃᖅᑐᑦ ᐊᒥᓯᐃᖅᓗᑎᒃ ᓄᖃᖃᑦᑕᖅᓂᐊᖅᑐᑦ ᕿᓚᒥᐅᑦᑕᖅᑐᒥᒃ ᑕᐃᒪᓗ ᖁᓕᒥᒎᓕᑦ ᐊᑦᑎᓈᖃᑦᑕᖅᓂᐊᖅᑐᑦ ᐊᕙᑖᓂ ᖃᑦᑕᖃᓯᓪᓗᑎᒃ ᐊᒻᒪᓗ ᒥᓇᓯᓪᓗᑎᒃ. (ᓄᓇᒥᒃ ᓇᐸᖅᑎᓇᓂᖅ ᓄᓇᑖᖁᑎᓂᒃ, ᖃᐅᔨᓴᕈᑖᖅᓂᖅ, ᓂᐅᑎᓂᖅ/ᐅᓯᓕᖅᓂᖅ).

- ᑕᒪᕐᒥᒃ ᓈᒻᒪᒃᓴᓐᖏᑦᑐᑦ ᐅᖃᖅᑐᑦ ᐊᑦᑎᓈᓗᐊᖅᓯᒪᓂᖏᓐᓂᑦ 2018 ᐱᓯᒪᒍᑎᒃ ᐊᑯᓂᐅᔪᒥᒃ ᖃᖓᑕᓂᐊᖅᑐᑦ, ᑕᐃᑲᓂᓗ ᖃᖓᑕᓲᖅᑎᑦ ᐊᑐᕆᐊᖃᖅᑕᒥᒍᑦ ᑎᑭᐅᑎᓯᒪᔪᑦ ᐊᒻᒪᓗ ᐊᑕᐅᓯᑦᑕᐃᓇᓕᔪᒥᒃ ᑐᑭᓕᐊᖅᑐᓄᑦ ᖁᑎᓈᖅᑐᑦ.

ᖁᓕᒥᒎᓕᑦ ᖃᖓᑕᔪᑦ ᐳᖅᑐᓂᖓ ᖃᐅᔨᔭᐅᓇᓱᓚᐅᖅᑐᖅ ᒪᓕᒃᑯᒋᑦ ᖃᖓᑕᓲᖅᑎᑦ ᑎᑎᕋᖁᑎᖏᑦ ᑕᒪᓐᓇ ᑲᔪᓯᓂᐊᖅᑐᖅ 2019-ᒥ.

ᑎᑎᕋᖅᓯᒪᔭᓂᒃ ᓇᓗᓇᐃᑭᑦ 1 ᓄᓇᒥ ᑭᒡᓕᐊᑕ, ᒥᐊᓂᕆᔭᐅᓂᖓᑕ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᑕᐅᓂᖓᑕ ᖃᓄᐃᓕᐅᕿᑕᐅᔪᑦ ᐱᓕᕆᔭᐅᓯᒪᔪᑦ 2018 ᓄᓘᔾᖓᓂ ᐅᔾᕋᖕᓂᐊᕐᕕᖕᒥ.

ᖃᐅᔨᓴᖅᑕᐅᔪᖅ	ᖃᐅᔨᓴᕿᑖ[1]	ᓴᓇᔾᔭᐅᓂᖓ ᐱᔾᔪᑎᖅᑐᖅ, ᐊᑐᐃᓂᖓ ᑕᑯᔭᐅᔪᖅ, ᐊᑐᓗᐊᖅᑕᐃᓕᒪᑎᑦᑎᔾᔪᑎᖃᕆᐊᓕᒃ ᐊᒻᒪᓗ ᐊᑐᓕᖁᔭᐅᔪᑦ ᓯᕗᓂᒃᓴᒥ ᐱᓕᕆᔭᕆᐊᓕᑦ
ᓱᑭᖅ ᑲᑕᒐᖅᑐᖅ ᒥᐊᓂᕆᔭᐅᓂᖓ	ᐅᖃᐅᓯᕆᓗᒋᑦ ᐅᔾᕋᖕᓂᐊᕐᕖᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 36, 50, 54d, 58c, ᐊᒻᒪᓗ ᐅᔾᕋᖕᓂᐊᕐᕕᖕᒥ ᐊᖕᖏᖅᑕᐅᓯᒪᔪᖅ 60	33-ᓂᑦ ᓱᑭᓂᑦ ᑲᑕᒐᕐᕕᐅᔪᓂᑦ ᓄᐊᑦᑎᓚᐅᖅᑐᑦ ᓇᑭᑐᐃᓐᓈᖅᑐᓂᒃ ᐅᔾᕋᖕᓂᐊᕐᕕᖕᒥ, ᐃᓚᖏᑦ ᐅᖓᓯᖕᓂᖅᓴᐅᓪᓗᑎᒃ ᐅᔾᕋᖕᓂᐊᕐᕕᐅᔪᖅ ᓴᓇᕕᒋᔭᖏᓐᓂ, ᐊᒻᒪᓗ ᐲᔭᖅᑕᐅᖃᑦᑕᖅᑐᑦ. ᐅᖓᑖᓂ 4 ᐅᕿᐅᓄᑦ ᒥᐊᓂᕆᔭᐅᔪᖅ ᑕᐃᑲᖓᑦ ᐋᒍᓯ 2013 ᑎᑭᓪᓗᒍ ᑎᓯᐱᕆ 2018 ᐱᔭᕇᖅᓯᒪᓕᖅᑐᑦ. ᓯᕗᓂᒃᑎᓂ ᒥᐊᓂᕆᔭᐅᓂᖓ ᑲᔪᓯᓂᐊᖅᑐᖅ ᖃᐅᔨᓇᓱᒡᓗᑎᒃ ᑲᑕᒐᖅᑐᑦ ᓱᕋᖅ ᑕᐃᑲᓂ 33 ᐃᓂᖏᓐᓂ ᑕᒪᐅᓐᓇ ᐊᐅᔭᒃᑯᑦ ᐊᒻᒪᓗ ᐃᓚᖓ ᐊᑯᓂᐅᓂᖅᓴᐅᔪᒥᑦ 16-ᐅᕿᐅᓄᑦ ᑕᒪᕐᒥᒃ ᐃᓂᖏᑦ. ᐱᐅᓯᕚᓪᓕᖅᑎᑕᐅᓚᐅᖅᑐᑦ ᐊᕐᑯᑎᓂ ᐃᖏᕐᕋᔭᒃᑐᑦ ᑎᑎᕋᖅᑕᐅᕙᓪᓕᐊᔪᖅ ᐅᓄᖅᓯᕆᐊᑦᑎᐊᕐᓂᐊᕐᒪᑕ ᐃᖏᕐᕋᔭᒃᑐᑦ ᓄᓇᓯᐅᑎᑦ.
ᐱᕈᖅᑐᑦ ᐅᓄᖅᓯᕙᓪᓕᐊᓂᖏ ᒥᐊᓂᕆᔭᐅᔪᑦ	ᐅᖃᐅᓯᕆᓗᒋᑦ ᐅᔾᕋᖕᓂᐊᕐᕖᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 36 & 50, ᐊᒻᒪᓗ ᐅᔾᕋᖕᓂᐊᕐᕕᖕᒥ ᐊᖕᖏᖅᑕᐅᓯᒪᔪᖅ 67	ᐊᓯᑭᖅᑕᖃᑦᑕᕐᓂᖓ ᖃᐅᔨᓴᖅᑕᐅᕝᕙ ᖃᐅᔨᓴᓱᒃᑯᓪᓗᒋᑦ ᐊᓯᑦᑐᒍᓐᓇᖅᑐᑦ ᐳᓴᑎᖓ ᐱᕈᖅᑐᑦ ᓇᒧᖔᓯᒪᖕᒫᖓᑕ ᐊᒻᒪᓗ ᖃᓄᕆᑑᖕᒪᖕᒫᑕ ᐱᕈᖅᑐᑦ ᑭᓯᖃᐅᕐᒪᖕᒫᑦ ᐱᓪᓗᒍ ᐅᖓᓯᒋᔭᖕᖓᓃᑦᑐᖅ ᐅᔾᕋᖕᓂᐊᕐᕕᒃ ᓇᐸᖅᓯᒪᔭᖕᖓᓂᑦ ᐊᒻᒪᓗ ᓴᓗᒪᖅᓴᐃᕕᒃ ᐊᒃᑐᐃᓂᖓ ᐊᕙᑖᓂᑦ ᒪᑐᐃᔪᑦ ᐊᒻᒪᓗ ᒪᑐᓯᒪᔪᑦ ᐃᓂᖏᑦ. ᐊᕙᑖᓂᑦ-ᐊᕐᕌᒍᑕᒫᑦ ᐊᔾᔨᓖᖏᓐᖏᑦᑐᑦ ᑲᑎᒡᓗᒋᑦ ᐳᓴᑎᖏᑦᑎᒍᑦ ᓄᓇᒦᑦᑐᑦ, ᑲᑎᒡᓗᒋᑦ ᐳᓴᑎᖏ ᖄᓕᖅᓯᒪᓂᖓᓂᒃ, ᐊᒻᒪᓗ ᐱᕈᖅᑐᓂ ᑲᑎᖓᔪᓂᑦ ᒥᑭᑑᑕᐅᓚᐅᖅᑐᑦ ᐊᒻᒪᓗ ᐊᔾᔨᑦᑎᐊᒥᒃ ᓇᒧᑐᐃᓐᓇᖅ ᐅᖓᓯᕆᔭᖏᑦ ᖃᓄᕆᑑᑕᐅᓖᖓᑕ ᐊᒻᒪᓗ ᓴᓗᒪᖅᓴᐅᑎᑦ ᑭᓯᐊᓂ ᒥᑭᔪᑦ ᐊᑕᕝᒃᑐᑦ ᐃᓗᐊᓂ ᐊᕐᕌᒍ ᐊᒻᒪᓗ ᐅᖓᓯᖕᓂᖓᓐᓂᑦᑐᑦ ᑕᐃᒃᑯᐊᓕ ᑐᕐᑯᓕᖓᔪᑦ ᐊᒻᒪᓗ ᐋᕿᒃᓯᒪᑦᑎᐊᕐᖏᑦᑐᑦ; ᑕᐃᒪᐃᒻᒪᑦ, ᐊᔾᔨᒌᖕᖏᓐᖏᑦᑐᑦ ᓄᓇᒥᑦ ᑕᐃᒪᓐᓇᐃᓕᑎᓯᒪᔪᓪᓗ ᐱᕈᖅᑐᑦ ᖃᖓᓂᑦᑐᑦ ᑕᐃᒪᖓᓂ ᐊᕐᕌᒍᓂ ᐊᓂᒍᖅᑐᓂᑦ ᑭᓯᒪᓇᑎᒃ ᐅᔾᕋᖕᓂᐊᕐᕕᖕᒥᑦ ᐊᒃᑐᐃᓂᖓ ᓯᕗᓪᓕᖓᓂ ᑎᓴᒪᓂᑦ ᐊᕐᕌᒍᓂ ᒥᐊᓂᕆᔭᐅᕙᒥ.
ᐱᕈᖅᑐᑦ ᐊᒻᒪᓗ ᐃᔾᔭᖅ ᓴᕕᕋᔭᒃᓴᖃᕐᒪᖔᑦ ᖃᐅᔨᔭᐅᓇᓱᒃᑐᓂ	ᐅᖃᐅᓯᕆᓗᒋᑦ ᐅᔾᕋᖕᓂᐊᕐᕖᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 34, 36 ᐊᒻᒪᓗ ᐅᔾᕋᖕᓂᐊᕐᕕᖕᒥ ᐊᖕᖏᖅᑕᐅᓯᒪᔪᖅ 50	ᐅᓇ ᐱᓕᕆᑎᑦᑎᔾᔪᑕᐅᔪᖅ ᐱᓕᕆᔭᐅᓚᐅᖅᑐᖅ 2018-ᒥ. ᒪᓕᒃᓱᒍ ᐃᓂᓕᐅᖅᓯᒪᔪᖅ ᑎᑎᕋᖅᓯᒪᔪᖅ ᓄᓇᐅᑉ ᐊᕙᑎᒥᒃ ᐊᒃᑐᓈᖅᑕᐅᓕᑎᑦᑎᔾᔪᑕᐅᔪᑦ ᐊᒻᒪᓗ ᒥᐊᓂᕆᔾᔭᑕᐅᔪᑦ ᐸᕐᓇᐅᑎᑦ, ᐱᕈᖅᑐᑦ ᐊᒻᒪᓗ ᐃᔾᔭᖅ ᓴᕕᕋᔭᒃᓴᖅᑕᖃᕐᒪᖔᑦ ᖃᐅᔨᔭᐅᓇᓱᒃᑐᑎᒃ 2019-ᒥ.
ᖁᓕᒥᑰᓕᑦ ᐊᑦᑎᓈᖃᑦᑕᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᖅᑕᐅᓗᑎᒃ	ᐅᖃᐅᓯᕆᓗᒋᑦ ᐅᔾᕋᖕᓂᐊᕐᕖᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 59, 71 ᐊᒻᒪᓗ 72	ᑎᑭᓚᐅᓐᖏᓐᖏᓂ ᐸᓂᓐᓛᓐᑦ, ᑕᒪᕐᒥᒃ ᓴᓇᔨᑦ ᖃᐅᔨᒪᑎᑕᐅᓗᑎᒃ ᖃᖓᑕᓲᑦ ᐊᑦᑎᓈᕆᐊᖃᓐᖏᓐᖏᓂ ᕿᓖᑎᑦᑎᓂᐊᕈᑎᒃ ᓂᕐᔪᑎᓂᒃ ᕿᑭᖅᑖᓗᖕᒥ, ᐱᓗᐊᖅᑐᒦᒃ ᐊᑦᑕᕐᓇᖅᑐᒦᓗᐊᖅᑎᓪᓗᒋᑦ ᖃᖓᒃᑯᑦ (ᓲᕐᓗ ᐃᕗᓂᕕᖅᑐᑦ, ᓄᕐᕆᐅᕙᑦ, ᐊᓯᖏᓪᓗ). ᖃᐅᔨᒪᓇᕐᓗᓂ ᐅᑯᐊ ᖃᖓᑕᓲᑦ ᑕᐃᒪᓐᓇᐅᔭᕆᐊᖃᕐᕕᖏᑦ ᒪᓕᖕᓂᐊᕐᒪᑕ (ᑭᓯᐊᓂ ᑎᓕᔭᐅᓯᒪᒍᑎᒃ ᐊᑦᑎᓈᕈᓐᓇᕐᓗᑎᒃ ᐱᓕᕆᔭᖅᑐᖅᓯᒪᑎᓪᓗᒋᑦ ᓲᕐᓗ ᓂᐅᖅᑐᖅᑐᑦ, ᖃᖓᑦᑕᖅᑐᑦ ᐊᒻᒪᓗ ᒥᑦᑕᖅᑐᖅᑐᑦ), ᐊᒻᒪᓗ ᒪᓕᒃᑐᖅ ᖃᖓᑕᓲᖅᑎ ᐊᑐᕈᒪᔭᖓᓂᒃ ᖃᖓᑕᓲᖅ ᐱᔾᔪᑎᒋᓪᓗᒍ ᐃᓄᐃᓪᓗ ᖃᓄᐃᖏᑦᑎᐊᕐᑯᓪᓗᒋᑦ, ᐊᑦᑎᓈᕐᓂᖓ 650 ᒦᑕ ᐅᐸᒃᑕᖓᓂ ᑕᐃᒪᓗ ᑎᑭᐸᒃᑐᓂᒃ ᑎᖕᒥᐊᖅᑕᖃᕈᓇᕐᒥᔪᖅ, ᐊᒻᒪᓗ 1,100 ᒦᑕ

[1] ᐱᓕᕆᐊᖑᔪᖅ ᖃᓄᕆᑑᓂᖓ ᐊᒻᒪᓗ ᐅᔾᕋᖕᓂᐊᕐᕕᒃ ᐊᖕᖏᖅᓯᒪᔭᖏᑦ ᐊᑐᓂ: ᐱᓕᕆᔪᓐᓇᖅᑎᑕᐅᓂᖓ ᐅᔾᕋᖕᓂᐊᕐᕕᖏᒥ ᓈᓴᐅᑖ 005.

		ᖁᓛᓂᑦ ᐊᒻᒪᓗ 1,500 ᐅᖓᓯᓈᖅᓯᒪᓪᓗᑎᒃ ᑖᒃᑯᓄᖓ ᑲᑎᖓᔪᓄᑦ ᑎᖏᐊᓄᑦ. ᖃᖓᑕᕆᐅᔪᑦ ᐊᑯᑎᖏ ᐊᑐᖅᑕᐅᕗᑦ ᐅᐸᒃᑕᐅᓂᐊᖕᖏᒻᒪᑕ ᓂᕐᔪᑎᖃᓗᐊᖅᑐᑦ. ᑕᐃᑲᓂ 2018, ᒪᓕᑦᑎᐊᕋᓗᐊᕐᒪᖔᑕ ᒪᓕᒐᕐᓂᒃ ᐃᓗᐊᓂ ᓂᕐᓕᖃᖅᑐᓂ ᖃᖓᑦᑕᕋᑯᒃᐸᓪᓕᐊᓕᖅᑎᓪᓗᒋᑦ ᓂᕐᓕᐊᕋᐃᑦ 94%, ᐊᒻᒪᓗ ᒪᓕᑦᑎᐊᕐᓗᑎᒃ ᐃᓗᐊ ᐊᒻᒪᓗ ᓯᓚᑖᓂ ᓂᕐᓕᖃᕐᓇᐅᑎᓪᓗᒍ ᑕᒪᕐᒥᒃ ᑕᕐᕿᓄᑦ 98%. 2018-ᒥ ᐊᑦᕌᒍᓇᔭᐅᑦᑎᐊᓚᐅᖅᑐᖅ ᑕᒪᒃᑯᐊ ᐊᑦᑎᓈᓇᐊᖃᖕᖏᑦᒃᑐᑦ ᖃᖓᑕᓲᑦ ᖃᐅᔨᔭᒃᓴᐅᓪᓗᑎᒃ ᖃᖓᑕᓲᖅᑎᑦ ᑎᑎᕋᒃᑦᑕᖅᑕᖏᑦᑎᒎᑦ ᖃᖓᑕᒫᑦ ᐃᑲᔫᑎᓂᐊᖅᑐᑦ ᖃᐅᔨᓇᖅᓯᓗᑎᒃ ᖃᓄᐃᒻᒪᑦ ᒪᓕᖕᓂᕐᖏᒻᒪᖔᑕ ᒪᓕᒐᕐᓂᒃ ᖁᑎᓈᓇᐊᖃᖅᑎᓪᓗᒋᑦ. ᖃᐅᔨᓇᓱᒍᑎᒃᓴᐅᓗᑎᒃ, ᒪᓕᖕᖏᑦᑐᓄᑦ ᖃᖓᑕᓲᑦ ᖃᖓᑕᑎᓪᓗᒋᑦ ᐊᑦᑎᓈᓇᐊᖃᖕᖏᓂᖏᑦ ᐱᓪᓗᒋᑦ ᐋᕿᒃᑕᐅᑦᑎᐊᓚᐅᖅᑐᑦ ᐱᔾᔪᑎᖏᑦ ᐱᓪᓗᒋᑦ ᒪᓕᒋᐊᖃᖅᑐᓄᑦ ᐱᓕᕆᐊᕆᓯᒥᖕᓄᑦ ᖃᓄᐃᓕᖓᓂᖓᒍᑦ ᓇᓗᓇᐃᔭᑦᑎᐊᕈᑎᖏᑦ ᖃᖓᑕᓲᖅᑎᑦ. ᖄᖓᒍᑦ ᖃᐅᔨᓇᓱᒃᑎᓪᓗᒋᑦ ᖃᓄᐃᒻᒪᑦ ᐅᓄᖅᓯᖔᖓᑕ ᖁᓕᒥᒎᓕᑦ ᐊᑦᑎᓈᒃᑲᖅᑐᑦ ᑕᐃᒪᖓᓂ ᐊᑦᕌᒍᓂᑦ ᐊᓂᒍᖅᑐᓂᑦ. ᐆᒃᑑᑎᑦ ᑐᓂᔭᐅᓚᐅᖅᑐᑦ ᓇᓗᓇᐃᖅᓱᑎᒃ ᐊᑦᑎᓈᒃᑲᑦᑕᕈᑎᖏᑦ ᐱᔾᔪᑎᒋᓪᓗᒋᑦ: ᐊᓄᓇ, ᑲᓕᑦᑐᑦ, ᓄᓇᒥ ᓇᐸᖅᓯᒃᑲᑦᑕᖅᑐᑦ ᓄᓇᖁᑎᑖᒥᖕᓂᒃ, ᖃᐅᔨᓴᖅᑐᑦ, ᓂᐅᕕᔪᑦ/ᐅᕕᓕᖅᑐᑦ, ᐅᓇᑕᖅᑐᒃᓴᓕᖅᓂᖅ ᐊᒻᒪᓗ ᐃᓄᐃᖅᑎᑦᑎᓂᖅ.
ᐊᐳᑎᓂ ᑐᒦᑦ ᖃᐅᔨᓴᖅᑕᐅᓗᑎᒃ	ᐅᖃᐅᓯᖅᑐᒋᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 54dii, 58f ᐅᖃᐅᓯᒃᖃᖅᑐᖅ ᕿᑭᖅᑕᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᐃᓱᒫᓘᑎᖏ ᐊᐳᔾᔭᕆᖕᓂᖏ ᐊᒻᒪᓗ ᐊᒃᑐᐃᓂᖏᑦ ᓂᕐᔪᑎᑦ ᐃᑳᕐᕕᖏᓐᓂᒃ	ᐊᐳᑎᓂ ᑐᒥᑦ ᒪᓕᒃᑕᐅᓪᓗᑎᒃ ᖃᐅᔨᓇᓱᒃᑐᑦ ᐱᔪᓐᓚᐅᖅᑐᑦ ᐅᖁᒪᐃᑦᑐᓕᕆᔪᓄᑦ ᐊᖁᑎᖓ ᖃᐅᔨᓇᓱᓪᓗᑎᒃ ᓄᒃᑕᖅᑐᒃᑲᕐᒪᖔᑦ ᑐᒃᑐᓂᒃ ᐊᐃᕆᓕᐅᑎᓪᓗᒍ - ᑎᕆᒐᓂᐊᑦ ᐊᒻᒪᓗ ᐅᑲᓖᑦ ᑕᐅᕙᓂ ᑕᑯᔭᐅᔾᔪᐊᖑᓚᐅᖅᑐᑦ; ᑐᒃᑐᓯᐊᓚᐅᕐᖏᑦᑐᑦ ᖃᐅᔨᓴᕋᓗᐊᕈᒥᒃ. ᐃᓚᖓᑦᑕᐅᖅ ᖃᐅᔨᓴᖅᑕᐅᔪᖅ, ᑕᒪᐃᓐᓂ ᐃᓂᖏᓐᓂ ᑐᒥᖏ ᐅᖁᒪᐃᑦᑐᓕᕆᐅᔪᖅ ᐊᖁᑎ, ᐊᐳᑎᑦ ᐊᐳᔾᔭᓇᖕᓂᖏᑦ ᓇᓃᒻᒪᖔᑕ ᑎᑎᕋᖅᑕᐅᓪᓗᑎᒃ, ᐊᒻᒪᓗ ᐃᓃᑦ ᒪᓕᒃᑕᐅᓪᓗᑎᒃ ᐊᑕᐅᓯᕐᒥᒃ ᑕᑯᔪᖃᕈᓂ ᐊᓯᐊᓄᑦ ᓴᖑᓪᓗᑎᒃ ᐊᖁᑎᓄᑦ ᐃᑳᕈᓐᓇᖕᖏᓇᒥᒃ. ᓯᕗᓂᒃᓴᑦᑎᓂ ᖃᐅᔨᔭᐅᓇᓱᑦᑎᐊᕐᓂᐊᖅᑐᑦ ᑕᑯᓐᓇᕐᑎᒃ ᑐᒃᑐᓂᒃ ᐊᒻᒪᓗ ᐊᓯᖏᓐᓂᒃ ᓂᕐᔪᑎᑦ ᑐᒥᖏᓐᓂᒃ ᐊᒻᒪᓗ ᖃᐅᔨᓇᕐᒪᖔᑦ ᖃᓄᖅ ᐱᑎᑦᑎᓯᒪᖕᒪᖔᒃ ᐅᖁᒪᐃᑦᑐᓕᕆᔾᔭᑕᐅᔪᖅ ᐊᖁᑎ.
ᐊᐳᔾᔭᓇᒃᑐᑦ ᖃᐅᔨᓴᖅᑕᐅᓗᑎᒃ ᒥᐊᓂᕆᔭᐅᓗᑎᒃ	ᐅᖃᐅᓯᖅᑐᒋᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 53ai ᐊᒻᒪᓗ 53c ᐅᖃᐅᓯᒃᖃᖅᑐᖅ ᕿᑭᖅᑕᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᐃᓱᒫᓘᑎᖏ ᐊᐳᔾᔭᕆᖕᓂᖏ ᐊᒻᒪᓗ ᐊᒃᑐᐃᓂᖏᑦ ᓂᕐᔪᑎᓂᒃ.	ᐊᐳᔾᔭᓇᒃᑐᑦ ᐳᖅᑐᓂᖏ ᖃᐅᔨᓴᐅᓇᓯᑦᐊᑎᖏᓐᓇᖅᑐᑦ ᑕᐃᒪᖓᓂ ᔫᓄᐊᓇ, ᕙᕗᐊᓇ, ᐊᐃᓇᓕ ᐊᒻᒪᓗ ᒪᐃ ᒪᓕᑦᑎᐊᕐᒪᖔᑕ ᐊᑐᓕᖁᔭᐅᔪᓂ ᐊᐳᔾᔭᓇᓱᐊᖅᑎᑦᑎᑕᐃᓕᓂᕐᒧᑦ 1 ᒦᑕ. ᐅᓇ ᐊᐅᓚᑕᐅᓂᖓ ᐊᐳᔾᔭᓇᒃᓯᓗᐊᕐᖁᓇᒥᑦ ᐊᔪᖏᓂᐊᕐᒪᑕ ᓂᕐᔪᑎᑦ, ᐱᓗᐊᖅᑐᒥᒃ ᑐᒃᑐᐃᑦ ᐃᑳᖁᓇᕐᓗᑎᒃ ᐊᖁᑎᒋᔭᐅᔪᑎᒍᑦ ᒪᐅᔭᕐᒧᑦ ᐊᔪᓕᕐᓂᐊᖕᖏᒻᒪᑕ ᐊᐳᔾᔭᓕᖅᑎᓯᒪᓂᖏᓐᓂ, ᐊᒻᒪᓗ ᐊᔪᖏᓪᓗᑎᒃ ᐊᖁᑎᑦ ᑕᑯᔪᓐᓇᕐᓗᑎᒃ ᓂᕐᔪᑎᓂᒃ ᑐᓗᖅᓯᒃᑕᑦᑕᕐᓂᐊᖕᖏᒪᑕ. ᑕᐃᑲᓂ 2018, ᐳᔅᑎᖓ ᒪᓕᒋᐊᖃᖅᑐᓄᑦ ᑕᒪᐃᓐᓄᑦ ᐊᐳᔾᔭᓇᒃᓯᑎᑦᑎᓗᐊᖅᑕᐃᓕᓂᖅ ᖃᐅᔨᓇᓱᖕᓂᖅ ᑎᑭᓪᓗᒋᑦ 87%. ᐃᓚᖏᓐᓂ ᐊᐳᔾᔭᓇᐊᓗᒍᑦ ᒪᓕᒋᐊᖃᖅᑕᒥᖕᓂᒃ ᐊᑐᖅᓯᓐᖏᑦᑐᑦ, ᐊᐳᑎᑦ ᖃᓗᕋᖅᑕᐅᕙᖅᑐᖅ ᓄᓇ ᐱᓪᓗᒍ ᐊᔪᕐᓇᕈᑎᔮᑦᑕᕐᒥᔪᖅ.
ᓄᓇᐅᑉ ᐳᖅᑐᓂᖓᓂ ᓴᕿᔫᖅᑐᑦ ᑐᒃᑐᓂ ᑕᑯᓇᓱᒡᓗᑎᒃ	ᐅᖃᐅᓯᖅᑐᒋᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 53a, 53b, 54b, 58b	ᐅᓇ 24 ᖃᐅᔨᓴᕐᕕᐅᔪᑦ ᐅᐸᒃᑕᐅᓚᐅᖅᑐᑦ ᐊᑕᐅᓯᐅᖅᑕᐅᑲᓗᐊᖅᓱᑎᒃ ᐃᓚᒋᑦ 2018-ᒥ. ᑲᑎᓪᓗᒋᑦ 18.3 ᐃᑳᕋᑦ ᖃᐅᔨᓴᕐᕕᐅᓪᓗᑎᒃ ᑕᐃᑲᓂ ᐃᓂᖓᓂ ᖁᓛᓂ ᔩ (ᑐᒃᑐ ᓄᕐᓇᐅᕐᕕᖓᓂ) ᑖᒃᑯᐊᓗ ᐆᒪᔪᓇᔾᒃᑯᑦ ᖃᐅᔨᓴᖅᑎᑦ ᐊᒻᒪᓗ ᑎᑭᐅᑎᓪᓗᒍ ᒪᕿᔾᔪᓂᒃ ᐃᖅᑲᓇᐃᔭᖅᑎᓂᒃ. ᑐᒃᑐᑦᑲᓚᐅᓐᖏᑦᑐᖅ ᑕᐃᑲᓂ ᖃᐅᔨᓇᓱᒃᑕᐅᓚᐅᓚᐅᖅᑐᑦ.

		ᑕᐃᑲᓂ 2016, ᑕᒄᔭᐅᔪᑦ ᓄᓇᓐᖑᐊᓕᐊᖑᓪᓗᑎᒃ ᐱᔭᕇᖅᑲᑎᒃ ᑎᑭᐅᑎᓪᓗᒍ ᓄᓇᖏᑦ ᖃᐅᔨᓴᖅᑎᓂ ᑕᒄᔭᐅᔪᓂᒃ ᑕᐃᑲᓂ ᖃᐅᔨᓴᖅᑎᓪᓗᒋᑦ. ᒥᐊᓂᕆᔪᑦ ᓂᕆᐅᓇᖅᑐᑦ ᐱᓕᕆᔭᐅᑲᓂᕐᓂᐊᕐᓂᖏᓐᓂᒃ ᐊᕐᕋᒍᑕᒫᕐᓗᑎᒃ. ᐅᓇ 2018 ᑕᒄᔭᐅᔪᑦ ᐃᓚᔭᐅᕙᒡᕙᑎᒃ ᐊᙵᕐᓂᖅᓴᐅᔪᓄᑦ ᖃᐅᔨᓴᕐᕕᑦ ᓄᐊᑦᑎᕕᒋᔭᖏᓐᓄᑦ ᖃᐅᔨᓇᓱᒍᑕᐅᖃᑦᑕᖅᑐᓄᑦ ᑲᔪᓯᓂᐊᖅᑐᖅ ᑕᒪᓐᓇ ᐅᔭᕋᖕᓂᐊᕐᓂᓕᒫᖏᓐᓂ.
ᐊᒻᕖᖅᑎᕆᓂᖅ ᐃᕙᕕᖕᓂᒃ ᖃᐅᔨᓴᕐᓗᑎᒃ	ᐅᖃᐅᓯᕆᓗᒋᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ 66, 70	ᑕᐃᑲᓂ 2018, ᖃᓂᒋᔭᖓᓂ 232,355 ᒥᑕ² ᐸᒻᕕᔭᐅᓚᐅᖅᑐᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥᑦ ᓇᑉᐸᖅᑕᐅᓯᒪᔪᓂᑦ. ᒪᓕᒃᓱᒋᑦ ᖃᓅᑎᒋᓂᖓ ᓄᓇᐃᑦ ᐅᐸᒃᑕᐅᔭᕆᐊᖃᖏᑦᑐᑦ, 36% ᓴᓇᔭᒃᓴᑦ ᓯᓚᑖᓂᑦ ᐱᓕᕆᔭᐅᓚᐅᖅᑐᑦ ᑎᖕᒥᐊᓂᑦ. ᑕᐃᑲᓂ ᐃᕙᔭᕇᖅᑎᓪᓗᒋᑦ, ᖃᓂᒋᔾᔭᓂ 83,388 ᒥᑕ² ᓄᓇᒥ ᐱᔭᕇᓚᐅᖅᑐᑦ ᐲᔭᖅᑕᐅᓪᓗᑎᒃ 163,358 ᒥᑕ² ᖃᐅᔨᓴᖅᑕᐅᓪᓗᓂ ᑖᒃᑯᑎᒍᑦ ᒫᓐᓇ ᐊᑐᖅᑕᐅᔪᑦ ᑎᑭᐸᒃᑐᓄᑦ ᑎᖕᒥᐊᓄᑦ ᐃᕙᕕᖏᓐᓂᒃ ᕿᓂᖅᓱᑎᒃ. ᖁᓕᑦ (10) ᐊᒻᕖᖅᑎᕆᓚᐅᖅᑐᑦ ᖃᐅᔨᓴᑲᓂᓕᖅᓱᑎᒃ, ᑲᑎᓪᓗᒍ 9.35 ᐃᓄᐃᑦ ᐃᑲᕋᓄᑦ ᐊᒻᒪᓗ 163,358 ᒥᑕ² (16.3 Hᐃᒃᑎᐊᔅ) ᓄᓇᖓ ᕿᓂᖅᑕᐅᓗᓂ ᐃᕙᔪᖃᕐᒪᖔᑦ ᕿᓐᖑᐊᓂ, ᐅᖁᒪᐃᑦᑐᓄᑦ ᐊᖁᑎ ᐊᒻᒪ ᕿᓐᖑᐊᓂ ᐃᒃᓴᕐᕕᒃ ᓴᓇᕕᐅᔪᑦ ᓄᓇᖏᓐᓂ. ᒪᕐᕈᒃ ᐃᕙᔪᑦ ᓇᓕᔭᐅᓚᐅᖅᑐᑦ 2018-ᒥ, ᑕᒪᕐᒥᒃ ᖃᓂᒋᔭᖓᓂ ᕿᓐᖑᐊᓂ. ᐊᑐᓂ ᐃᓂᖏᑦ ᑖᒃᑯᐊ, ᓴᓇᕕᐅᔪᓪᓗ ᑭᖑᕙᖅᓯᒪᓚᐅᖅᑐᑦ ᑭᓯᐊᓂ ᐱᔭᕇᕐᒪᑕ ᑎᖕᒥᐊᑦ. ᖃᐅᔨᓴᖅᓂᖅ ᑲᔪᓯᓂᐊᖅᑐᖅ ᖃᖓᑐᐃᓐᓇᖅ ᐲᔭᕆᐊᖃᖅᐸᑕ ᐱᕈᖅᑐᑦ ᐃᓗᐊᓂ ᑎᑭᐸᒃᑐᑦ ᑎᖕᒥᐊᓄᑦ ᐃᕙᓇᐅᑎᓪᓗᒍ.
ᐃᓅᕈᓂᑦ-ᐃᕙᔫᑦ ᓂᕿᑐᓰᑦ ᐃᓂᖃᖅᑐᑦ ᐊᒻᒪᓗ ᕿᑐᕐᖑᐃᖅᑕᖏᓪᓗ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ	ᑐᕌᕈᑎᑦ ᐱᓕᕆᐊᒃᓴᑦ ᖃᓄᐃᓕᖓᓂᖏᑦ 50, 73, 74, ᐊᒻᒪᓗ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥ ᐊᙵᕐᖅᑕᐅᓯᒪᔪᖅ 75	ᐅᓇ ᐱᓕᕆᑎᑦᑎᔾᔪᑕᐅᔪᖅ ᑲᔪᓯᔪᒥᒃ ᑭᒡᓕᖓ ᐊᒻᒪᓗ ᐊᒃᑐᐃᓯᒪᔪᖅ ᒥᐊᓂᕆᔾᔪᑕᐅᔪᖅ ᓴᓇᔭᐅᔪᓄᑦ ᑕᐃᒪᖓᓂ 2011. ᖃᓂᒋᔭᖓᓂ 37% ᑖᒃᑯᓇᖓᑦ 166 ᖃᐅᔨᒪᔭᐅᔪᑦ ᐃᕙᕕᑦ ᐃᓂᒋᔭᐅᓚᐅᖅᑐᑦ ᑎᖕᒥᐊᓂᑦ ᖃᐃᖅᓱᒫᕐᒥ-ᐃᕙᔫᑦ ᓂᕿᑐᓰᑦ ᑎᖕᒥᐊᑦ ᒥᐊᓂᕆᔭᐅᔪᑦ ᖃᐅᔨᔭᐅᓇᓱᑦᑎᐊᖅᑐᑦ 2018 ᐃᓂᒋᔭᐅᓚᐅᖅᑐᑦ ᐃᓅᕈᑎᒍᑦ ᓯᕕᖓᓂᖓᓂ ᐃᕙᔪᑦ ᓂᕿᑐᓰᑦ ᑎᖕᒥᐊᑦ. ᑖᒃᑯᓇᖓᑦ, 48-ᖑᓪᓗᑎᒃ ᑭᒻᒐᕕᐊᕐᔪᐃᑦ, 11-ᖑᓪᓗᑎᒃ ᑳᔫᖅ, ᐊᑕᐅᓯᖅ ᑭᒻᒐᕕᒃ, ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᑐᓗᒐᖅ. ᐃᕙᔭᖏᓐᓂᑦ ᑎᖏᔪᓐᓇᖅᓯᔪᑦ ᑭᒻᒐᕕᐊᕐᔪᒃ ᐊᒻᒪᓗ ᑳᔫᖅ 0.9+0.2 ᐊᒻᒪᓗ 0.5+0.2 ᐃᕙᔭᖏᓐᓂᑦ, ᖃᖓᑦᑕᖅᑐᑦ. 2018 ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᓂᕿᑐᓰᑦ ᑎᖕᒥᐊᑦ ᑕᐅᕙᓃᑉᐸᒃᑐᑦ ᐊᒻᒪᓗ ᒪᓂᖅᑲᖅᐸᓪᓗᑎᒃ. ᒥᑭᔪᑦ ᓂᕐᔪᑎᑦ ᐅᓄᕐᒪᑕ ᑕᒄᔭᐅᖃᑦᑕᖅᑐᑦ ᖃᐅᔨᓇᓱᒃᑕᐅᓕᓚᐅᖅᑐᖅ ᑕᒪᓐᓇ 2018 ᐅᖃᐅᓯᐅᔪᒪᓪᓗᓂ ᑕᐃᒪᓐᓇᐅᕙᖕᒪᑦ ᐅᐸᒃᑕᐅᓯᒪᓕᖃᑦᑕᖅᑐᖅ ᑭᒻᒐᕕᐊᕐᔪᖕᓂᑦ ᐊᒻᒪᓗ ᑲᒨᕐᓂᑦ ᒪᓕᒃ:ᑎᒃ ᓂᕐᔪᑎᑦ ᒥᑭᔫᑎᑦ ᑕᒫᓃᕋᔭᓕᕌᖓᑕ.

2018 Mary River Project Terrestrial Environment Annual Monitoring Report

Prepared For

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SUMMARY

The Mary River Project (the Project) is an iron ore mine located in the Qikiqtaaluk Region on North Baffin Island, Nunavut. The Project involves the construction, operation, closure, and reclamation of a 22.2 million tonne per annum (mtpa) open pit mine that will operate for 21 years. The high-grade iron ore is suitable for international shipment after crushing and screening with no chemical processing facilities. Construction on the Project and associated facilities started in 2013, and mining began in September 2014. Currently, up to 4.2 mtpa of the crushed and screened iron ore is trucked to Milne Inlet year-round, stockpiled, and shipped during the open water season. Also approved is a railway system that will transport 18 mtpa of the ore from the mine area to a proposed all-season deep-water port at Steensby Inlet where the ore will be loaded into ore carriers for overseas shipment through Foxe Basin. The Project was issued Amendment No. 1 to Project Certificate No. 005 by the Nunavut Impact Review Board (NIRB) on May 28, 2014. Currently the Project only trucks iron ore to Milne Port for open water shipping.

As a condition of Project approval, the NIRB Project Certificate #005 includes numerous conditions that require Baffinland to conduct effects monitoring for the terrestrial environment. Work conducted for the terrestrial environmental monitoring program is guided by Inuit Qaujimajatuqangit and by the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP; (Baffinland Iron Mines Corporation 2017) and is overseen by the Terrestrial Environment Working Group (TEWG) which includes members from Baffinland, the Qikiqtani Inuit Association (QIA), the Government of Nunavut (GN), Environment and Climate Change Canada (ECCC) and the Mittimatalik Hunters and Trappers Organization (MHTO). The terrestrial environment monitoring program began in 2012 and has continued through 2018 with adaptations to the programs over the years.

Baffinland anticipates that programs will continue in the future. However, all carnivore monitoring programs completed in the past were put on hold in 2015 as the Terrestrial Environment Working Group (TEWG) consider these surveys to no longer be required due to low abundance of wolves. These studies will be initiated in the future should changes occur in wolf abundance and after further discussion with the GN and the TEWG.

This report summarizes the data collection and monitoring activities conducted in 2018 for the Project, including the following survey programs (summaries provided in Table 1):

- Dust fall monitoring program;
- Vegetation abundance monitoring;
- Rare plant observations (incidental findings);
- Helicopter flight height analysis;
- Snow track surveys;
- Snow bank height monitoring;

- Height of land caribou surveys;
- Pre-clearing nest surveys; and
- Cliff nesting raptor occupancy and productivity surveys.

Results of 2018 monitoring programs are as follows:

Climate, Dust Fall and Traffic:

- Air temperature data indicated that there was a slightly cooler summer with a slightly warmer winter in 2018. The number of days with rainfall at Milne Port was higher than during baseline data collection, while at Mary River the number of days with reported rainfall was inconclusive due to malfunctioning equipment.
- There was a slight increase in the average daily number of ore haul transits in 2018 compared with 2017. Other non-haul truck traffic had an annual average of 37.3 vehicle transits per day, which was only slightly higher than in 2017 (32.3 vehicle transits per day).
- Annual dust fall at the Mine Site sample locations currently falls within predicted levels; in 2018 summer dust fall was lower than winter, a trend driven by a decrease in summer dust fall.
- Dust fall at Milne Port continued to exceed predicted threshold levels at all sites except DF-P-07. As seen at the Mine Site dust fall monitoring locations in 2018 dust fall in summer months was lower than winter; since 2016 dust fall deposition in the summer has decreased while dust fall deposition in the winter months has increased.
- Dust fall associated with the Tote Road at both the north and south crossing was less in 2018 than in 2017. Similar trends were noted at both the north and south crossings. The greatest decrease in dust fall was at the monitors 30 m distant from the road. There was a smaller decrease in dust fall noted at the 100 m distant monitors. The continued decrease in dust fall deposition was determined to occur mostly in summer months, as dust fall deposition in the summer has decreased since 2016. Conversely, dust fall deposition along the Tote Road in winter months has remained constant since 2016.
- Dust fall continues to decrease at most year-round sampling locations throughout the Project area. This decrease may be due to increased effectiveness of dust suppression activities, particularly along the Tote Road, combined with favourable cool, wet summer conditions.

Climate, Dust and Traffic Monitoring will continue in 2019.

Vegetation:

- The vegetation abundance monitoring program design was finalized in 2016 and provides a statistically robust program that will be able to detect Project-related changes in abundance should that effect occur.
- All vegetation abundance plots have been measured consistently for three years, and some for four years.

- To date, while annual changes in vegetation abundance in the Project area have been observed, there is no suggestion of changes in vegetation abundance because of a Project-related effect.
- In 2018, measurement methods for the vegetation abundance monitoring program were evaluated. Evaluation of vegetation abundance monitoring methods show that the method used to measure vegetation is highly objective and repeatable, confirming that it is appropriate for addressing the objectives of the vegetation abundance monitoring program.
- Vegetation and soil base metals monitoring was not conducted in 2018 but is scheduled for 2019.
- Some previously reported rare plants have been found in the study area, and it is likely that more will be found as vegetation surveys continue in the Project area. Known populations will continue to be monitored in the Project area and newly discovered populations will be documented as they are found on an opportunistic basis. There is no evidence to suggest that the Mary River Project is affecting the population of these plants.

Vegetation monitoring will continue, but the frequency of detailed studies (e.g., vegetation abundance) is still being considered by the TEWG and Baffinland.

Mammals:

- Ground-based surveys continue to be used to monitor potential wildlife interactions with the Project. These include Height of Land surveys, snow track surveys, snow bank height surveys and incidental sighting reports from on-site personnel.
- In June 2013, a group of five caribou were observed in the Project Development Areas (PDA) during height-of-land (HOL) surveys; however, caribou have not been observed during surveys conducted between 2014 and 2018. Lack of caribou observations on site follow the trends of low numbers recorded in regional observations and have been confirmed through collaboration with the Government of Nunavut who conducts caribou aerial surveys and through local observations received at workshops held in November 2015 and April 2016. Spring caribou surveys were conducted in the North Baffin Region by the GN in 2018. Baffinland was notified by the GN that a fall survey was not conducted.
- Low numbers of incidental observations of caribou between the Mine Site and Milne Inlet between 2013 and 2018 also coincide with the lack of caribou observations during the HOL surveys.
- No caribou, wolf or other large mammal tracks were observed during 2018 snow tracking surveys; however, Arctic fox and Arctic hare tracks were observed in similar numbers to previous surveys.
- 2018 snow bank height monitoring was conducted at approximately monthly intervals (four surveys) instead of only once annually, as in previous years. Percent compliance for all surveys combined in 2018 was 87%, which was like previous years, except for 2017, where compliance was only 66%.

Height of Land, snow tracking, snow bank height, and incidental observations will continue in 2019.

Birds:

- Baffinland contributed funds and logistical support to regional shorebird monitoring in 2018, conducted by the Canadian Wildlife Service (CWS). CWS surveyed 14 PRISM plots within a 100 km radius of the Mary River Mine Site, and another 24 plots in other areas of north Baffin Island. The deployment of passive sound recording devices to detect red knot vocalizations was also scheduled for 2018 but was deferred to 2019/2020.
- Active migratory bird nest searches (AMBNS) have been conducted since 2013 prior to any proposed land disturbance and/or clearing during the breeding bird window (May 31 – August 15). In 2018, two nests were located during AMBNS, both of which were near the Mine Site. In each of these locations, construction activities were delayed until post fledging.
- In 2018, site occupancy, brood size, and nest success were monitored for all known nest sites located within 10 km of the PDA (the Raptor Monitoring Area).
- A total of 166 unique nesting sites were monitored in the RMA. Of these, 61 sites were occupied by raptors in 2018; 48 by peregrine falcon, 11 by rough-legged hawk, one by gyrfalcon, and one by common raven.
- Although annual variation in productivity for peregrine falcons and rough-legged hawks is apparent, it is most likely representative of natural variability associated with variation in prey availability and weather rather than due to any influence of disturbance.
- For rough-legged hawks, occupancy appears to be cyclical (approximately four-year oscillation), and strongly suggests that occupancy is associated with the natural small mammal cycle, which is also known to cycle approximately every four years. In 2018, small mammal abundance monitoring was incorporated into the raptor monitoring program to address this. No small mammals were captured during this program in 2018.
- Occupancy of potential nesting sites by gyrfalcon in the RMA have been too low to monitor annual trends.
- It appears that factors such as distance to disturbance and distance to nearest neighbour (individually and as an interaction) have no negative effect on occupancy or reproductive success at the raptor guild level for rough-legged hawk. However, there is some evidence ($p=0.05$) that distance to disturbance influenced reproductive success at peregrine falcon nesting sites near mine infrastructure in 2018.

Baffinland will continue to support regional monitoring of shorebirds, including species at risk in conjunction with CWS. AMBNS surveys will continue in future years prior to any proposed land disturbance and/or clearing during the breeding bird window, and raptor monitoring will continue to focus on multiple nesting territory visits in 2019.

Helicopter Flight Height:

- Helicopter flight heights continue to be used to monitor potential disturbance to birds and other wildlife inside and outside the snow goose area.
- In 2018, helicopter flight height compliance inside the goose area during moulting period was 94%, and compliance within and outside the goose area in all months was 98%.
- 2018 was the second year that additional analysis was performed, which considered rationale provided by pilots for many of the transits flown below the elevation requirements. For analytical purposes, flight height data points were designated "compliant" when elevation requirements were achieved, or where pilot's discretionary rationale for deviating from flight heights was provided. Data points were designated "non-compliant" if they did not meet elevation requirements, and no explanation was given.
- This additional analysis showed that when considering rationale provided by pilots for low-level flying, most low-level data points were compliant. For example, only 8% of compliant points inside the snow goose area met flight height requirements, and the other 92% were low level with reasons given by pilots. Similarly, only 6% of compliant points outside the snow goose area met flight height requirements, and the other 94% were low level with reasons given by pilots.
- The high percentage of low-level compliant flights in both areas is similar to what was observed in 2017, and will likely continue in future years as the majority of helicopter work conducted at Mary River either requires low-level flying for safety/operational reasons (e.g. slinging, surveys), or involves multiple short distance flights whereby helicopters are unable to reach the required elevations between take-off and landing sites (e.g. staking, sampling, drop offs/pick ups).
- Most compliant transits that met the elevation requirements in 2018 tended to be longer distance flights, where pilots were airborne long enough to reach and maintain the required elevations.

Helicopter flight height analysis including rationale from pilot timesheets will continue in 2019.

Table 1 Terrestrial baseline, monitoring and research activities conducted in 2018 for the Mary River Project.

Survey	Reason for survey[1]	Work completed, effects observed, required mitigation and recommendations for future work
Dust fall monitoring program	Addresses Project Conditions 36, 50, 54d, 58c, and Project Commitment 60	33 dust fall collectors are distributed around the Project area, some of which are further away from the Potential Development Area (PDA) and are controls. More than four years of monitoring from August 2013 to December 2018 are now complete. Future monitoring will continue to investigate dust fall at the 33 sites through the summer season and a subset of 16 year-round sites. Improvements were made to the traffic logs to better quantify road traffic.
Vegetation abundance monitoring	Addresses Project Conditions 36 & 50, and Project Commitment 67	A trend analysis was conducted to assess potential changes in percent plant cover and plant group composition with the relationship of distance to Project infrastructure and treatment effect between open and closed plots. Inter-annual differences in total percent ground cover, total percent canopy cover, and plant group composition were small in magnitude and consistent across all distance classes and treatments with the exception of a few interactions between year and distance class that were weak and inconsistent; therefore, differences are attributed to natural variation in plant cover among years rather than a Project related effect in the first four years of monitoring.
Vegetation and soil base metals monitoring	Addresses Project Conditions 34, 36 & Project Commitment 50	This program was not conducted in 2018. According to the schedule outlined in the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP), vegetation and soil base metals monitoring will take place in 2019.
Helicopter flight height analysis	Addresses Project Conditions 59, 71 and 72	Prior to flying for Baffinland, all personnel are made aware of flight height requirements to reduce stress to the wildlife of Baffin Island, particularly during sensitive times (e.g. staging, calving etc.). Ensuring that aircraft maintain, whenever possible (except for specified operational purposes such as drill moves, take offs and landings), and subject to pilot discretion regarding aircraft and human safety, a cruising altitude of at least 650 metres during point to point travel when in areas likely to have migratory birds, and 1,100 metres vertical and 1,500 metres horizontal distance from observed concentrations of migratory birds. Flight corridors are also used to avoid areas of significant wildlife importance. In 2018, compliance within the snow goose area during the moulting season was 94%, and compliance within and outside the snow goose area in all months was 98%. 2018 was the second year that flight height data were cross-referenced with pilot logs from daily timesheets to help justify non-compliant transits. For analytical purposes, non-compliant flight height data were converted to represent compliance with Project Conditions in cases where reasonable explanations were provided by pilots. This additional analysis resulted in an increase in helicopter flight height compliance when compared to previous years. Examples given to explain low-level flights included: weather, slinging, staking, surveys, drop off/pick up, demobilization and evacuations.
Snow track surveys	Addresses Project Condition 54dii, 58f Addresses QIA concerns about snow bank heights and the effects on wildlife crossings	Snow track surveys were completed along the Tote Road to investigate the movement of caribou in April — Arctic fox and Arctic hare were the only species detected; no evidence of caribou was observed during the survey. As part of the survey, at all locations where tracks crossed the Tote Road, snow bank depths were recorded, and tracks were followed to see if the individual was deterred by road crossing conditions.

[1] Project Conditions and Project Commitments as per: Project Certificate No. 005.

Table 1 Terrestrial baseline, monitoring and research activities conducted in 2018 for the Mary River Project.

Survey	Reason for survey[1]	Work completed, effects observed, required mitigation and recommendations for future work
		Future monitoring will continue to look for caribou and other wildlife tracks and indications of their interaction with the Tote Road.
Snow bank height monitoring	Addresses Project Conditions 53ai and 53c Addresses QIA concerns about snow bank heights and the effects on wildlife	Snow bank height monitoring was conducted in January, February, April and May to ensure compliance with recommended snow bank heights no greater than 1 m. The management of snow bank height allows for wildlife, specifically caribou, to cross the transportation corridor without being blocked by steep snow banks, as well as allowing drivers greater visibility to help reduce wildlife–vehicle collisions. In 2018, percent compliance for all snow bank surveys combined was 87%. In some areas where snow bank heights exceeded the guideline, the snow was being piled according to landscape limitations.
Height–of–land caribou surveys	Addresses Project Condition 53a, 53b, 54b, 58b	All 24 HOL stations were visited at least once in 2018. A total of 18.3 hours of surveys were conducted at these stations in early June (caribou calving) with an EDI biologist and up to two BIM staff. No caribou were observed during any of these surveys. In 2016, view shed mapping was completed to demonstrate the extent of area surveyors could observe while conducting HOL surveys. Monitoring is expected to be conducted annually. The 2018 observations will add to a larger database as monitoring efforts continue through the life of the Project.
Pre–clearing nest surveys	Addresses Project Conditions 66, 70	In 2018, approximately 232,355 m² was disturbed for Project infrastructure. Of the approximate areas cleared, 36% of the work was done outside of the breeding bird window. During the breeding bird window, approximately 83,388 m² of land was cleared while 163,358 m² was surveyed through AMBNS. Ten pre–clearing surveys were conducted, a total of 9.35 person hours and 163,358 m² (16.3 ha) of area were searched for active nests in the Mine Site, Tote Road and Milne Port development areas. Two nests were found in 2018, both of which were near the Mine Site. In each of these locations, construction activities were delayed until post fledging. Surveys will continue to be required whenever clearing vegetation within the migratory bird nesting season.
Cliff–nesting raptor occupancy and productivity surveys	Addresses Project Conditions 50, 73, 74, and Project Commitment 75	This program is a continuation of baseline and effects monitoring work conducted since 2011. Approximately 37% of the 166 known nesting sites within the raptor monitoring area surveyed in 2018 were occupied by cliff–nesting raptors. Of these, 48 were occupied by peregrine falcon, 11 by rough-legged hawk, one by gyrfalcon, and one by common raven. Productivity for peregrine falcons and rough–legged hawks was 0.9±0.2 and 0.5±0.2 nestlings, respectively. 2018 surveys focused on confirming raptor occupancy and productivity of known nesting sites. Small mammal abundance monitoring was also initiated in 2018 to address cyclical occupancy of rough-legged hawks according to small mammal cycles.

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Field crews included Kristina Beckmann (EDI), Brett Pagacz (EDI), Alain Fontaine (EDI), Diana Zylik (Baffinland), and Mick Appaqaq (Baffinland). Baffinland environmental staff conducted the dust fall monitoring through the year and were instrumental in providing ground-based transportation and field support. Raptor surveys were conducted by Alastair Franke and Ashton Bradley of Arctic Raptors Inc.

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ACRONYMS AND ABBREVIATIONS

ARInc. .... Arctic Raptors Inc.

Baffinland .... Baffinland Iron Mines Corporation

CCME .... Canadian Council of Ministers of the Environment

CoPC .... Metals/Metalloids of Potential Concern

COSEWIC .... Committee on the Status of Endangered Wildlife in Canada

CWS .... Canadian Wildlife Service

ECCC .... Environment and Climate Change Canada

EDI .... Environmental Dynamics Inc.

ERP .... Early Revenue Program

FEIS .... Final Environmental Impact Statement

GIS .... Geographic Information System

GN .... Government of Nunavut

GPS .... Global Positioning System

HOL .... Height of Land

mtpa .... Million Tonnes per Year

NIRB .... Nunavut Impact Review Board

NLC .... Northern Land Cover

PDA .... Potential Development Area

PRISM .... Program for Regional and International Shorebird Monitoring

Project .... Mary River Project

QIA .... Qikiqtani Inuit Association

RMA .... Raptor Monitoring Area

RSA .... Regional Study Area

SARA .... Species at Risk Act

TEMMP .... Terrestrial Environment Mitigation and Monitoring Plan

TEWG .... Terrestrial Environment Working Group

TSP .... Total Suspended Particles

US EPA .... US Environmental Protection Agency

VEC .... Valued Ecosystem Component

1 OVERVIEW OF TERRESTRIAL ENVIRONMENT MONITORING

As a condition of Project approval, the Nunavut Impact Review Board (NIRB) Project Certificate #005 includes numerous conditions that require Baffinland to conduct effects monitoring for the terrestrial environment. Work conducted for the terrestrial environmental monitoring program is guided by Inuit Qaujimajatuqangit and by the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP) (Baffinland Iron Mines Corporation 2017) and is overseen by the Terrestrial Environment Working Group (TEWG) which includes members from Baffinland, the Qikiqtani Inuit Association (QIA), the Government of Nunavut (GN), and Environment Canada and Climate Change (ECCC) and the Mittimatalik Hunters and Trappers Organization (MHTO). Several data collection and monitoring programs are conducted as part of the terrestrial environmental monitoring program and include the following inventories:

- Dust fall monitoring (2013–2018);
- Cliff nesting raptor occupancy and productivity surveys (2011–2018);
- Vegetation abundance monitoring (2014, 2016, 2017, 2018);
- Vegetation and soil base metals monitoring (2012–2017);
- Exotic invasive vegetation monitoring and natural revegetation (2014);
- Caribou fecal pellet collection (2011, 2012, 2013, 2014);
- Caribou water crossing surveys (2014);
- Height of land caribou surveys (2013–2018);
- Helicopter flight height analysis (2015–2018);
- Snow track surveys and snow bank height monitoring (2014–2018);
- Carnivore den survey (2014);
- Communication tower surveys (2014, 2015);
- Roadside waterfowl surveys (2012–2014);
- Red knot surveys (2014);
- Staging water fowl surveys (2015);
- Active migratory bird nest surveys (2013–2018);
- Raptor occupancy and productivity surveys (2011–2018);
- Tundra breeding bird PRISM (Program for Regional and International Shorebird Monitoring) plots (2012, 2013, 2018);
- Bird encounter transects (2013); and
- Coastline nesting and foraging habitat surveys along Steensby Inlet (2012) and Milne Inlet (2013).

The results of the 2012 to 2017 surveys are described in the completed and reviewed Annual Terrestrial Monitoring Reports (EDI Environmental Dynamics Inc. 2013, 2014, 2015, 2017, 2018). The 2018 terrestrial environment monitoring program summarized in this report includes details and updates about the following programs:

- Dust fall monitoring program;
- Vegetation abundance monitoring;
- Helicopter flight height analysis;
- Snow track surveys;
- Snow bank height monitoring;
- Height of land caribou surveys;
- Pre-clearing nest surveys; and
- Raptor occupancy and productivity surveys.

2 DUST FALL MONITORING PROGRAM

Several of the Project Conditions (e.g. Project Conditions 36, 50, 54d and 58c) address dust fall concerns or relate to reporting requirements for the dust fall monitoring program.

To meet these requirements, the Mary River dust fall monitoring program was initiated in the summer of 2013. The three main objectives of the dust fall monitoring program are to:

1. Quantify the extent and magnitude of dust fall generated by Project activities;
2. Determine seasonal variations in dust fall; and
3. Determine if annual changes in dust fall exceed ranges predicted with the dust fall dispersion models (Volume 6, Section 3; Baffinland Iron Mines Corporation 2013).

To address Project Condition 57g, which refers to assessment and presentation of annual environmental conditions including timing of snowmelt, green-up, as well as standard weather summaries, weather summaries including an overview of the 2018 weather conditions, timing of snow melt, and green–up are provided under Section 2.2.1.1.

2.1 METHODS

2.1.1 REVIEW OF SUPPORTING DATA

In addition to the collection of dust fall data, the monitoring program also reviewed supporting data that may affect the magnitude and extent of dust fall over 2018. These supporting data includes weather conditions and traffic on the Tote Road.

Environment Canada operated a climate station at Mary River from 1963–1965 during the summer months (Baffinland Iron Mines Corporation 2012). These data are included for comparison where relevant. Climate data for 2018 were collected from on-site meteorological stations at Mary River and Milne Inlet and compared to available baseline data (2005–2010; Baffinland Iron Mines Corporation 2012). Baffinland established an on-site meteorological station at Mary River Camp on June 13, 2005 and at Milne Inlet in June 2006. Parameters measured include monthly air temperature, wind direction, wind speed and precipitation as rainfall; the precipitation collectors were damaged in 2018 which resulted in an underestimate of the precipitation as rainfall. Data included in the following analysis was from January 1, 2018 to September 25, 2018. Air temperature, precipitation as rainfall, wind speed, and wind direction were considered in relation to dust fall.

Traffic data includes the number of trucks hauling ore on the Tote Road each day as well as non-haul traffic. The ore haul traffic is tracked by Mine Operations Dispatch and all non-haul vehicle traffic on the Tote Road from the Mine Site to Milne Port is recorded by Baffinland security. These data are compared with the projected ore haul and non-haul vehicle transits (Volume 3, Appendix 3B, Baffinland Iron Mines Corporation 2013). Not all vehicle travel on the Tote Road is Round trip, therefore traffic is tracked as 'vehicle transits', which counts as a one-way trip, return trips therefore comprise two transits.

Baffinland is committed to dust fall mitigation and suppression. Various activities are carried out by Baffinland Mine Operations staff throughout the Project footprint at the Mine Site, Milne Port, along the Tote Road, and along the Mine Haul Road. Information regarding dust fall mitigation and suppression completed in 2018 is described below.

2.1.2 DUST FALL SAMPLING

The 2018 dust fall monitoring program included data collected from 33 dust fall monitors located throughout the Project area (Table 2; Map 1):

- Nine (9) dust fall samplers located at the Mine Site (three within the Mine Site, four outside the mine footprint within low to moderate isopleth areas and two references sites; one to the northeast, and one to the south) located at least 14 km from any Project infrastructure, outside of the extent of expected dust fall;
- Six (6) dust fall samplers located at Milne Port (five active sites on the Port Site footprint; DF-P-5 replaced DF-P-2) and one (1) reference site located northeast of the Port Site outside of the extent of expected dust fall; and
- Sixteen (16) dust fall samplers divided between two sites along the Tote Road (North sites and South sites). These two sites are organized into transects, each composed of eight (8) dust fall samplers distributed perpendicular to the Tote Road centreline at 30 m, 100 m, 1,000 m, and 5,000 m on either side of the road. There are two (2) reference dust fall samplers located 14 km southwest of the Tote Road (one at the north site, one at the south site).

Each dust fall sampler comprises one sampling apparatus including a hollow post, approximately two metres high, and a terminal bowl-shaped holder for the dust collection vessel. The terminal bowl is topped with "bird spikes" to prevent birds perching and contaminating samples with feces. Dust collection canisters were placed in the holder; these containers were pre-charged with 250 mL of algaecide in summer and 250 mL of isopropyl alcohol in winter. Collection vessels were changed out every month and shipped to ALS Environmental Laboratory (ALS) in Waterloo, Ontario, for analysis of total suspended particulates (TSP; units of $mg/dm^2\cdot day$). In addition to the analysis of TSP, the dust fall samples were analyzed for total metal concentrations to help inform potential trends in soil and vegetation tissues, collected as part of vegetation health monitoring.

Dust fall sampling was conducted year-round at 16 out of 33 monitors; the reduced winter sampling is due to safety considerations associated with access to remote sites during the winter months when there is no helicopter support on site. Those sites exposed to the highest dust fall, i.e., those samplers located within one kilometre of the Potential Development Area (PDA) were sampled throughout 2018 (Table 3). The sites not visited over the winter months are generally those located at one kilometre or greater from the PDA, and therefore exposed to the least amount of Project-related dust fall.

For data analysis and reporting purposes, summer includes sampling data from June, July and August, and winter includes data collected September through May. This seasonal delineation was determined after reviewing site weather data, indicating that in September through May the average daily temperature is below 0°C, and more than 50% of the monthly precipitation falls as snow. The 2018 dust fall monitoring program data includes data collected for a full calendar year from early January 2018 through early January 2019.

Table 2 Dust fall monitoring sites.

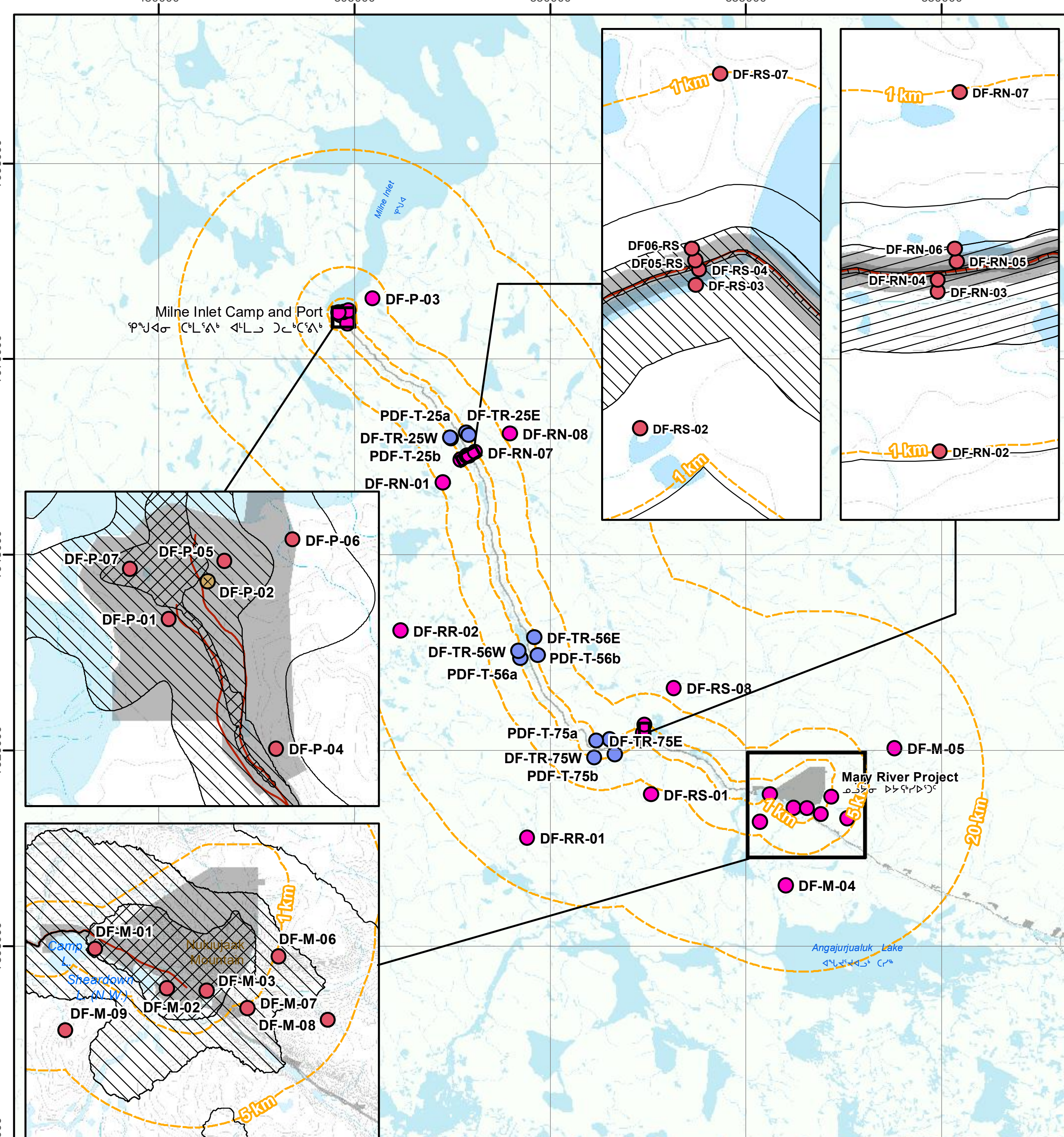
Site ID	Location	Sample period	Distance to PDA1 (m)	Dust isopleth zone	Latitude	Longitude
DF-M-01	Mine Site	year round	Within PDA	High	71.3243	-79.3747
DF-M-02	Mine Site	year round	Within PDA	High	71.3085	-79.2906
DF-M-03	Mine Site	year round	Within PDA	High	71.3072	-79.2433
DF-M-04	Mine Site	summer only [2]	9,000	Nil	71.2197	-79.3277
DF-M-05	Mine Site	summer only [2]	9,000	Nil	71.3731	-78.9230
DF-M-06	Mine Site	summer only [2]	1,000	Moderate	71.3196	-79.1560
DF-M-07	Mine Site	summer only [2]	1,000	Moderate	71.3000	-79.1953
DF-M-08	Mine Site	summer only [2]	4,000	Moderate	71.2945	-79.1002
DF-M-09	Mine Site	summer only [2]	2,500	Low	71.2936	-79.4127
DF-RS-01	Tote Road – south	summer only [2]	5,000	Nil	71.3275	-79.8001
DF-RS-02	Tote Road – south	summer only [2]	1,000	Low	71.3893	-79.8324
DF-RS-03	Tote Road – south	year round	100	Moderate	71.3967	-79.8228
DF-RS-04	Tote Road – south	year round	30	Moderate	71.3975	-79.8222
DF-RS-05	Tote Road – south	year round	30	Moderate	71.3980	-79.8228
DF-RS-06	Tote Road – south	year round	100	Moderate	71.3986	-79.8234
DF-RS-07	Tote Road – south	summer only [2]	1,000	Nil	71.4077	-79.8182
DF-RS-08	Tote Road – south	summer only [2]	5,000	Nil	71.4489	-79.7106
DF-RN-01	Tote Road – north	summer only [2]	5,000	Nil	71.6883	-80.5363
DF-RN-02	Tote Road – north	summer only [2]	1,000	Low	71.7145	-80.4704
DF-RN-03	Tote Road – north	year round	100	Moderate	71.7186	-80.4473
DF-RN-04	Tote Road – north	year round	30	Moderate	71.7189	-80.4456
DF-RN-05	Tote Road – north	year round	30	Moderate	71.7185	-80.4414
DF-RN-06	Tote Road – north	year round	100	Moderate	71.7189	-80.4397
DF-RN-07	Tote Road – north	summer only [2]	1,000	Nil	71.7226	-80.4165
DF-RN-08	Tote Road – north	summer only [2]	5,000	Nil	71.7435	-80.2898
DF-P-01	Milne Port	year round	Within PDA	Moderate	71.8802	-80.9072
DF-P-02	Milne Port	decommissioned	Within PDA	Moderate	71.8850	-80.8912
DF-P-03	Milne Port	summer only [2]	3,000	Nil	71.8996	-80.7884
DF-P-04	Milne Port	year round	Within PDA	Low	71.8710	-80.8828
DF-P-05	Milne Port	year round	Within PDA	Moderate	71.8843	-80.8945
DF-P-06	Milne Port	year round	Within PDA	Low	71.8858	-80.8790
DF-P-07	Milne Port	year round	Within PDA	Moderate	71.8838	-80.9160
DF-RR-01	Reference– Road	summer only [2]	14,000	Nil	71.2805	-80.2450
DF-RR-02	Reference– Road	summer only [2]	14,000	Nil	71.5189	-80.6923

1. PDA = Potential Development Area
2. Summer sampling includes data collection from June, July and August.

Table 3 Record of sampling associated with the 2018 dust fall monitoring program.

Sampling session	Start date [1]	End date [1]	Number of days [1]	Number of canisters deployed	Number of canisters analyzed	Sampling solution
1	10-Jan-2018	13-Feb-2018	35	16	16	Alcohol
2	14-Feb-2018	17-Mar-2018	32	16	16	Alcohol
3	18-Mar-2018	20,21,22-Apr-2018	34-36	16	16	Alcohol
4	23-Apr-2018	13-May-2018	21-23	16	15 [2]	Alcohol
5	14-May-2018	15-Jun-2018	33	16	16	Alcohol
6	16-Jun-2018	17,19-Jul-2018	32,34	33	33	Algaecide
7	18-Jul-2018	14,16-Aug-2018	28, 30	33	33	Algaecide
8	15-Aug-2018	11-16-Sep-2018	28-31	33	33	Algaecide
9	12-17 Sep-2018	10,11-Oct-2018	27-30	16	16	Alcohol
10	11,12-Oct-2018	10-12-Nov-2018	30-32	16	15 [3]	Alcohol
11	10-13-Nov-2018	8-10-Dec-2018	26-29	16	16	Alcohol
12	9-11-Dec-2018	7-9-Jan-2019	29-32	16	16	Alcohol

1. Sample collection and jar change out can take more than one day for all 33 sites to be collected.
2. Monitor DF-RN-04 was drifted over with snow and could not be located and retrieved in May.
3. Sample collection jar for DF-RN-06 was broken in transit to ALS for analysis. No data available.



LEGEND

- Active Dust Fall Monitoring Site
- Proposed Dust Fall Monitoring Site
- Decommissioned Dust Fall Monitoring Site
- Milne Tote Road
- Potential Development Area

TSP Annual Deposition

- High
- Moderate
- Low

Dust Fall Sample Locations for the Project Area

NOTES

TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.

Updated PDA provided by Hatch (25 April 2013).

Scale

0 5 10 20 30

Km

Map Scale: 1:750,000 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N

Drawn:	Checked:	Date:	
HG	MAS	10/25/2018	MAP 1

Baffinland EDI

Path: O:\2018\18Y0203_BIM_Monitoring_2018\Mapping\Finals\Map1_Dustfall.mxd

2.1.3 ANALYTICAL METHODS

The RSA was divided into four areas for the purposes of reviewing dust fall data:

1. The Mine Site;
2. Milne Port;
3. The Tote Road North crossing; and
4. The Tote Road South crossing.

Extent and Magnitude of Dust Fall at Various Sites — Dust fall deposition rates (as Total Suspended Particles — TSP) for each site were compiled for the 2018 season and reviewed to determine which sites in each sampling area are most affected by dust fall, and if any reference sites were recording high deposition rates of dust fall.

Daily dust fall from summer sampling periods (June, July, and August) were used to look at the relationship between dust fall and distance from the road for the mine, road north and road south sites. Mixed-effects models were used to test for a relationship between the distance from project infrastructure and daily dust fall. Distance from the mine was treated as a categorical variable with three classes — Near (within footprint), Far (1000 m – 5000 m), and Reference (>5000 m). Distance from the road was treated as a categorical variable with four classes — 30 m, 100 m, 1000 m, and 5000 m.

Data for daily dust fall as a function of distance from Project infrastructure did not meet the assumptions of normality or equality of variance in the residuals required for a linear model. We tested for differences in the distribution of dust fall by distance class using non-parametric Kruskal-Wallis tests, with data stratified by sampling month. If there was an effect of distance class on dust fall, we used pairwise tests to determine which distance classes were different. We report medians and inter-quartile ranges to summarize dust fall within distance classes. Statistical analysis was conducted using R version 3.5.2 (R Core Team 2018). Kruskal-Wallis tests were performed using the R package 'coin' (Hothorn et al. 2006).

Seasonal Variation in Dust Fall – We used generalized least squares regression to test for effects of season (summer and winter) and sample site on daily dust fall accumulation for each project area (Mine Site, Milne Port, north road and south road), for sites that were sampled throughout the year. Each model included main effects of season and sample site, with an interaction term between sample site and season. All dust fall data were log transformed prior to analysis and results were back-transformed to the original scale. Models included a first-order autocorrelation structure, based on sampling period within a site, to account for the possibility that dust fall in one sampling period was more like samples from the preceding period than other samples from the same site (Zuur et al. 2009). Fixed model weights based on the number of days in each sampling period were used to give more weight to dust samples collected over a longer time (Zuur et al. 2009).

Residual plots were examined to confirm assumptions of normality and equality of variance in the residuals. The significance of model terms was tested using F-tests; terms were considered significant at $\alpha < 0.05$. If there was no evidence that daily dust fall was related to season or site, then median dust fall ± 95 % confidence intervals were reported across all sites and seasons. If there was evidence of an effect of season on daily dust fall we used least squared means to estimate the median effect of the season after accounting for the effect of sample site (Lenth 2014). Statistical analysis was conducted using R version 3.5.2 (R Core Team 2018).

Annual Dust Fall — Annual total suspended particulates (TSP) predictions were developed for the Project, see Appendix B. 4-3 of the TEMMP (Baffinland Iron Mines Corporation 2017). These predictions were developed with input from the results of the dust dispersion models, existing literature related to air quality guidelines and dust deposition, and similar dust monitoring programs in place at other northern mines:

Low: 1–4.5 $g/m^2/year$;

Moderate: 4.6–50 $g/m^2/year$; and

High: $\geq$50 $g/m^2/year$.

The results of the 2018 dust fall sampling program were converted from units of $mg/dm^2 \cdot day$ to $g/m^2/year$ and were compared with the modelled dust deposition isopleths for the Project to determine if deposition rates exceed the predicted range. Each month's data are converted to ($g/m^2/day$), and then summed to add up to one year.

Sites in the nil and low isopleth zones were not sampled during winter months, so annual accumulation was not calculated for those sites. Very low dust fall accumulation, often below laboratory detection, was observed at these sites during the summer months.

Inter-annual Trends — We used linear mixed effects models to test for effects of season (summer and winter) and year on daily dust fall accumulation for each project area (mine site, Milne Inlet port, north road and south road). Only sites that were sampled throughout the year were included in this analysis (three mine sites, five port sites, four road north sites, and four road south sites). Each model included main effects of season and year, with an interaction term between season and year. Both season (summer and winter) and year (2015, 2016, 2017, and 2018) were treated as categorical variables in this analysis. Sample site was included as a random effect, to account for a lack of independence in samples collected from the same location over time. All dust fall data were log transformed prior to analysis and results were back-transformed to the original scale. A constant variance structure for season was used to account for higher variation in summer dust fall relative to winter dust fall (Zuur et al. 2009).

Residual plots were examined to confirm assumptions of normality and equality of variance in the residuals. Significance of model terms was tested using F-tests; terms were considered significant at $\alpha < 0.05$. Tests with p values between 0.05 and 0.1 are reported as suggestive evidence of group differences. If there was evidence of an effect of season or year on daily dust fall we used least squared means to estimate pairwise differences among groups (Lenth 2018). Statistical analysis was conducted using R version 3.5.2 (R Core Team 2018).

2.2 RESULTS AND DISCUSSION

2.2.1 SUPPORTING DATA

2.2.1.1 Overview of Weather Conditions

From 1963–1965, Environment Canada operated a climate station at Mary River during the summer months (Baffinland Iron Mines Corporation 2012). Where relevant, this data has been included to compare to data collected from Baffinland's on-site meteorological stations. Baffinland established a meteorological station at Mary River Camp on June 13, 2005 and at Milne Inlet in June 2006 creating a baseline dataset, 2005– 2010 (Baffinland Iron Mines Corporation 2012). Climate data for 2018 was collected from on-site meteorological stations at Mary River and Milne Inlet and compared to available baseline data. Parameters measured include monthly air temperature, precipitation as rainfall, wind speed, and wind direction.

North Baffin Island has a semi-arid climate with relatively little precipitation and few frost-free days (Baffinland Iron Mines Corporation 2012). Generally, the snowmelt period in the Project area occurs in June and frost-free conditions last until late August. Snowmelt is initiated when air temperatures rise and remain relatively consistent above 0ºC producing surface water from melting snow (Van Bochove et al. 2001, Iwata et al. 2008, NASA 2014). During the snow melt period there is an increase in water availability, longer daylight hours, and higher air temperatures which trigger plant growth and green-up; the beginning of this growth cycle is termed green-up (National Wildfire Coordinating Group 2012). During 2018, air temperatures at the Mary River weather station rose above 0ºC on June 6 and remained above freezing until Sept 7. At Milne Inlet, air temperatures rose above 0ºC on June 7 and remained above freezing until Sept 3.

In 2018, on-site staff reported that the meteorological stations at Mary River and Milne Inlet malfunctioned at an unspecified date until annual maintenance on the wind monitor and replacement of the rain gauge funnel was performed by Campbell Scientific on August 28 at Milne Inlet and annual maintenance on the tipping bucket and replacement of the wind monitor on September 3 at Mary River. Staff identified inaccurate wind speeds and precipitation volumes recorded at these stations due to their knowledge of conditions on site (i.e. raining on a specific day, but no precipitation recorded). Upon further analysis, no outliers in the data or large discrepancies were identified relative to baseline conditions for wind speed or precipitation; however, the data collected should be interpreted with caution because values may over or under represent actual figures. Additional gaps in the weather data are due to on-site maintenance performed by Campbell Scientific from August 28–31 at Milne Inlet and September 3–4 at Mary River. In consideration of these limitations, the following analysis includes data collected from January 1, 2018 to December 31, 2018.

Air Temperature — Air temperatures in 2018 were somewhat cooler during the summer relative to baseline conditions, 2005–2010. During winter, air temperatures were somewhat warmer at Mary River in 2018 relative to baseline, but colder at Milne Inlet relative to baseline conditions. Air temperatures recorded by Environment Canada at the Mary River meteorological station from 1963–1965 were cooler during the summer months than 2018 air temperatures. In general, air temperatures for North Baffin Island tend to be warmest in July and coldest in February.

At Milne Inlet, the lowest air temperature recorded during baseline conditions was -46.9°C in February 2008 compared to -44.4°C in February 2018. The coldest air temperature recorded in 2018 was in November at - 49°C. The highest air temperature recorded during baseline was 22.3°C in July 2009 compared to 18.7°C in July 2018.

At the Mine Site, the lowest air temperature recorded during baseline was -70.0°C in April 2010 compared to -45.8°C in February 2018. The highest air temperature recorded during baseline was 22.8°C in July 2009 and 11.0°C in September 1964. In 2018, the highest temperature recorded was 19.4°C in July.

Precipitation (Rainfall) — There were more days of rainfall, but less amount of rain per day at Milne Inlet in 2018 relative to baseline conditions, 2005–2010. The number of rainfall days and highest recorded rainfall at Mary River was similar to baseline conditions. Total rainfall recorded annually from 1963– 1965 by Environment Canada at the Mary River meteorological station was somewhat lower than the 2018 amount at the Mine Site. In general, July and August tend to be the wettest months for North Baffin Island.

At Milne Inlet, the total number of days when rainfall was recorded during baseline conditions was 40 days in 2006, 25 days in 2007, and 26 days in 2008. Baseline rainfall data was not available for Milne Inlet in August 2009 and after March 4, 2010 to provide an accurate estimate for these years. In 2018, there were 52 days when rainfall was recorded. The highest recorded rainfall at Milne Inlet during baseline conditions was 7.4 mm in July 2008. This is somewhat higher than in 2018 where 4.0 mm of rain fell in July 2018. The total amount of rainfall recorded at the Milne Inlet weather station in 2018 was 164.8 mm. During baseline conditions, the highest amount of rainfall recorded in a single year at the Milne Inlet weather station was 221 mm in 2006.

At Mary River, the total number of days when rainfall was recorded during baseline conditions was 46 days in 2005, 53 days in 2006, 34 days in 2007, 27 days in 2008, and 51 days in 2009. Baseline rainfall data for Mary River was not available after July 7, 2010 to provide an accurate estimate for 2010. In 2018, there were 42 days when rainfall was recorded. The highest recorded rainfall at Mary River during baseline conditions, 2005–2010, was 5.3 mm in July 2007. This is similar to 2018 with 6.0 mm of rain falling in June 2018. The total amount of rainfall recorded at the Mary River weather station in 2018 was 106.7 mm. From 1963– 1965, the highest amount of rainfall recorded in a single year at the Mary River meteorological station was 94.4 mm in 1964.

Wind Direction and Speed — Wind direction recorded in 2018 at Milne Inlet and Mary River was mostly consistent with baseline wind direction data, 2005–2010. In both 2018 and baseline conditions, the range in minimum and maximum wind speeds was variable from calm to gusting winds on the upper end of the Beaufort scale. Wind data was not recorded at the Environment Canada Mary River meteorological station, 1963–1965.

At Milne Inlet, wind direction data during baseline conditions is consistent with current wind direction data from the Baffinland weather station where prevailing north/northwest winds occur most frequently. The range in baseline minimum and maximum wind speeds was similar during baseline conditions and in 2018 with 0–23.8 m/s or 85 km/hr, which is considered "calm" to "strong gale" on the Beaufort scale. In 2018, a maximum wind speed of 100 m/s was recorded at Milne Inlet during nine out of 12 months with the strongest wind speeds recorded in December, January, and February. This is categorized as "hurricane" winds on the Beaufort scale, indicating strong, violent winds. Wind speed is recorded every hour at Baffinland weather stations and high winds indicating hurricane conditions are likely a result of short, but powerful gusting winds.

At the Mine Site, baseline wind direction data is mostly consistent with previously reported wind direction data from the Mary River weather station where prevailing south/southeast winds occur frequently, followed by strong north winds. The range in baseline minimum and maximum wind speed was similar during baseline conditions to 2018.

2.2.1.2 Vehicle Transits on the Tote Road

The average number of ore haul transits per day in 2018 was 219.5 (Figure 1; Table 4); this represents a slight increase in the average daily number of ore haul transits in 2018 compared with 2017 (195 ore haul transits per day). As seen in previous years there are periodic full or partial closures of the Tote Road associated with adverse weather conditions (freeze/thaw, poor visibility, etc.). However, these closures and corresponding decreases in ore haul transits are short-lived and the average daily number of transits was steady through the 2018 calendar year.

Other non-haul truck traffic had an annual average of 37.3 vehicle transits per day, which was only slightly higher than in 2017 (32.3 vehicle transits per day). Therefore, the average daily total vehicle transits (haul and other) on the Tote Road in 2018 was 256.8 vehicle transits per day.

Table 4 Average and total vehicle transits along the Tote Road, including ore haul, non-haul, and all vehicles combined.

Sample Year	Ore Haul Transits		Non-Haul Transits		Combined Vehicle Transits	
	Average	Total	Average	Total	Average	Total
2015	73.0	26662	53.9	19668	126.9	46330
2016	151.2	55354	27.7	10150	179.0	65504
2017	195.9	71516	32.3	11777	228.2	83293
2018	219.5	80118	37.3	13616	256.8	93734

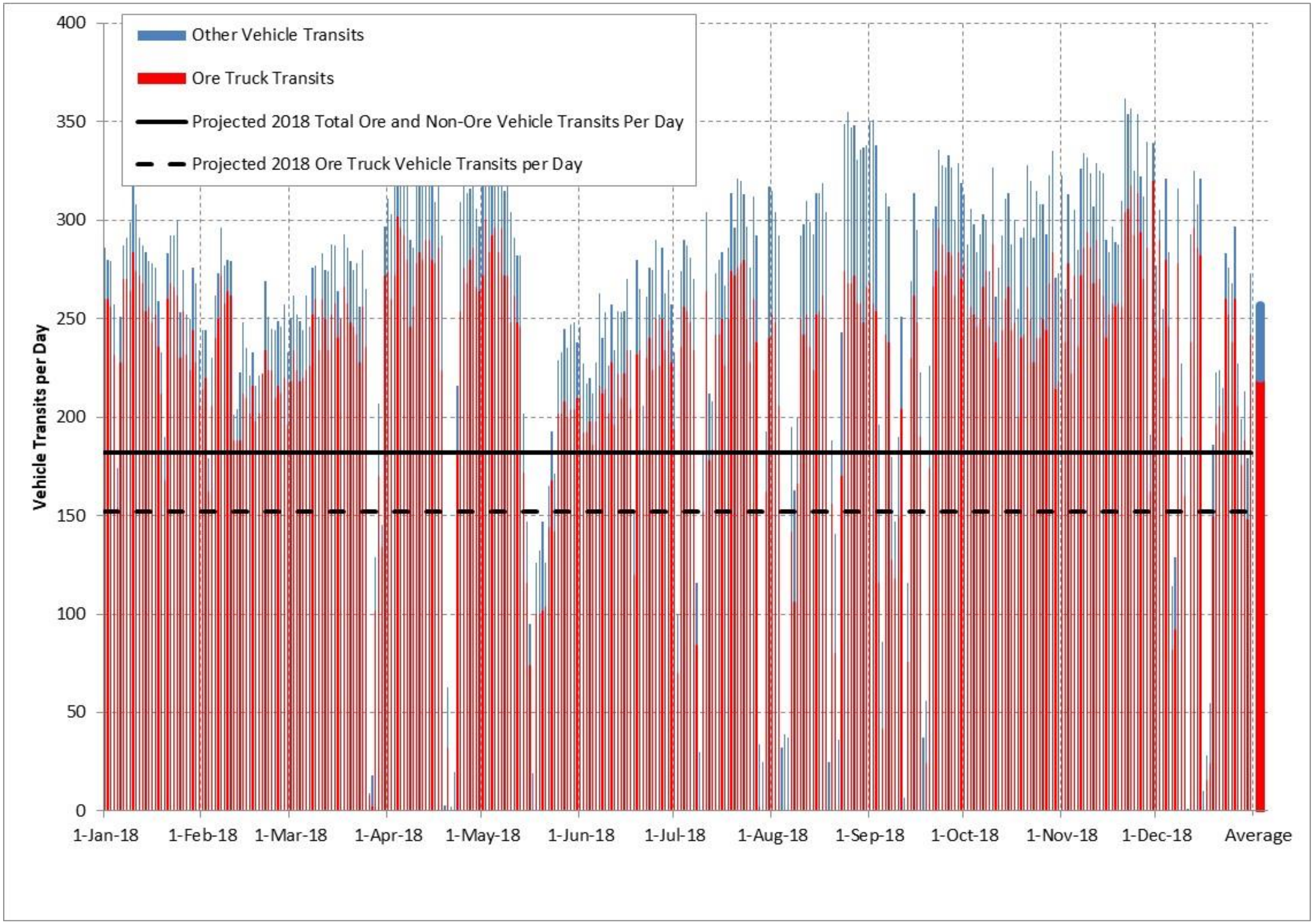


Figure 1 Vehicle transits per day on the Tote Road, including both full ore trucks (red), and all other traffic (blue) through 2018. *Also included is the projected maximum number of vehicle passes per day on the Tote Road, and the projected maximum number of Ore Haul Trucks per day on the Tote Road.*

2.2.1.3 Dust Fall Suppression and Mitigation in 2018

Baffinland has implemented multiple dust fall mitigations and suppression activities. These activities are intended to reduce dust fall on the terrestrial environment and decrease sedimentation in the aquatic environment. Some mitigations including road watering equipment improvements and road construction projects on the Mine Haul Road were completed prior to 2018 but have been previously unreported. The water truck improvements included the addition of spray bar attachments and changes made to the truck and pump valves allowing trucks to pull water faster from source points, ultimately increasing water truck cycle time. The Mine Haul Road had strategic locations of the road resurfaced and recontoured with competent aggregate which reduces interaction with older less ideal road surfacing materials; this work raised the roads up to 10 m in elevation to decrease slumping and subsequent erosion. Dust fall mitigation and suppression activities are included as part of ongoing mine construction (including road improvements) and operations. The following described activities are those that were conducted in 2018**:**

Tote Road Dust Mitigation:

Use of granular material for road construction and maintenance (road resurfacing) — This is an ongoing activity aimed to improve the quality of the road base, thereby decreasing dust associated with all mine traffic. There are granular material stockpiles placed throughout the PDA and graders are working continuously to repair/replace materials along the roadways.

Mine Haul Road Re-Construction — Some sections of the Mine Haul Road were resurfaced and recontoured with competent aggregate that reduces exposure with older less ideal road surfacing materials. Continual improvements are made to this roadway.

Limit speed of vehicles on all roads and road closures — The speed limit on the Tote Road is 50 km per hour. However, this speed limit is changed as per road conditions and can be set as low as 25 km per hour. During freshet and times of heavy rain the road speed is reduced. Additionally, the Tote Road can be closed to mitigate erosion and potential sedimentation to surrounding areas.

Limiting traffic to essential use over construction areas — Management staff control the use of light-duty vehicles, and all staff who have permission to drive on site must first complete Tote Road training. The use of light-duty trucks at the Mine Site and on the Tote Road is reduced using a regular bus service that transports workers between different areas as needed. Finally, all traffic is actively tracked which allows for limiting traffic on the road as required.

Use of EK-35 at the airstrip — EK-35, a dust suppressant is applied once annually following freshet to the airstrip to reduce dust generation from the airstrip.

Water and Calcium Chloride Use in the Project Area — Water and calcium chloride were used for dust suppression throughout the Project area from June 1 through September 3, 2018. Water was used to suppress dust fall on Project areas including the Tote Road, the Mine Site, Milne Port and the Mine Haul Road. Dust suppression activities started a month earlier in 2018 than in 2017.

Water was used on 35 events in the Mine Site area, three (3) events along the Mine Haul Road, 334 events along the northern half of the Tote Road, and 265 events along the southern half of the Tote Road (Table 5; Map 2). The total amount of water used in each area was 864.6 m³ in the Mine Site area, 90.8 m³ along the Mine Haul Road, 9,652.9 m³ along the North Tote Road, and 7,488.2 m³ along the South Tote Road.

Calcium chloride was used only along the Tote Road. Along the North Tote Road there were 51 events where calcium chloride was spread, with an average of 1,836.9 kg per event, for a total of 93,680 kg used. Along the South Tote Road there were 75 events where calcium chloride was spread with an average of 2,495 kg per event, for a total of 187,140 kg used (Table 5; Map 3).

Table 5 Summary of dust fall suppression activities, summer 2018.

Area	Type of Dust Suppression	Number of Application Events[1]	Average Quantity of Suppressant per Event	Total Quantity of Suppressant Used
Mine Site	Calcium Chloride	0	-	-
	Water	35	24.7 m³	864.6 m³
Mine Haul Road	Calcium Chloride	0	-	-
	Water	3	30.3 m³	90.8 m³
Milne Port	Calcium Chloride	0	-	-
	Water	1	30.3 m³	30.3 m³
North Tote Road	Calcium Chloride	51	1836.9 kg	93,680 kg
	Water	334	28.9 m³	9652.9 m³
South Tote Road	Calcium Chloride	75	2495.2 kg	187,140 kg
	Water	265	28.3 m³	7488.2 m³

'Events' refers to each truck carrying either calcium chloride or water for dust suppression activities; there may be more than one event per day

Milne Port Dust Fall Mitigations:

Minimize drop distances for stockpiling activities — Conveyors are continuously evaluated and adjusted to minimize drop distances while allowing for safe operation as per required angles; this decrease in drop heights results in a reduction in dust generation.

Install downwind fence to limit dust fall transport — Fences were installed downwind of the crusher and ore stockpiles on a trial basis. It was determined that the beneficial effects in the area around the crusher were minimal and therefore the trial was removed from this site. The fencing still exists for the Milne Port Ore Pad beach area.

Ore pad re-design — The Ore pad fines and lump layout was reworked to inherently reduce dust transport by relocating lump ore containment piles that would act as competent walls for potential fines transport.

Mine Site Dust Fall Mitigations:

Installation of shrouding at crusher circuit transfer points — Shrouding installation on Mine Site crusher circuit transfer points is ongoing through fall 2018. Key areas, such as the main jaw house which had engineered dust housing installed on top, were focused first (this work was completed in 2017). Housings were installed on the end chutes to reduce dust dispersion.

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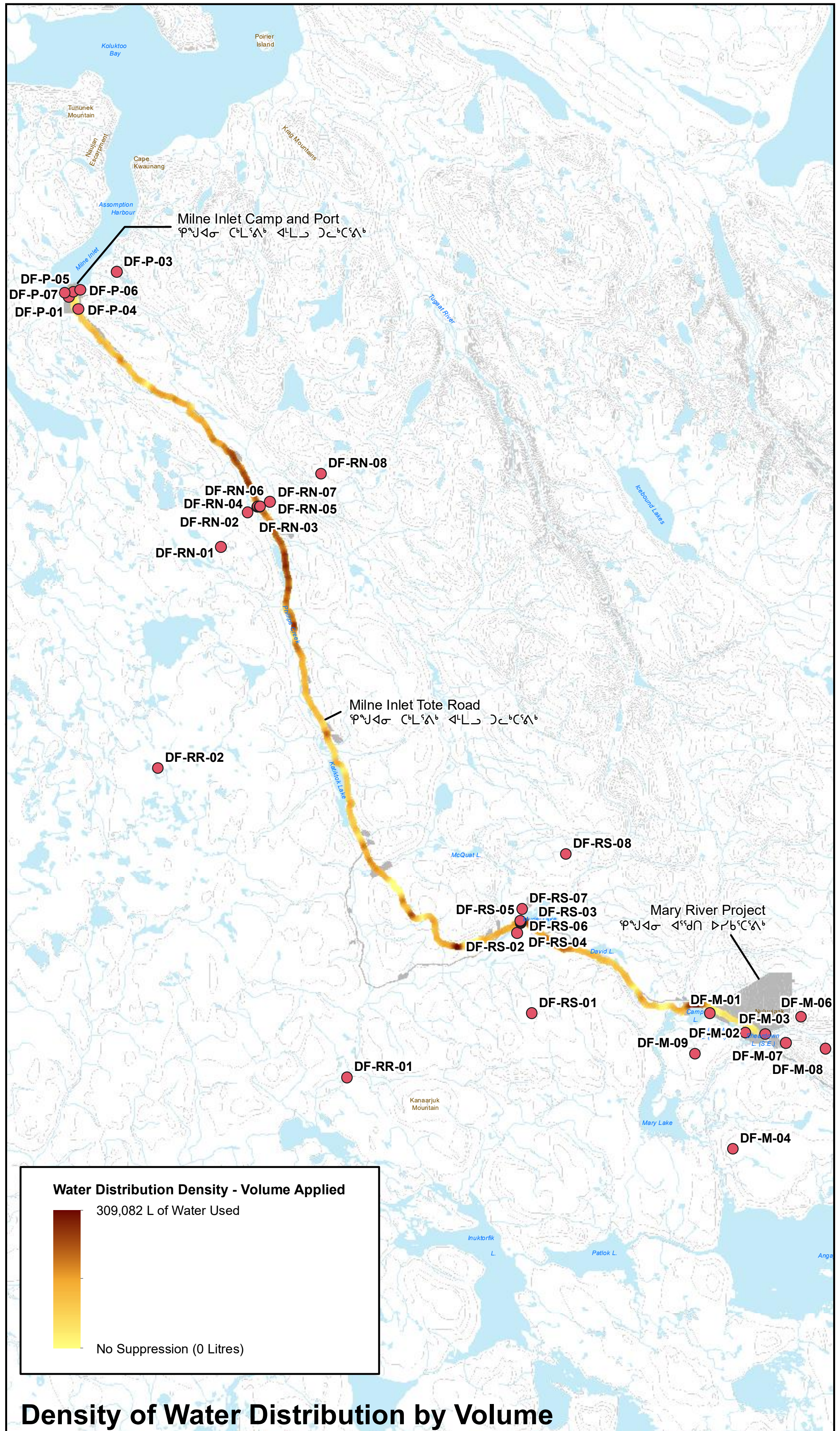
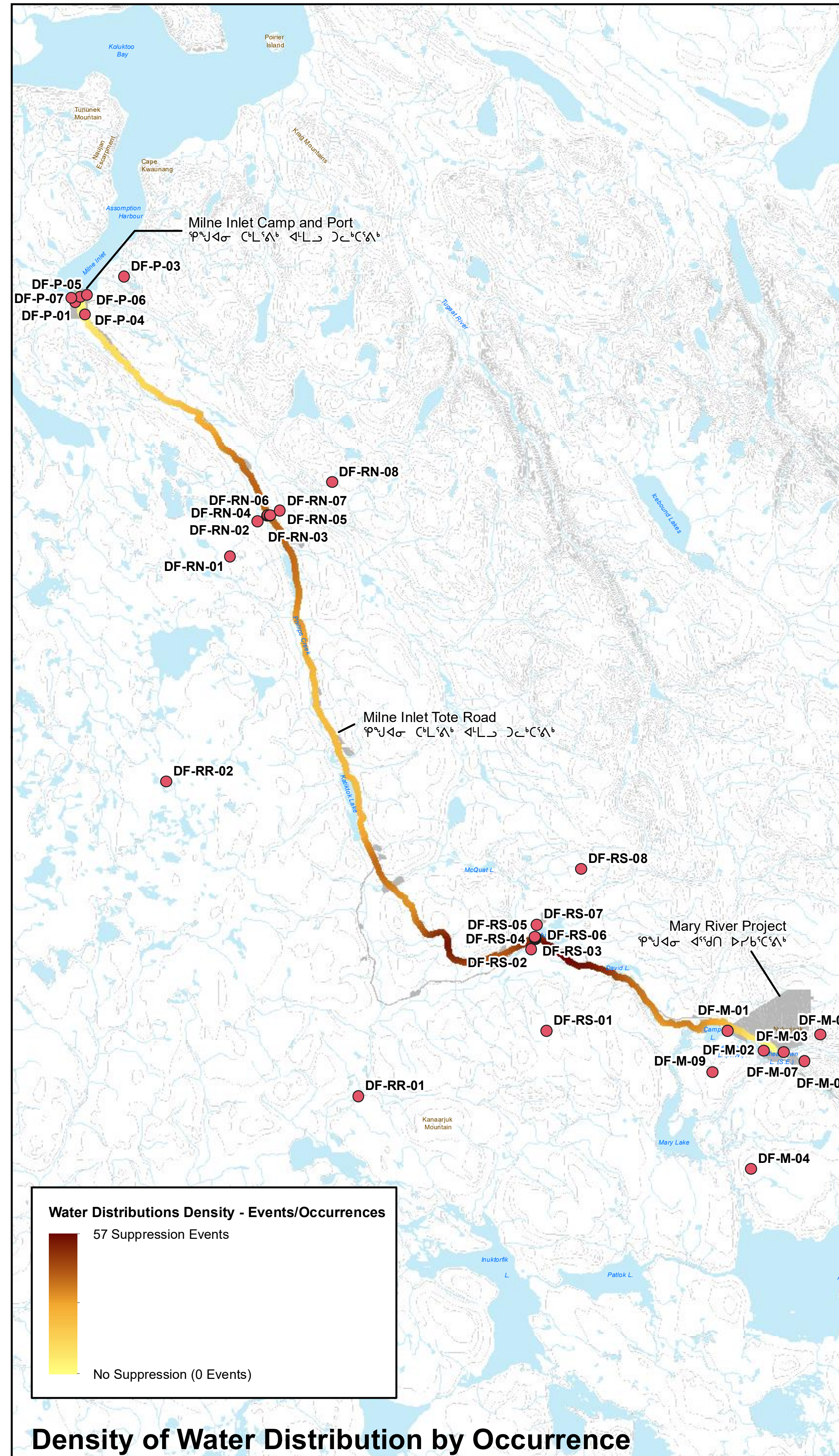




LEGEND

- Dust Fall Monitoring Site
- Potential Development Area
- Regional Study Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

PDA provided by KP, July 11, 2017.

Suppression data provided by Baffinland Iron Mines (October 2018). Data includes suppression events from June to September, 2018.

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale: 0, 2.75, 5.5, 11, 16.5, 22, 27.5 Km

Baffinland

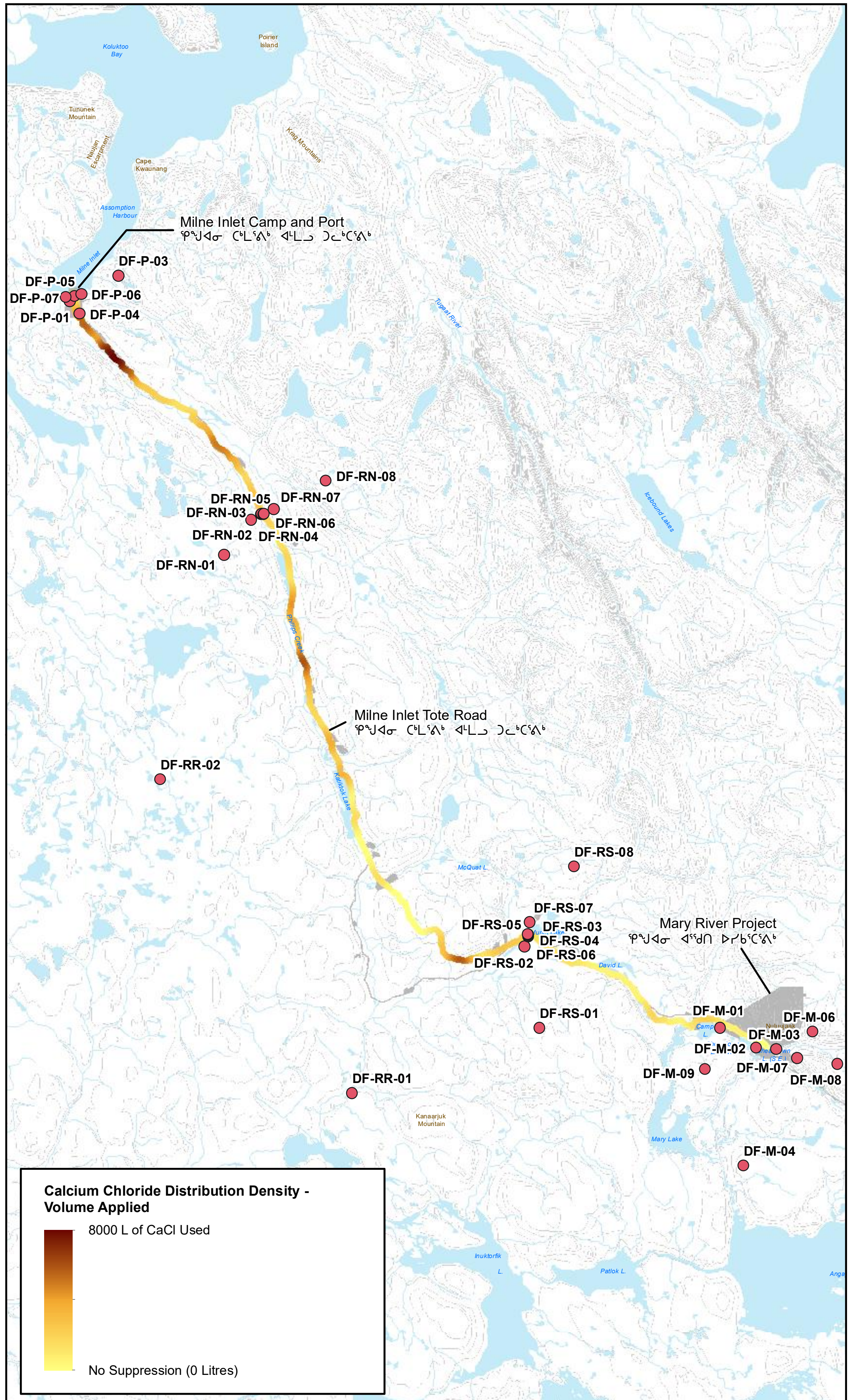
Dust Fall Suppression Using Water Along the Tote Road

EDI

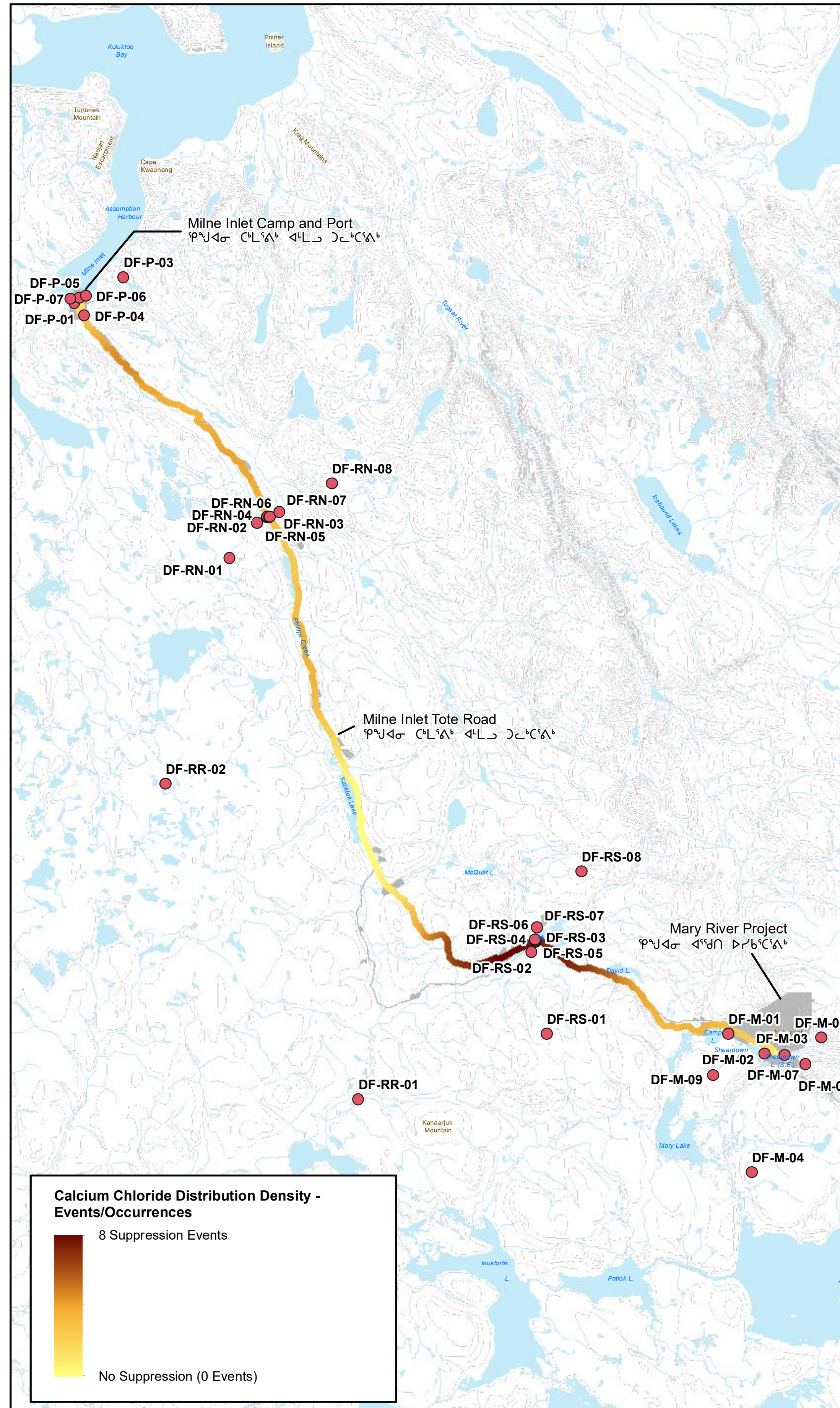
Date: 10/23/2018

Map 2

Path: S:\Data\Project_Data\Baffinland_Spatial\2018_SpatialData\Mapping\Reporting\MonitoringReport_20181022\Map2_Water_Supp.mxd



Density of CaCl Distribution by Volume



Density of CaCl Distribution by Occurrence

LEGEND

- Dust Fall Monitoring Site
- Potential Development Area
- Regional Study Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

PDA provided by KP, July 11, 2017.

Suppression data provided by Baffinland Iron Mines (October 2018). Data includes suppression events from June to September, 2018.

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.75 5.5 11 16.5 22 27.5 Km

Baffinland Iron Mines Corporation

Dust Fall Suppression Using Calcium Chloride Along the Tote Road

EDI

Date: 10/23/2018

MAP 3

Path: S:\Data\Project_Data\Baffinland_Spatial\2018_SpatialData\Mapping\Reporting\MonitoringReport_20181022\Map3_CaCl_Supp.mxd

2.2.2 MAGNITUDE AND EXTENT OF 2018 DUST FALL

Mine Site — The 2018 monitoring included nine dust fall samplers associated with the Mine Site — three within the mine footprint (Near sites), four outside the mine footprint but within the five kilometre buffer (Far sites), and two reference sites located more than 5 km from the Mine Site (Table 2). Dust fall deposition rates at sample site DF-M-01, located near the airstrip (Map 1), ranged from 0.13 mg/dm²·day in August 2018 to a high of 5.54 mg/dm²·day in May 2018 (Table 6). At DF-M-02, located nearest the crusher, the dust deposition rates ranged from below detection (<0.10 mg/dm²·day) to 5.00 mg/dm²·day in April 2018. At site DF-M-03, located just south of the mine haul road, the dust fall deposition rates ranged from 0.34 mg/dm²·day in August 2018 to a high of 3.54 mg/dm²·day, measured in October.

Sites DF-M-06, -07, -08, and -09, all located outside the mine footprint but within 5 km radius, are sampled only during the summer months (June, July and August). Dust fall sampled at these stations was below detection at all monitors in all samples (Table 6). Similarly, dust fall deposition rates at both Mine Site reference locations (DF-M-04 and DF-M-05) were below detection in all samples collected (also sampled only during summer months).

The dust fall was significantly higher in the Near monitoring sites when compared with Far and Reference monitors. There was strong evidence of differences in distance class for Mine Sites ($p < 0.001$; Figure 2). Median daily dust fall was highest in the Near distance class at 1.0 (CI = 0.4–2.5) mg/dm²·day, this significantly higher than the other two distances classes (all $p < 0.004$). Daily dust fall for the far and reference areas were below laboratory detection (<0.1 mg/dm²·day) for all samples collected in 2018. This indicates negligible dust fall outside a one-kilometre radius of the PDA.

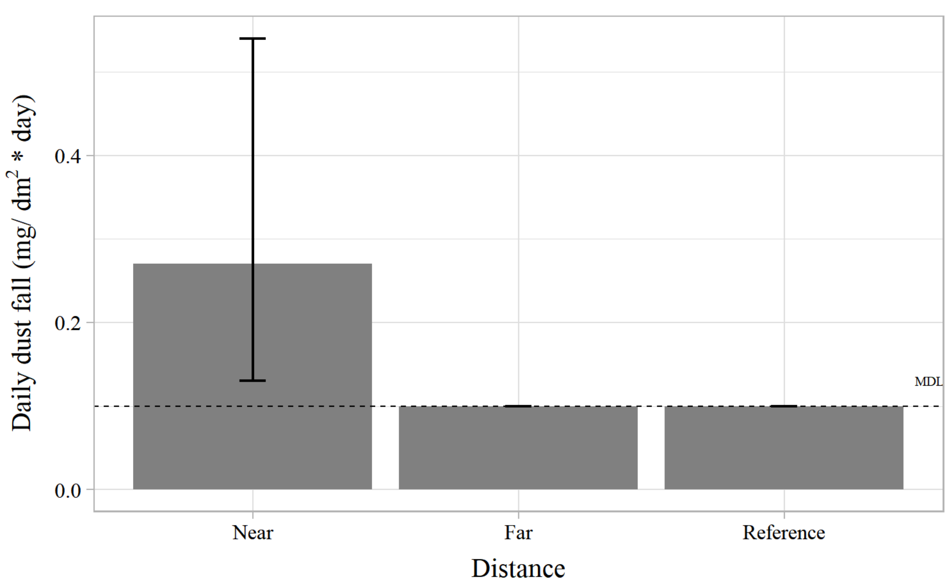


Figure 2 Median daily dust fall (mg/dm²·day) for Mine Sites by distance class.
Bar heights show median daily dust fall with inter-quartile ranges. Confidence intervals are asymmetrical because dust data were analysed on the log scale and back transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

Milne Port — Six dust fall samplers were associated with Milne Port in 2018 (Table 2, Map 1); five active sites on the port footprint; DF-P-5 replaced DF-P-2 and one reference site located northeast of the Port Site. Dust fall deposition rates at Milne Port were highest at DF-P-01, nearest the ore pad and quarry, where dust fall ranged from 0.88 $mg/dm^2 \cdot day$ to 28.1 $mg/dm^2 \cdot day$ in April; if the April data is removed dust fall at DF-P-01 was similar to DF-P-05, nearest the ore pad and traffic corridor, which ranged from 0.36 $mg/dm^2 \cdot day$ to 10.7 $mg/dm^2 \cdot day$ (Table 6). Dust fall at DF-P-07, near to the ore pad, had dust fall that ranged from 0.17 to 2.30 $mg/dm^2 \cdot day$. Dust fall deposition rates at DF-P-06, nearest to the sea lift staging pad and quarry, ranged from below detection to a high of 2.12 $mg/dm^2 \cdot day$. Dust fall deposition rates at the Milne Port reference site, DF-03-P, which is sampled only in summer months were below detection in all samples.

Tote Road Crossings — Eighteen dust fall samplers were associated with the Tote Road; eight at each of two sample sites consisting of transects perpendicular to the road (the North crossing site and South crossing site), and two reference samplers are located approximately 14 km from the road.

North Crossing — Dust fall was highest at the sample station nearest the centerline on the south side of the Tote Road (DF-RN-04) with dust fall that ranged from 1.32 $mg/dm^2 \cdot day$ to 14.7 $mg/dm^2 \cdot day$. On the north side of the road (DF-RN-05) the dust fall ranged from 1.21 $mg/dm^2 \cdot day$ to 9.04 $mg/dm^2 \cdot day$. Dust fall decreased with distance from the centerline, and dust fall at DF-RN-03 and DF-RN-06 ranged from 0.23 $mg/dm^2 \cdot day$ to 5.07 $mg/dm^2 \cdot day$, and from 0.43 to 4.56 $mg/dm^2 \cdot day$, respectively. Dust fall in samples collect during the summer season at the farthest sites (DF-RN-01, -02, -07 and -08) were all at or below laboratory detection, 0.10 $mg/dm^2 \cdot day$ (Table 6).

At the North Crossing there was strong evidence that dust fall decreased with increasing distance from the road ($p < 0.001$; Figure 3). Median daily dust fall was highest in the 30 m distance class at 2.1 (Interquartile Range [IQR] = 1.6 – 4.4) $mg/dm^2 \cdot day$, this was significantly higher than all other distance classes (all $p < 0.008$). Median daily dust fall in the 100 m distance class was 0.6 (IQR = 0.4 – 1.2) $mg/dm^2 \cdot day$, this was significantly higher than the two farther distance classes (all $p = 0.004$). There was no difference in dust fall between the 1000 m and 5000 m distance classes ($p = 1.00$), where daily dust fall was <0.1 $mg/dm^2 \cdot day$ for all samples.

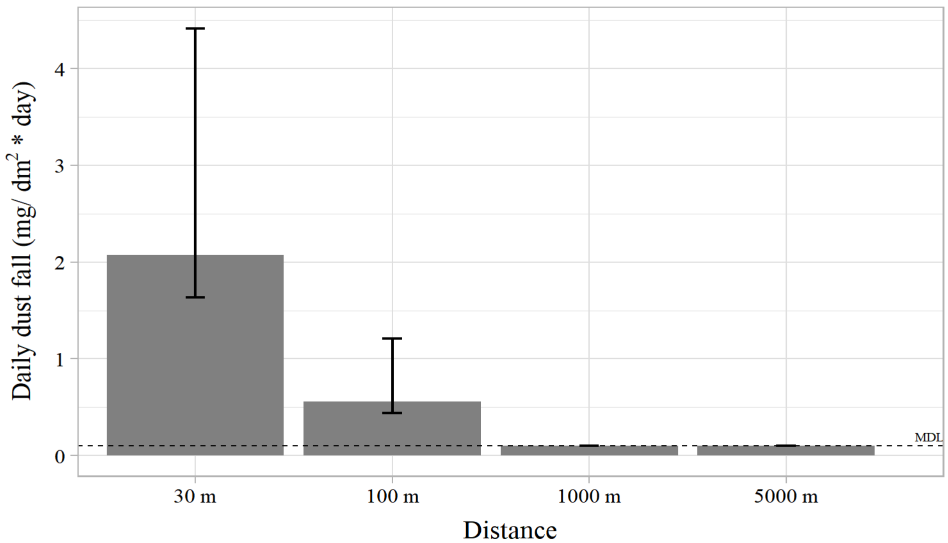


Figure 3 **Median daily dust fall (mg/dm²·day) for north road sites as a function of distance from the Tote Road.** *Bar heights show median daily dust fall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analysed on the log scale and back transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.*

South Crossing — Dust fall was highest at the sample station nearest the centerline on the south side of the Tote Road (DF-RS-04) with dust fall that ranged from 0.95 mg/dm²·day to 37.3 mg/dm²·day. On the north side of the road (DF-RS-05) the dust fall ranged from 0.63 mg/dm²·day to 12.5 mg/dm²·day. Elevated dust fall on the south side of the road compared with the north likely associated with prevailing wind direction (Photo 1). Dust fall decreased with distance from the centerline, and dust fall at DF-RS-03 and DF-RS-06 ranged from 0.30 to 5.65 mg/dm²·day and from 0.22 to 4.19 mg/dm²·day, respectively. Dust fall in samples collected during the summer season at the farthest sites (DF-RS-01, -02, -07 and -08) were all low, below 0.3 mg/dm²·day (Table 6).

As seen at the North crossing, dust fall at the South crossing decreased significantly with increasing distance from the Tote Road centerline ($p < 0.001$; Figure 4). Median daily dust fall was highest in the 30 m distance class at 4.5 (IQR = 3.6 – 10.6) mg/dm²·day, this was significantly higher than all other distances classes (all $p < 0.004$). Daily dust fall in the 100 m distance class was 0.6 (IQR = 0.6 – 1.8) mg/dm²·day, which was significantly higher than the two farther distance classes (all $p = 0.004$). There was no difference in dust fall between the 1,000 m and 5,000 m distance classes ($p = 0.31$), where daily dust fall was <0.1 mg/dm²·day for 9 out of 12 samples and maximum recorded daily dust fall was only 0.29 mg/dm²·day.

Reference sites — Dust fall deposition rates at the two Tote Road reference sites (DF-RR-01 and DF-RR-02), which are sampled only in summer months were below lab detection in all samples (Table 6) and are not included in graphs such as Figure 4.

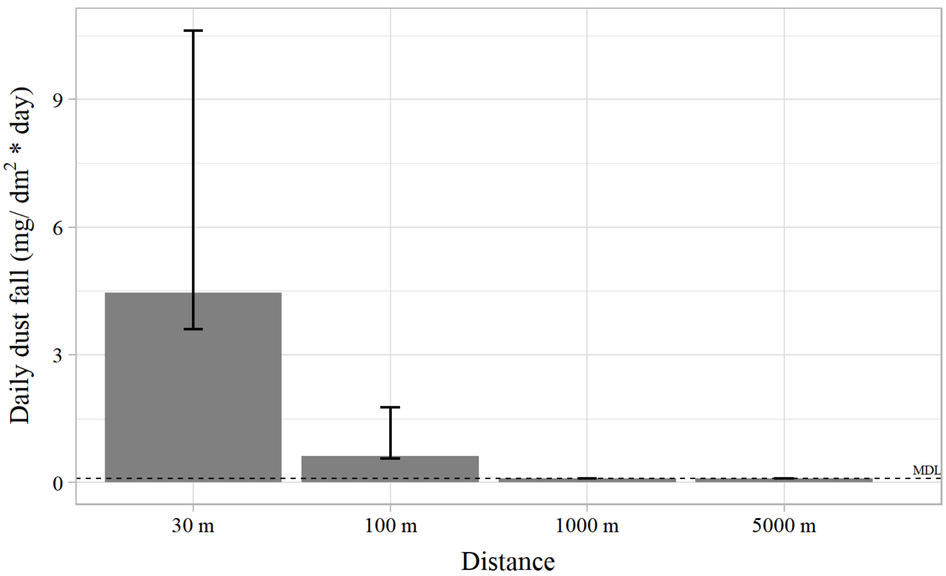


Figure 4 Median daily dust fall (mg/dm²·day) for south road sites as a function of distance from the Tote Road.
Bar heights show median daily dust fall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analysed on the log scale and back transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

Photo 1 Effect of wind direction on dust fall; photo looking towards Mine Site.

Table 6 Dust fall, as total suspended particulate matter (mg/dm²·day), collected at all sample sites during the 2018 monitoring year.

Site Name	Sample Collection Timing											
	Jan/Feb	Feb/Mar	Mar/Apr	Apr/May	May/June	June/July	July/Aug	Aug/Sept	Sept/Oct	Oct/Nov	Nov/Dec	Dec/Jan
DF-M-01	2.84	2.10	4.54	5.54	3.98	0.87	0.13	0.27	2.87	0.49	0.45	1.54
DF-M-02	4.73	1.50	5.00	3.17	2.43	0.11	<0.10	0.26	4.42	2.71	1.78	3.65
DF-M-03	2.06	0.93	2.34	1.41	4.30	1.56	0.34	0.54	3.54	1.12	0.47	1.14
DF-M-04	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-M-05	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-M-06	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-M-07	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-M-08	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-M-09	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-P-01	3.11	3.93	28.1	5.73	2.44	4.43	0.96	0.88	7.97	0.62	1.33	2.67
DF-P-03	-	-	-	-		<0.10	<0.10	<0.10	-	-	-	-
DF-P-04	<0.10	0.17	0.69	1.80	0.90	0.67	<0.10	0.12	0.48	0.51	1.75	0.29
DF-P-05	3.35	2.04	6.63	3.06	3.45	2.06	0.36	0.53	10.70	1.83	3.32	3.02
DF-P-06	0.60	0.23	0.72	0.71	0.36	<0.10	<0.10	<0.10	0.44	1.26	2.12	0.39
DF-P-07	0.44	1.55	2.30	0.55	0.53	0.59	0.17	0.30	1.11	0.68	0.66	1.18
DF-RN-01	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-RN-02	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-RN-03	0.36	0.23	1.59	1.86	2.34	1.39	0.39	0.46	5.07	0.38	0.23	1.11
DF-RN-04	2.08	1.32	10.0	-	14.7	9.68	2.13	2.02	11.00	1.15	0.61	2.11
DF-RN-05	1.58	1.34	4.45	5.79	6.07	5.18	1.21	1.51	9.04	1.09	0.78	0.84
DF-RN-06	0.79	0.78	1.80	2.55	4.56	1.98	0.43	0.66	4.41	-	0.49	0.48
DF-RN-07	-	-	-	-	-	0.10	<0.10	<0.10	-	-	-	-
DF-RN-08	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-RS-01	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-RS-02	-	-	-	-	-	0.29	0.10	0.10	-	-	-	-
DF-RS-03	0.52	0.30	0.66	1.37	5.65	3.12	0.44	0.61	2.46	0.82	0.29	0.17
DF–RS-04	2.00	0.95	2.52	6.53	37.3	35.5	3.94	4.98	12.50	3.53	0.99	0.61
DF-RS-05	1.34	0.63	3.10	7.61	8.93	12.5	3.08	3.48	6.82	2.03	0.73	0.49

Table 6 Dust fall, as total suspended particulate matter (mg/dm²·day), collected at all sample sites during the 2018 monitoring year.

Site Name	Sample Collection Timing											
	Jan/Feb	Feb/Mar	Mar/Apr	Apr/May	May/June	June/July	July/Aug	Aug/Sept	Sept/Oct	Oct/Nov	Nov/Dec	Dec/Jan
DF-RS-06	0.39	0.24	0.87	2.15	4.19	2.15	0.63	0.55	1.74	0.58	0.19	0.24
DF-RS-07	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-RS-08	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-RR-01	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-
DF-RR-02	-	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-

2.2.3 SEASONAL COMPARISONS OF 2018 DUST FALL

Seasonal variations in dust fall in all Project areas were investigated as per the dust fall monitoring objectives.

Mine Site — Dust fall was higher in the winter than in summer at all three year-round sites within the Mine Site area, potentially due to dust suppression activities during the summer months. At DF-M-01, average dust fall was 6.9 (CI = 2.6 – 18.0) times higher in winter than in summer ($p < 0.001$; Figure 5). At DF-M-02, average dust fall was 21.2 (CI = 8.1 – 55.4) times higher in winter than in summer ($p < 0.001$). There was suggestive evidence that dust fall at DF-M-03 was 2.3 (CI = 0.9 - 6.0) times higher in winter than in summer ($p = 0.09$). However, the effect of seasonality on dust fall differed among sample sites, i.e., there were greater differences in dust fall among the sites in the summer than in winter.

Milne Port — Like the Mine Site, dust fall was higher in the winter than in the summer at all year-round Milne Port sampling locations, however different sites respond differently to seasonal influences. There was a significant seasonal effect on daily dust fall across all sites ($p = 0.001$; Figure 6). On average, dust fall in winter was 3.6 (CI = 2.2 – 6.0) times higher than dust fall in summer. After accounting for season, DF-P-05 was 6.3 (CI = 3.2 – 12.4) times higher than DF-P-06 ($p < 0.001$), 4.9 (CI = 2.5 – 9.6) times higher than DF-P-04 ($p < 0.001$), and 3.1 (CI = 1.5 – 6.4) times higher than DF-P-07 ($p = 0.03$). DF-P-01 was 9.1 (CI = 4.4 – 18.8) times higher than DF-P-06 ($p < 0.001$), 7.1 (CI = 3.6 – 13.9) times higher than DF-P-04 ($p < 0.001$), and 4.5 (CI = 2.2 – 9.2) times higher than DF-P-07 ($p = 0.002$).

North Crossing — At each site, average dust fall was higher in winter than in summer, however, there was no statistical evidence of seasonal differences in dust fall for the north road sites ($p = 0.50$; Figure 7). There was no evidence of an interaction between sample site and season for the north road sampling area ($p = 0.20$).

South Crossing – Conversely to other dust fall monitoring areas, there dust fall was higher at each site in summer than in winter, however, there were no significant seasonal differences (all $p > 0.27$). There was evidence of an interaction between sample site and season for the south road sampling area ($p = 0.001$; Figure 8). This interaction occurred because the differences in dust fall among sites were larger in summer than in winter.

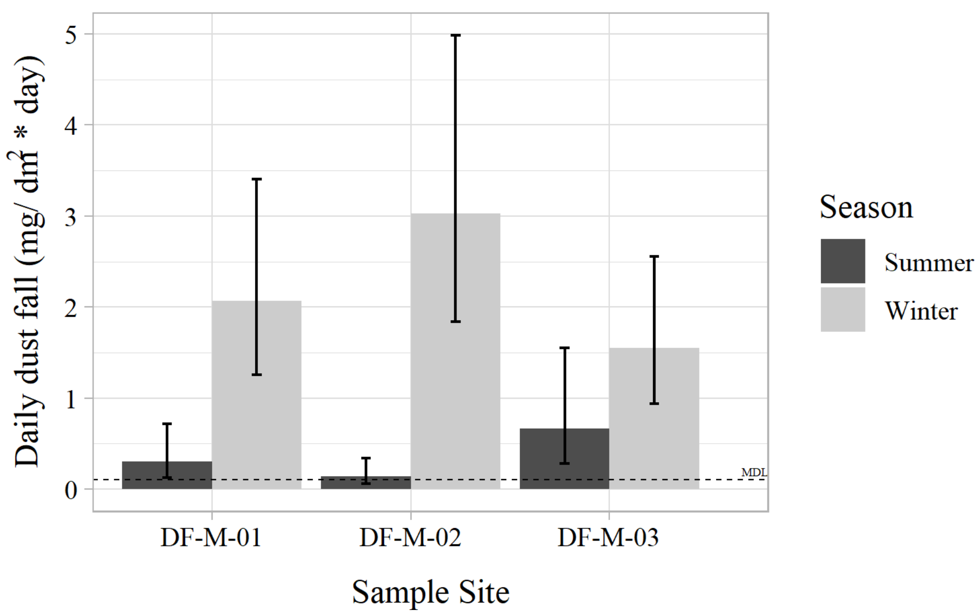


Figure 5 Median daily dust fall by site and season for the Mine Site sampling sites.
Bar heights show median daily dust fall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analysed on the log scale and back transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

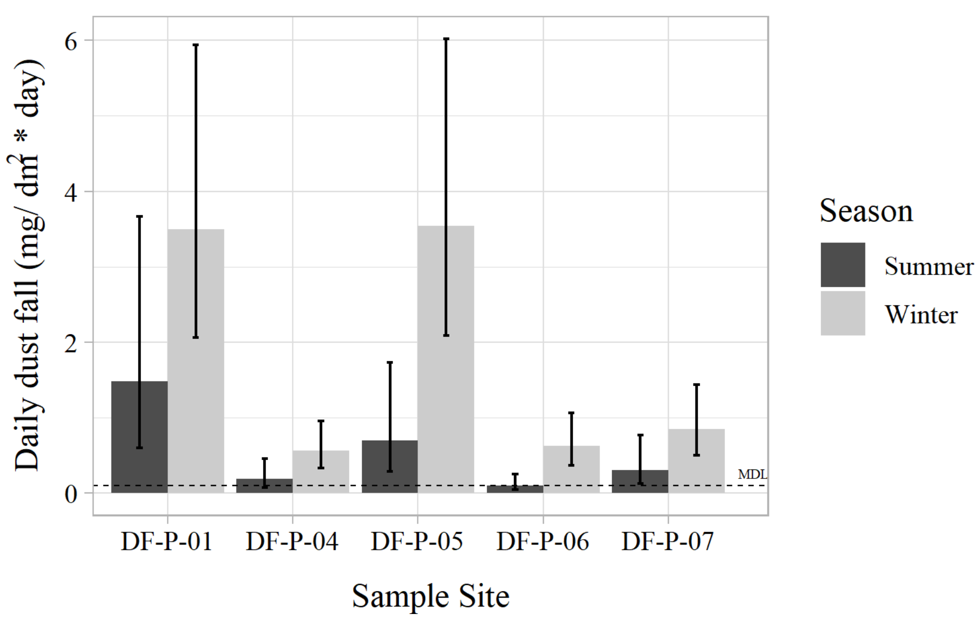


Figure 6 Median daily dust fall by site and season for the Milne Inlet Port sampling sites.
Bar heights show median daily dust fall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analysed on the log scale and back transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

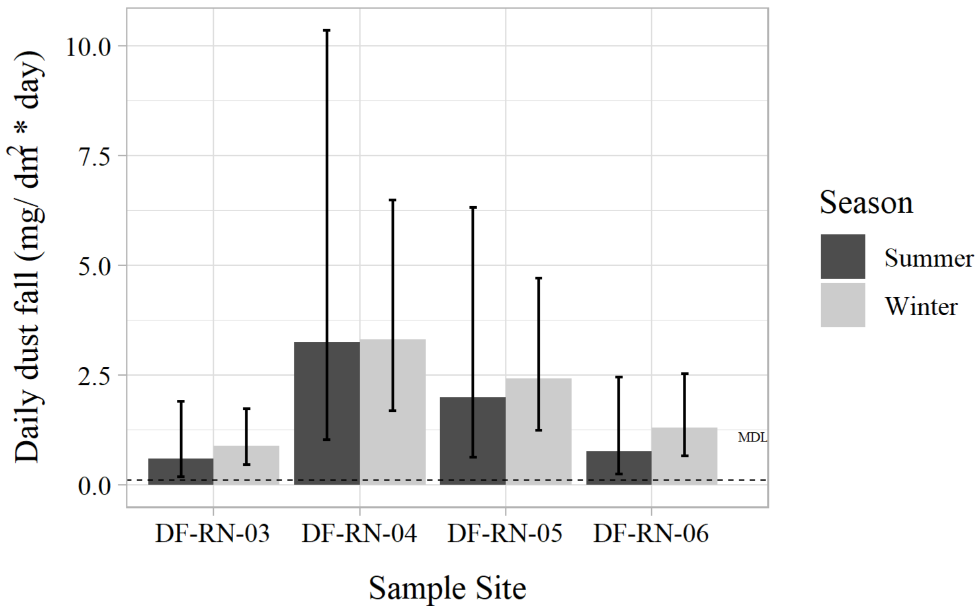


Figure 7 Median daily dust fall by site and season for the Road North sampling sites.
Bar heights show median daily dust fall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analysed on the log scale and back transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

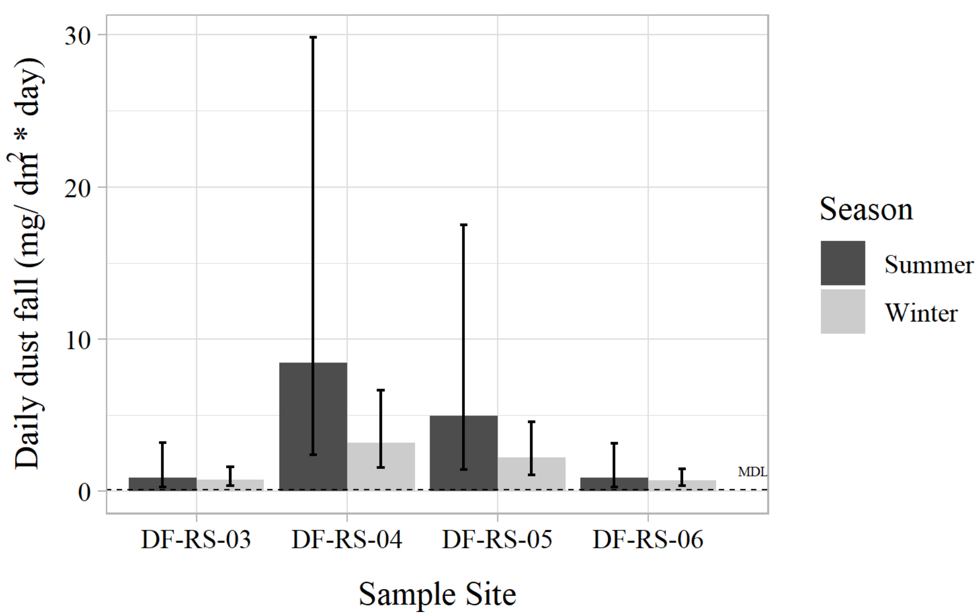


Figure 8 Median daily dust fall by site and season for the Road South sampling sites.
Bar heights show median daily dust fall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analysed on the log scale and back transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

2.2.4 2018 ANNUAL DUST FALL

Total annual dust fall was reviewed at all sites that were sampled year-round for the 2018 calendar year. Sites in the nil and low isopleth zones were not sampled during winter months when helicopter access was unavailable; therefore, annual accumulation was not estimated for these sites. However, very low dust fall accumulation, generally below laboratory detection, was observed at these sites during the summer months.

Annual dust fall in samplers at the Mine Site were all predicted to be in the 'high' isopleth (≥50 g/m²/year). Dust fall from sample locations DF-M-01, -02 and -03 all had annual dust fall greater than 50 g/m²/year (Table 7), with the highest dust fall at site DF-M-02 (91.16 g/m²/year), followed by DF-M-01 (77.02 g/m²/year), and DF-M-03 (60.44 g/m²/year) (Figure 9).

Year-round dust fall samplers at Milne Inlet Port Sites DF-P-01 and -05 had annual dust fall deposition rates that were greater than 50 g/m²/year, though pre-project modelling predicted it would fall into the moderate isopleth. The total annual deposition rate at DF-P-01 and -05 were 199.03 g/m²/year and 124.35 g/m²/year, respectively (Table 7). Annual dust fall from Milne Port Sites DF-P-04, -06 and -07 all fell into the moderate isopleth with annual dust fall rates of 21.46, 21.19 and 31.46 g/m²/year, respectively; however, DF-P-04 and -06 were modelled to be in the low isopleth range (Figure 10).

Annual dust fall at the north and south Tote Road crossing locations within 30 m of the road centerline fell within the high isopleth, though they were modelled to fall into the moderate isopleth range (Table 7; Figure 11 and Figure 12). However, dust fall measured at 100 m from the centerline was within the predicted moderate isopleth, as predicted at all sites save DF-RN-06, which had an annual dust fall of 63.81 g/m²/year, slightly exceeding the predicted dust fall. This is a decrease from previous sampling years.

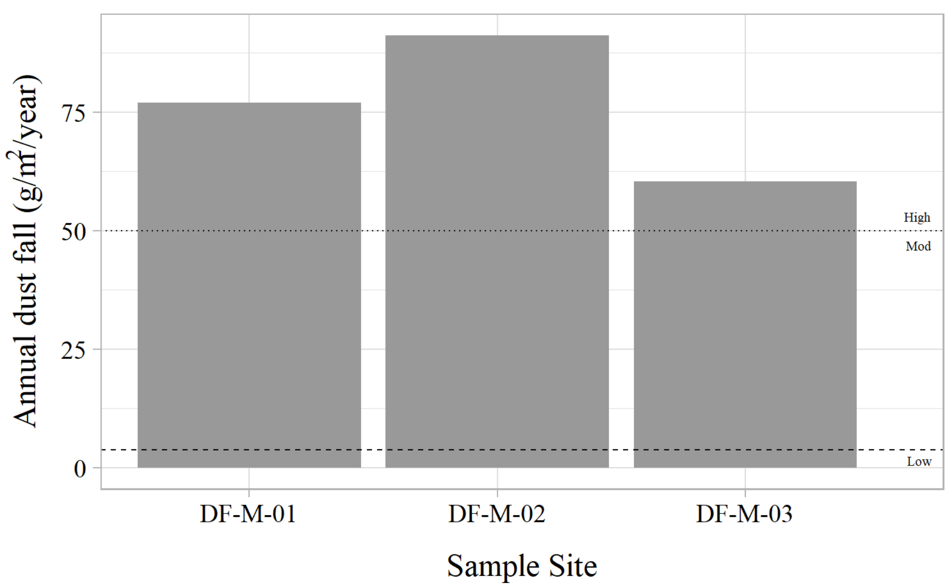


Figure 9 Mine Site annual dust fall for high isopleth sampling stations that were sampled year-round. *Dashed horizontal lines show low, moderate, and high dust isopleth upper limits.*

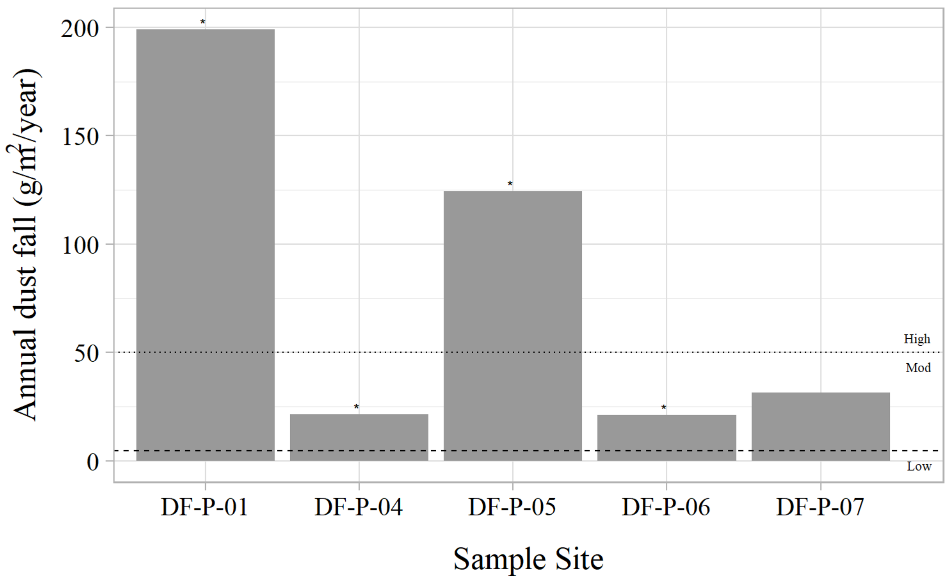


Figure 10 **Milne Port annual dust fall for sampling stations that were sampled year-round.**
Dashed horizontal lines show low, moderate, and high dust isopleth upper limits. The asterisk (*) denotes that the annual dust fall was greater than projected by the predicted isopleth.

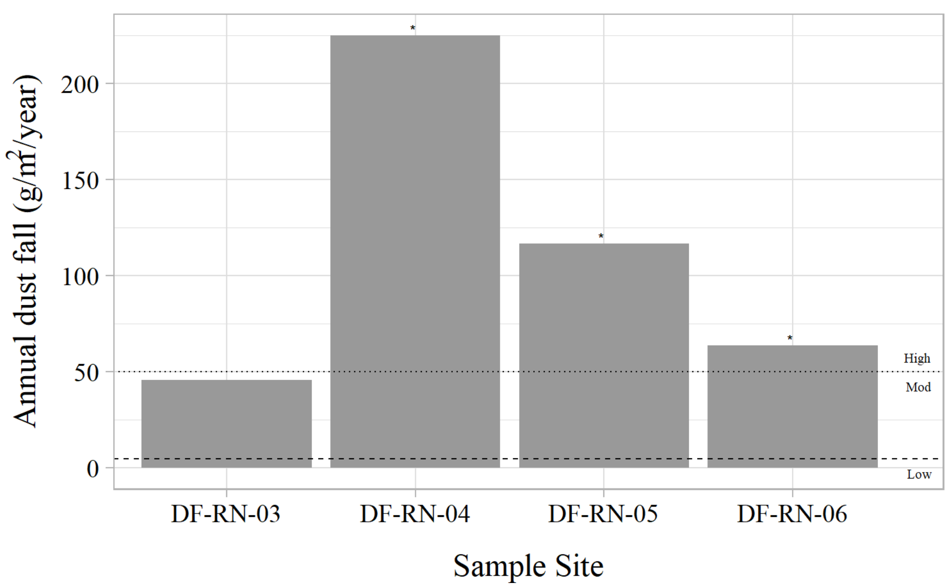


Figure 11 **Tote Road north crossing annual dust fall for sampling stations that were sampled year-round.**
Dashed horizontal lines show low, moderate, and high dust isopleth upper limits. The asterisk (*) denotes that the annual dust fall was greater than projected by the predicted isopleth.

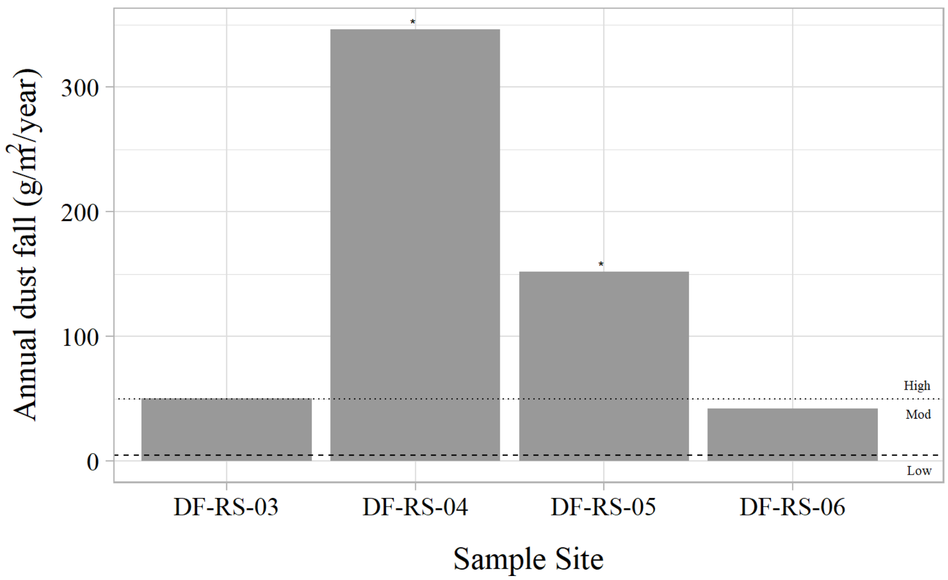


Figure 12 Tote Road south crossing annual dust fall for sampling stations that were sampled year-round. *Dashed horizontal lines show low, moderate, and high dust isopleth upper limits. The asterisk (*) denotes that the annual dust fall was greater than projected by the predicted isopleth.*

Table 7 Annual dust fall accumulation for sites sampled throughout the year. Annual accumulations are reported for the period 09 Jan 2018 to 09 Jan 2019. Sample sites that exceeded the predicted annual dust fall are shaded.

Site	Area	Distance from PDA	Predicted Range [1]	Isopleth Upper Limit	Annual Dust Fall ($g/m^2/year$)
DF-M-01	Mine Site	0	High	N/A [2]	77.02
DF-M-02	Mine Site	0	High	N/A	91.16
DF-M-03	Mine Site	0	High	N/A	60.44
DF-P-01	Milne Inlet Port	0	Moderate	50	199.03
DF-P-04	Milne Inlet Port	0	Low	4.5	21.46
DF-P-05	Milne Inlet Port	0	Moderate	50	124.35
DF-P-06	Milne Inlet Port	0	Low	4.5	21.19
DF-P-07	Milne Inlet Port	0	Moderate	50	31.46
DF-RN-03	Road North	100	Moderate	50	45.71
DF-RN-04 [3]	Road North	30	Moderate	50	224.97
DF-RN-05	Road North	30	Moderate	50	116.59
DF-RN-06 [4]	Road North	100	Moderate	50	63.81
DF-RS-03	Road South	100	Moderate	50	50.51
DF-RS-04	Road South	30	Moderate	50	346.42
DF-RS-05	Road South	30	Moderate	50	151.93
DF-RS-06	Road South	100	Moderate	50	42.01

Notes:

1. Predictions based on pre-Project dust dispersion models.
2. The 'high' range does not have an upper limit; sites modelled in the high category are predicted to have >50 $g/m^2/year$ of total suspended particulate matter (dust fall).
3. Sample bottle for DF-RN-04 in May 2018 was buried in the snow. An interpolated value of 42.26 g/m^2 was used for this missing sample, this was based on the mean of total dust fall at this site in April 2018 (36.0 g/m^2) and June 2018 (48.51 g/m^2).
4. Sample bottle for DF-RN-06 in November 2018 broke during handling. An interpolated value of 6.81 g/m^2 was used for this missing sample, this was based on the mean of total dust fall at this site in October 2018 (12.35 g/m^2) and December 2018 (1.27 g/m^2).

2.3 INTER-ANNUAL TRENDS

2.3.1 SEASONAL DUST FALL

Mine Site — Median daily dust fall at the Mine sites was different between summer and winter and the extent of these seasonal differences changed across years. There was a statistically significant interaction between season and year ($p < 0.001$). Summer dust fall decreased between 2015 and 2018, while winter dust fall increased between 2015 and 2018.

Dust fall in summer 2018 was 4.5 (CI = 1.8 – 11.1) times lower than in 2015 ($p = 0.008$), 5.6 (CI = 2.0 – 15.3) times lower than in 2016 ($p = 0.006$), and 3.2 (CI = 1.3 – 7.8) times lower than in 2017 ($p = 0.07$). There was evidence suggesting that dust fall in winter 2018 was 2.0 (CI = 1.1 – 3.5) times higher than in 2015 ($p = 0.08$). There was no evidence of inter-annual differences in winter dust fall among the other years (all $p > 0.12$).

There was no difference between summer and winter dust fall for 2015 ($p = 0.39$), 2016 ($p = 0.87$) or 2017 ($p = 0.12$). In 2018, median dust fall in summer was 6.5 (CI = 3.1 – 13.6) times lower than dust fall in winter ($p < 0.001$).

Milne Port — Median daily dust fall at the Port sites was different between summer and winter; the extent of these seasonal differences changed across years. There was a statistically significant interaction between season and year ($p < 0.001$). Summer dust fall decreased between 2015 and 2018, while winter dust fall increased between 2015 and 2018.

Dust fall in summer 2017 was 2.0 (CI = 1.2 – 3.3) times lower than in summer 2015 ($p = 0.04$). Dust fall in 2018 was 2.6 (CI = 1.6 – 4.3) times lower than in 2015 ($p = 0.002$) and 2.1 (CI = 1.2 – 3.6) times lower than in 2016 ($p = 0.05$). In 2016, winter dust fall was 2.1 (CI = 1.5 – 3.0) times higher than in 2015 ($p < 0.002$). In 2017, winter dust fall was 2.2 (CI = 1.5 – 3.1) times higher than in 2015 ($p < 0.001$). In 2018, winter dust fall was 3.4 (CI = 2.4 – 4.8) times higher than in 2015 ($p < 0.001$), 1.6 (CI = 1.1 – 2.2) times higher than 2016 ($p = 0.05$), and 1.5 (CI = 1.1 – 2.2) times higher than in 2017 ($p = 0.08$).

In 2015, summer dust fall was 2.7 (CI = 1.7 – 4.1) times higher than in winter ($p < 0.001$). In 2016, there was no difference between dust fall in summer and winter (p 0.95). In 2017, summer dust fall was 1.6 (CI = 2.5 – 1.5) times lower than in winter ($p = 0.03$). In 2018, summer dust fall was 3.2 (CI = 5.0 – 2.1) times lower than in winter ($p < 0.001$).

North Crossing — Median daily dust fall at the Road North sites was different between summer and winter, the extent of these seasonal differences changed across years. There was a statistically significant interaction between season and year ($p < 0.001$). Summer dust fall decreased between 2015 and 2018. Winter dust fall increased slightly between 2015 and 2018, however, there was not strong statistical support for this trend.

Summer dust fall in 2017 was 3.5 (CI = 1.7 – 7.0) times lower than it was in 2015 ($p = 0.005$). Summer dust fall in 2018 was 5.8 (CI = 2.9 – 11.4) times lower than it was in 2015 ($p < 0.001$) and 3.9 (CI = 1.8 – 8.5) times lower than it was in 2016 ($p = 0.003$). There was weak evidence that winter dust fall in 2018 was 1.7 (CI = 1.1 – 1.7) times higher than in 2016 ($p = 0.09$); there were no other statistically significant differences among years for dust fall in winter (all $p > 0.10$).

In 2015, summer dust fall was 7.6 (CI = 4.2 – 13.8) times higher than in winter ($p < 0.001$). In 2016, summer dust fall was 5.6 (CI = 2.8 – 10.8) times higher than in winter ($p < 0.001$). In 2017 and 2018, there was no significant difference between dust fall in summer and winter (2017: $p = 0.22$; 2018: $p = 0.47$).

South Crossing — Dust fall at the Road South sites was different between summer and winter and the extent of these seasonal differences changed across years. There was a statistically significant interaction between season and year ($p < 0.001$). Summer dust fall was highest in 2015 and 2016, and lowest in 2018. There were no significant inter-annual differences in winter dust fall.

Summer dust fall in 2018 was 3.5 (CI = 1.7 – 7.0) times lower than it was in 2015 ($p = 0.003$) and 3.6 (CI = 1.6 – 7.8) times lower than it was in 2016 ($p = 0.009$). There were no differences in winter dust fall across years (all $p > 0.18$).

In 2015, summer dust fall was 9.9 (CI = 4.9 – 19.8) times higher than in winter ($p < 0.001$). In 2016, summer dust fall was 12.5 (CI = 5.8 – 26.7) times higher than in winter ($p < 0.001$). In 2017, the difference between summer and winter dust fall decreased; summer dust fall was 4.5 (CI = 2.2 – 9.0) times higher than in winter ($p < 0.001$). In 2018, there was no significant difference between dust fall is summer and in winter ($p = 0.12$).

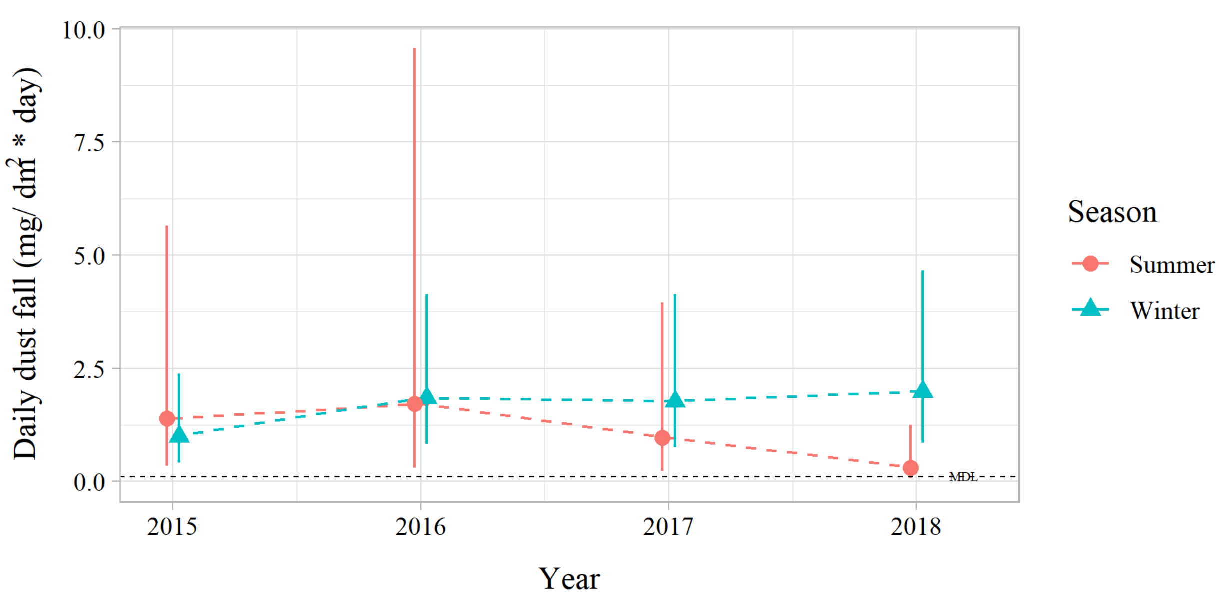


Figure 13 Inter-annual differences in dust fall at the Mine sites in summer and winter.
Points represent median dust fall, and vertical error bars are 95% confidence intervals. The dashed lines highlight changes in seasonal dust fall across years. Medians and confidence intervals were calculated on a log scale; therefore, the confidence intervals are asymmetrical on the linear scale shown in this graph.

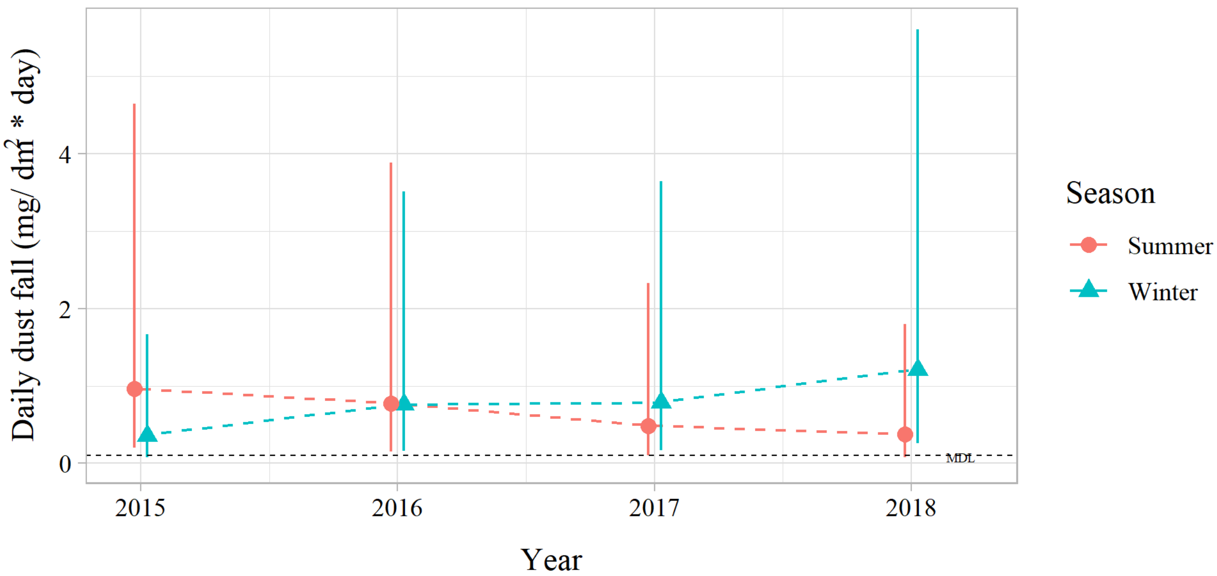


Figure 14 **Inter-annual differences in dust fall at the Port sites in summer and winter.**
Points represent median dust fall, and vertical error bars are 95% confidence intervals. The dashed lines highlight changes in seasonal dust fall across years. Medians and confidence intervals were calculated on a log scale; therefore, the confidence intervals are asymmetrical on the linear scale shown in this graph.

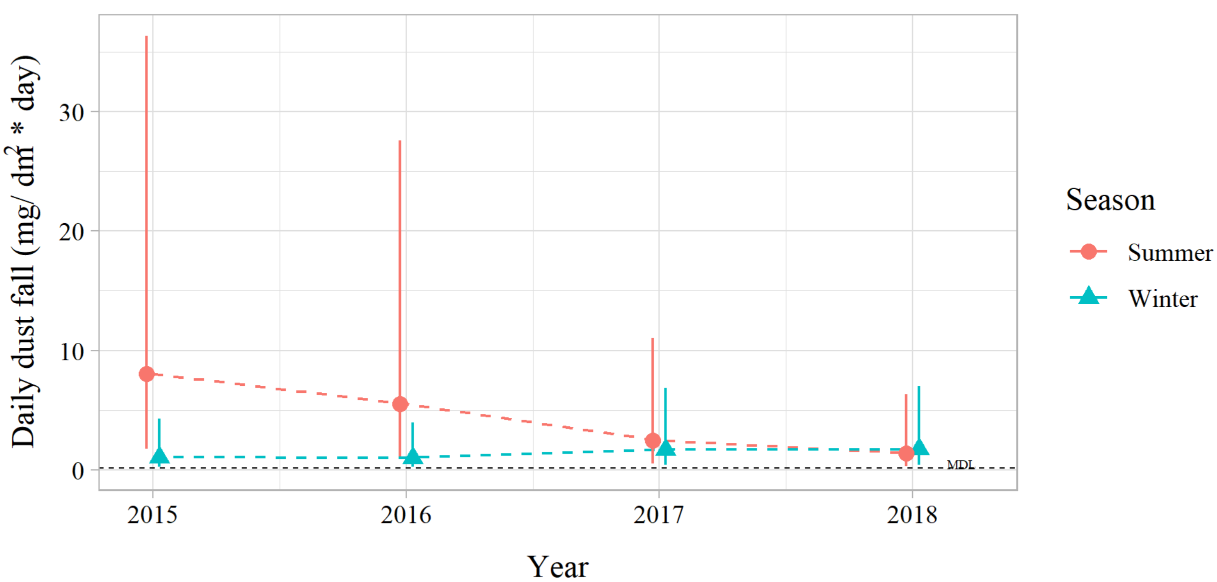


Figure 15 **Inter-annual differences in dust fall at the North Road sites in summer and winter.**
Points represent median dust fall, and vertical error bars are 95% confidence intervals. The dashed lines highlight changes in seasonal dust fall across years. Medians and confidence intervals were calculated on a log scale; therefore, the confidence intervals are asymmetrical on the linear scale shown in this graph.

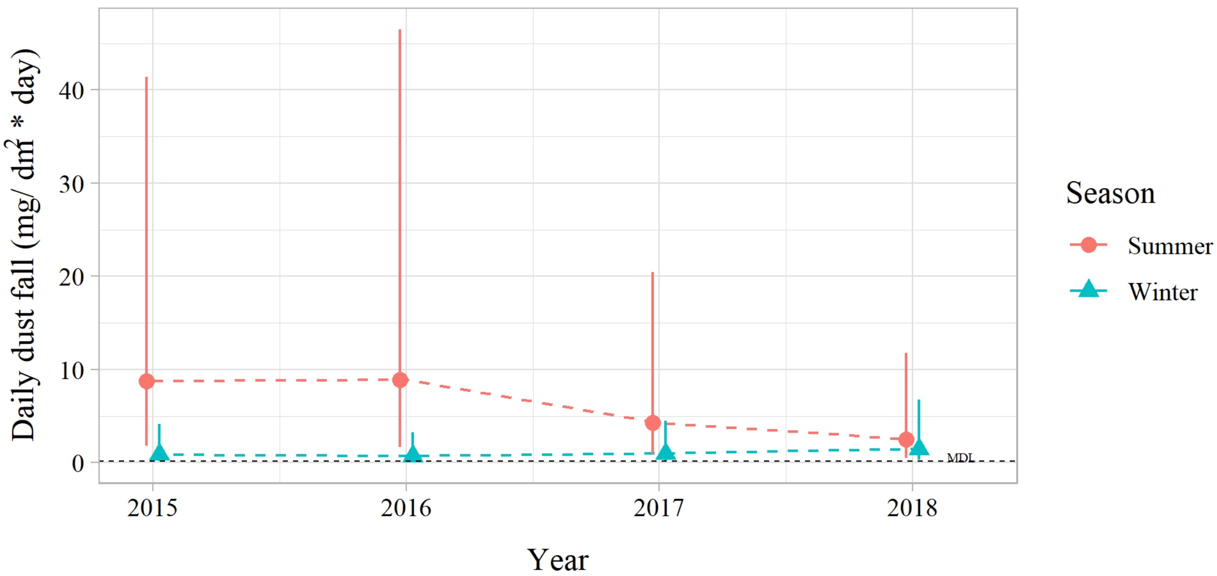


Figure 16 **Inter-annual differences in dust fall at the South Road sites in summer and winter.** *Points represent median dust fall, and vertical error bars are 95% confidence intervals. The dashed lines highlight changes in seasonal dust fall across years. Medians and confidence intervals were calculated on a log scale; therefore, the confidence intervals are asymmetrical on the linear scale shown in this graph.*

2.3.2 TOTAL ANNUAL DUST FALL

Year over year trends can be reviewed for all year-round monitoring stations. In general, dust fall across the Project area increased from 2014 through 2016 as mine production increased, however, 2016 and 2017 showed a levelling off and subsequent decrease as increasing dust fall mitigation and suppression actions are completed.

All Mine Site dust fall monitoring sites saw a decrease in dust fall in 2018 compared with 2017 and 2016 (Figure 17).

There was a decrease in dust fall at Milne Port dust fall monitoring site DF-P-01 in 2018 when compared with 2017. Slight decreases in dust fall were also noted at DF-P-04, -06 and -07. Only at site DF-P-05 was there minimal increase over 2017 (Figure 17).

Dust fall trends along the Tote Road were similar at both the north and south crossing dust fall monitors. There was a decrease in dust fall noted at the 100 m distant monitors on both sides of the road at both the north and south crossings (DF-RN-03 and -06 and DF-RS-03 and -06; Figure 1). There were greater decreases at the dust fall monitors 30 m distant from the road, particularly at the south crossing (DF-RS-04 and -05; Figure 1). This decrease in dust fall along the Tote Road is likely associated with effective dust suppression activities along the Tote Road combined with favourable cool and wet summer conditions.

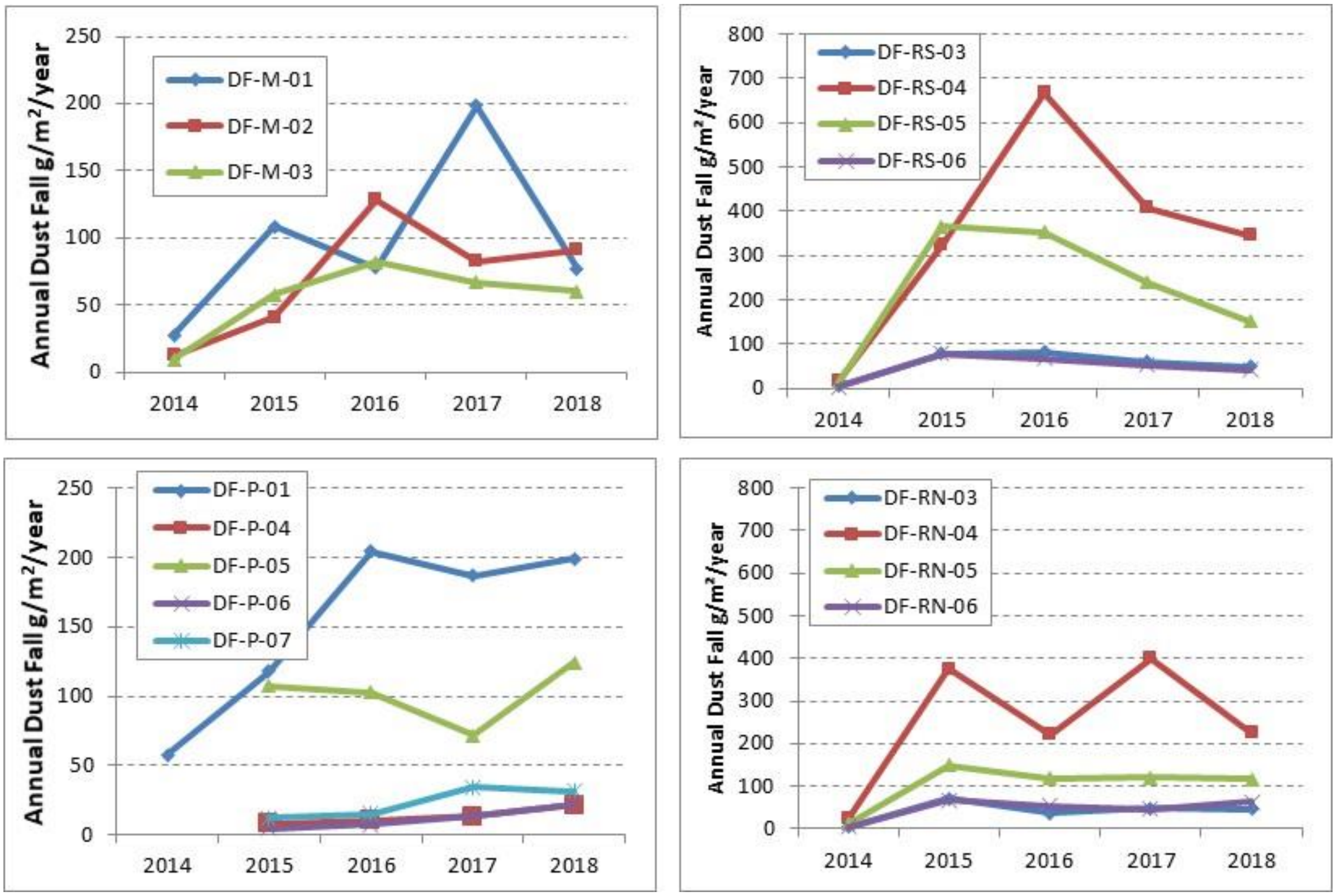


Figure 17 **Annual dust fall trends throughout the Project area; note the y-axis scales are not consistent across the plots.**

2.4 DUST FALL SUMMARY

- Dust fall monitoring data is compared to predictions that were made in the Project's Final Environment Impact Statement FEIS and is important in the context of effects to other indicators including potential changes to vegetation and soil.
- Climate data collected in 2018 was compared with climate data collected as part of the project baseline data collection (2005–2010). Air temperature indicated that there was a slightly cooler summer with a slightly warmer winter in 2018. The number of days with rainfall at Milne Port was higher than during baseline data collection, while at Mary River there was an average number of days with rainfall; however, on-site rain gauge malfunctions likely resulted in an underestimate of precipitation through summer 2018.
- There was a slight increase in the average daily number of ore haul transits in 2018 compared with 2017. Other non-haul truck traffic had an annual average of 37.3 vehicle transits per day, which was only slightly higher than in 2017 (32.3 vehicle transits per day).

- Annual dust fall at the Mine Site sample locations currently falls within predicted levels; in 2018 summer dust fall was lower than winter, a trend driven by a decrease in summer dust fall.
- Dust fall at Milne Port continued to exceed predicted threshold levels at all sites except DF-P-07. As seen at Mine Site dust fall monitoring locations in 2018 dust fall in summer months was lower than winter; since 2016 dust fall deposition in the summer has decreased while dust fall deposition in the winter months has increased.
- Dust fall associated with the Tote Road at both the north and south crossing was less in 2018 than in 2017. Similar trends were noted at both the north and south crossings. The greatest decrease in dust fall was at the monitors 30 m distant from the road. There was a smaller decrease in dust fall noted at the 100 m distant monitors. This decrease was determined to occur mostly in summer months, as dust fall deposition in the summer has decreased since 2016. Conversely, dust fall deposition in winter months has remained constant since 2016.
- Dust fall in 2018 was measured to be at or below laboratory detection at all dust fall monitors one kilometre distant from the Project Development Area.
- Dust fall continues to decrease at most year-round sampling locations throughout the Project area. This decrease may be due to increased effectiveness of dust suppression activities, particularly along the Tote Road, combined with favourable cool, wet summer conditions.

3 VEGETATION

The Project's FEIS identified potential effects on vegetation abundance, diversity and health (Baffinland Iron Mines Corporation 2012) as a potentially Project-related effect. Overall effects to vegetation abundance and diversity were predicted to be not significant with a high level of confidence, while effects on vegetation health were predicted to be limited, with moderate confidence due to uncertainties on the effects of dust, metals and emissions on local vegetation. To address these limitations, data collection for long-term vegetation monitoring was completed in 2018 for the following programs:

- Dust fall monitoring (Section 2); and
- Vegetation abundance monitoring.

Vegetation and soil base metal monitoring was not conducted in 2018 and is scheduled for 2019.

3.1 VEGETATION ABUNDANCE MONITORING

To meet the terms and conditions required by the NIRB Project Certificate, Baffinland committed to establishing a long-term monitoring program to study potential changes to vegetation abundance used as caribou forage within the RSA. This commitment directly relates to the following conditions:

- Project Condition #36 — *The Proponent shall establish an on-going monitoring program for vegetation species used as caribou forage (such as lichens) near Project development areas, prior to commencing operations.*
- Project Condition #50 *and Project Commitment #67 also address these limitations or relate to the reporting requirements for the vegetation abundance monitoring program.*

To meet these monitoring commitments, a long-term vegetation monitoring program was initiated in 2014. The objective of the vegetation abundance monitoring program is to:

- Measure percent plant cover and plant group composition of available caribou forage within the RSA to track potential changes at varying distances from the edge of the PDA through long-term monitoring.

Vegetation monitoring data was collected under the initial study design for four years. Vegetation data was collected for a total of 15 balanced transects and six reference sites according to the following schedule:

- 2014 — Transects one to eight and reference sites one to three
- 2015 — No vegetation monitoring occurred
- 2016 — Transects one to fifteen (transects four, five and eight were only sampled at the 1,200 m distance class) and reference sites one to six (excluding reference site five)
- 2017— Transects one to fifteen and reference sites one to six
- 2018 — Transects one to fifteen and reference sites one to six

In 2018, a trend analysis was conducted to assess potential changes in percent plant cover and plant group composition with the relationship of distance to Project infrastructure and treatment effect between open and closed plots (to control for the effect of herbivory).

Inter-annual differences in total percent ground cover, total percent canopy cover, and plant group composition were small in magnitude and consistent across all distance classes and treatments except for a few interactions between year and distance class that were weak and inconsistent. We conclude that differences were driven by natural variation in plant cover among years rather than a Project-related effect in the first four years of monitoring.

A repeatability assessment was also done in 2018 to evaluate the sampling method used to measure vegetation as part of the vegetation abundance monitoring program. The objective of the study was to evaluate the repeatability of the point quadrat method to determine if percent plant cover estimates were repeatable among years. This study determined that measurements of all plant groups (except for graminoids) using the point quadrat method were highly repeatable among years, confirming that the point quadrat method is an objective and defensible method to monitor vegetation abundance in the Project area.

3.1.1 METHODS

3.1.1.1 Vegetation Abundance Monitoring

The study design and sample site selection were based on a review of relevant literature, and input from the Government of Nunavut Department of Environment staff in their role on the TEWG. Information considered when developing the vegetation monitoring program included dust fall modeling (Baffinland Iron Mines Corporation 2013), northern Canadian vegetation habitat types (Olthof et al. 2009), preferred caribou forage (summarized in Baffinland Iron Mines Corporation 2012) and other literature (Spatt and Miller 1981, Walker and Everett 1987, Walker 1996, Auerbach et al. 1997). Where feasible, recommendations from the Government of Nunavut (2014) and Parks Canada (Hudson and Ouimet 2011) were included in the study design.

A distance gradient approach was used based on the assumption that vegetation close to Project disturbance would likely be more affected than vegetation further from disturbance areas. To assess potential changes in vegetation associated with Project disturbance (e.g. dust and emissions), vegetation sampling occurred at specific distances (30, 100, 750 and 1,200 m) from the edge of the PDA. The four distance classes were chosen based on a review of the relevant available literature and dust isopleth modelling (Baffinland Iron Mines Corporation 2013).

The monitoring program follows a Before-After-Control-Impact-design (BACI) (Bernstein and Zalinski 1983, Stewart-Oaten et al. 1992) with a stratified random paired/block design. The BACI design is common for impact assessments where the goal is to determine whether there is a statistically significant and biologically meaningful difference between baseline and disturbance conditions (e.g., changes to the abundance of a species). This design involves pairing control and impacted sites where samples are taken simultaneously at both sites before and after a disturbance occurs.

To reduce natural variability in vegetation cover associated with different habitat types and to allow for meaningful statistical comparisons, all sites were located within one habitat type. The habitat type chosen was based on the following factors:

- Relative abundance of habitat type (as summarized in the Project's wildlife baseline report – Appendix 6F, Baffinland Iron Mines Corporation 2012);
- Relative habitat use by caribou (a mixture of the Resource Selection Probability Function model results in the Project's wildlife baseline report and the energetics model presented in Russell (2014); and
- Likelihood of habitat type containing high-quality caribou forage (Appendix 6F, Baffinland Iron Mines Corporation 2012).

The habitat type selected for vegetation abundance monitoring was the Moist to Dry Non-Tussock Graminoid/Dwarf Shrub type (Northern Land Cover, Olthof et al. 2009), one of the more common habitats in the RSA (Photo 2). The North Baffin Island Caribou herd does not appear to select one habitat type over another, but do exclude areas where vegetation cover is relatively low (Russell 2014). The Moist to Dry Non-Tussock Graminoid/Dwarf Shrub vegetation habitat type is considered high-quality caribou forage, given that it contains lichen, grasses, sedges, forbs and deciduous shrubs. These plant groups are considered important food items for caribou in summer when plant nutritional value and digestibility is high, as well as in winter when food availability is mainly limited to lichen.

The vegetation abundance monitoring program involved the establishment of long-term vegetation plots. Plots were situated along 15 transects radiating out from the Mine Site (six transects), Tote Road (five transects) and Milne Inlet (four transects). In addition, six control (reference) sites were established within the RSA, approximately 20 km from the Project footprint. In total, 66 sample sites were located within the RSA (Map 4). Some pre-selected site locations had to be moved to locate the site within the selected habitat type. To prevent pseudo-replication and ensure independence between sites, all transects were spaced a minimum of 200 m apart with the majority of transects spaced 500 m apart. Each transect extended perpendicular from the Project disturbance footprint. Along each transect, four sample sites were located at 30 m, 100 m, 750 m and 1,200 m from the edge of the Project footprint.

To exclude potentially confounding effects of grazing (e.g., from caribou and small mammals) exclosure (i.e., closed plots consisting of a cage) and open plots were used to account for herbivory effects. In response to recommendations made by the Government of Nunavut, all 1 x 1 m cages from 2014 were replaced with 2m x 2 m cages in 2016 to reduce the influence of edge effects associated with the cages. Each sample site consisted of one closed plot and one open plot. To account for within-site variability in vegetation cover, some sites included a second open plot, for a total of three plots at one site. Of the 66 sample sites, 47 sample sites had one closed plot associated with an open plot and 19 sites had one closed plot associated with two open plots (all three control sites had three plots each). In total, 151 1 m x 1 m plots were sampled. To reduce bias, individual plots at each site were located close to the center of the polygon. Plots within a site were spaced 3 m apart to provide replication and reduce within site variability. At sites where 1 x 1 m cages were replaced with 2 x 2 m cages, plots were spaced 2.5 m apart. Figure 18 provides a schematic illustration of sample site and plot locations along a transect. At the time of plot establishment none of the sites selected for this study showed signs of herbivory. A table of all plots, transects, distances, treatments and coordinates is provided in APPENDIX A — Vegetation Abundance Monitoring Site Locations.

Closed-plot cages were constructed from sturdy, weather-resistant materials for long-term durability and to prevent caribou grazing from above and small mammal grazing at ground level. Galvanized rebar was used to mark the measuring plot and corner posts for the cage, half-inch galvanized hex wire along all four sides and one-inch galvanized poultry netting for the roof. Galvanized wire was used to secure the roof and galvanized nails with weather resistant rope were used to secure and stake the cage to the ground. Completely enclosed, the cage stands approximately 1 m in height and covers an area of 2 m x 2 m. The hex wire was flanged at the base and piled with rocks to exclude small mammals from entering below the cage from the edges. The cage tops were designed to be removable along three sides to allow for vegetation monitoring at plots inside the cages during future sampling events. The roof can be re-secured using galvanized wire. A typical site in terms of plot layout, topography, vegetation characteristics and closed plot cage construction is illustrated in Photo 3.

Each monitoring plot was given a unique identifier code. The plot labelling scheme was based on the transect number, distance class, and type and number of plots at a given site. Closed plots were denoted with an "X". The first open-plot at a site was represented by an "A"; the second, if present, was labelled with a "B". For example, plot T1D30X represents Transect 1, distance class 30 m and it is a closed plot.

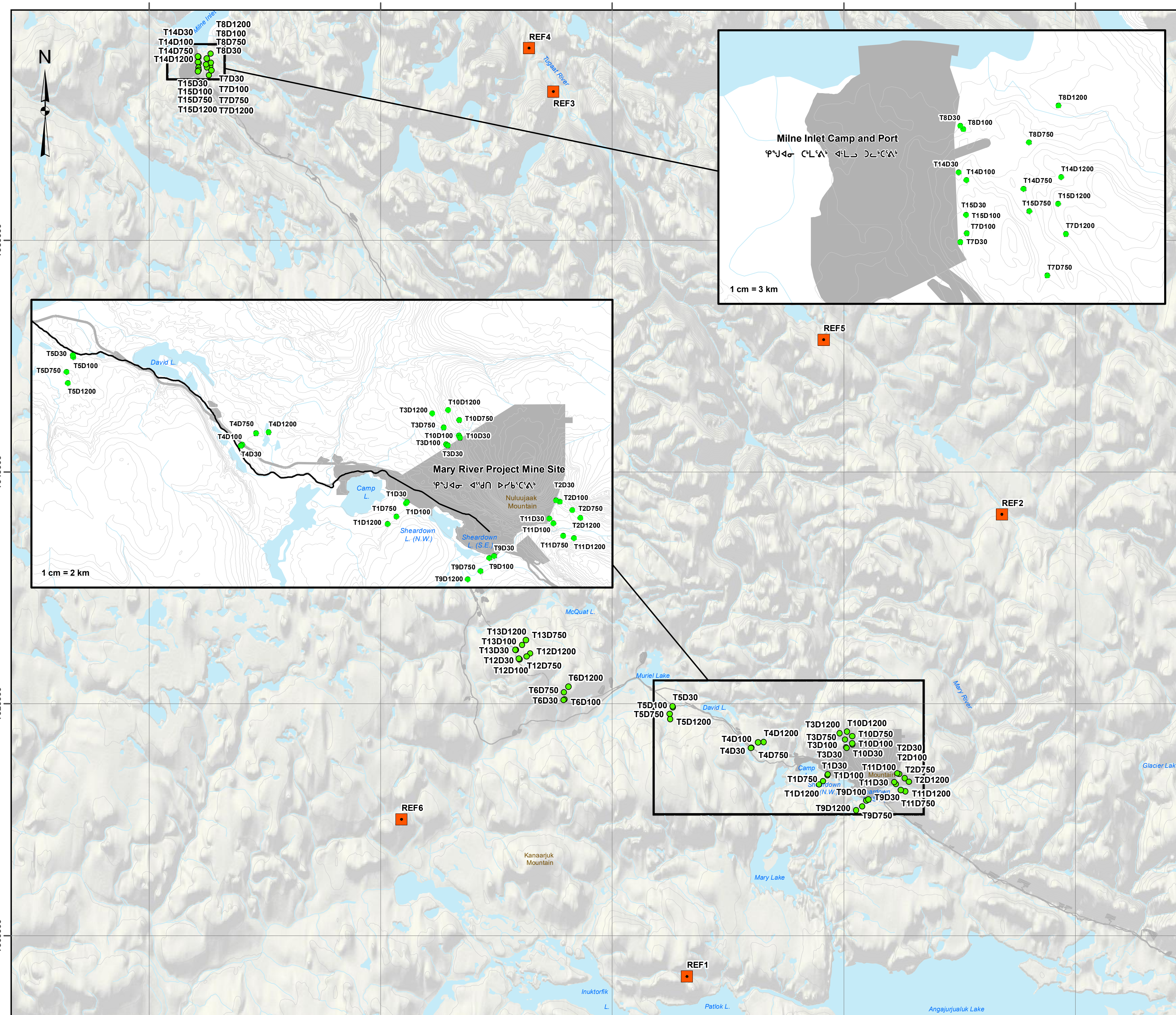
Vegetation abundance monitoring plots (both open and closed) were 1m x 1 m square and were sampled using the point quadrat method. Plot dimensions and design were based on standards used by the International Tundra Experiment (ITEX; Walker 1996). The point quadrat method is considered one of the most objective and repeatable methods for monitoring vegetation (Levy and Madden 1933, Goodall 1952, Bonham 2013) and is the recommended method for assessing vegetation changes in tundra plant communities (Molau and Mølgaard 1996). It is a quantitative method that has been widely recommended for measuring vegetation abundance and is suitable for long-term monitoring (Stampfli 1991, Elzinga et al. 1998, Hudson and Henry 2009).

The point quadrat method involves a square 1 m x 1 m metal plot frame with 100 fixed measurement locations spaced 10 cm apart across the frame (Figure 19). In traditional studies, a long pin is dropped through the frame at each of the 100 locations; however, the quadrat frame in this study uses a laser instead of pins. The laser was moved and shot vertically downwards at each of the 100 marked locations along the frame. The first plant species that was touched or "hit" by the laser in the canopy layer and in the ground layer were tallied. Figure 20 provides a schematic illustration of the laser "hitting" the first plant in the canopy layer and then the first plant in the ground layer within a sampling plot. Percent plant cover was determined by summing the total number of "hits" for each species in each of the canopy and ground layers. Plant species were also categorized into respective plant groups to determine percent plant group cover.

The quadrat (i.e., plot) frame was set above the ground on four legs, two of which were permanent rebar posts marking the plot location (Photo 4). The rebar corner posts allow the frame to be set up in the same location year after year for repeatable measurements. All measurements began at the corner of the frame with the thicker of the two rebar pieces, moving from one side of the frame to the other and ended on the side of the plot with the skinny rebar post. The frame was levelled and positioned above the ground from 15–45 cm depending on the slope. The height of the frame had no effect on the diameter of the laser projecting onto the vegetation (~2 mm) (Photo 5).

Percent plant cover by plant group was used as the measure of vegetation abundance. Percent plant cover was measured using the point quadrat method with a total of 100 sampling points each for canopy cover and ground cover per plot. This method is widely used by ITEX for measuring various vegetation abundance measures (Walker 1996). Plant composition was assessed by tallying all species encountered and then grouped into broad vegetation groups (Molles and Cahill 2008). The plant groups selected for this study coincide with those used in the caribou energetics model (Russell 2014) and include deciduous shrubs, evergreen shrubs, forbs, graminoids, moss and lichen. Standing dead litter was also included as important winter forage that provides nutritional balance to caribou winter diet (Heggberget et al. 2002). Dead ground litter, un-vegetated substrates including bare ground, rock or gravel and cryptobiotic soil crusts were recorded but excluded from the percent cover values because these do not represent useable forage for caribou.

Photo 2 Example of the Moist to Dry Non–Tussock Graminoid/Dwarf shrub vegetation habitat type in the Mary River RSA selected for the vegetation abundance monitoring program.



LEGEND ᑐᑭᓯᒋᐊᕐᑕ

Vegetation Abundance Monitoring Samping Site [1]

- REF 1 — Reference site
- T7D1200 — Transect site
- Topographic contour (20m interval)
- Potential Development Area
- Regional Study Area

[1] Vegetation Abundance: Transect Site Nomenclature

Transect #
T1D30
Distance Class (m)

NOTES ᖃᐅᔨᒪᔭᑦᓴᐃᑦ

Map Projection: North American Datum UTM Zone 17N.

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2 4 8 12 16 20 Km

Baffinland Iron Mines Corporation

Vegetation Abundance Monitoring Sites within the RSA, 2014-2018

EDI

Date: 10/25/2018

MAP 4

Path: S:\Data\Project_Data\Baffinland_Spatial\2018_SpatialData\Mapping\Reporting\MonitoringReport_20181022\Map4_VegAbundance.mxd

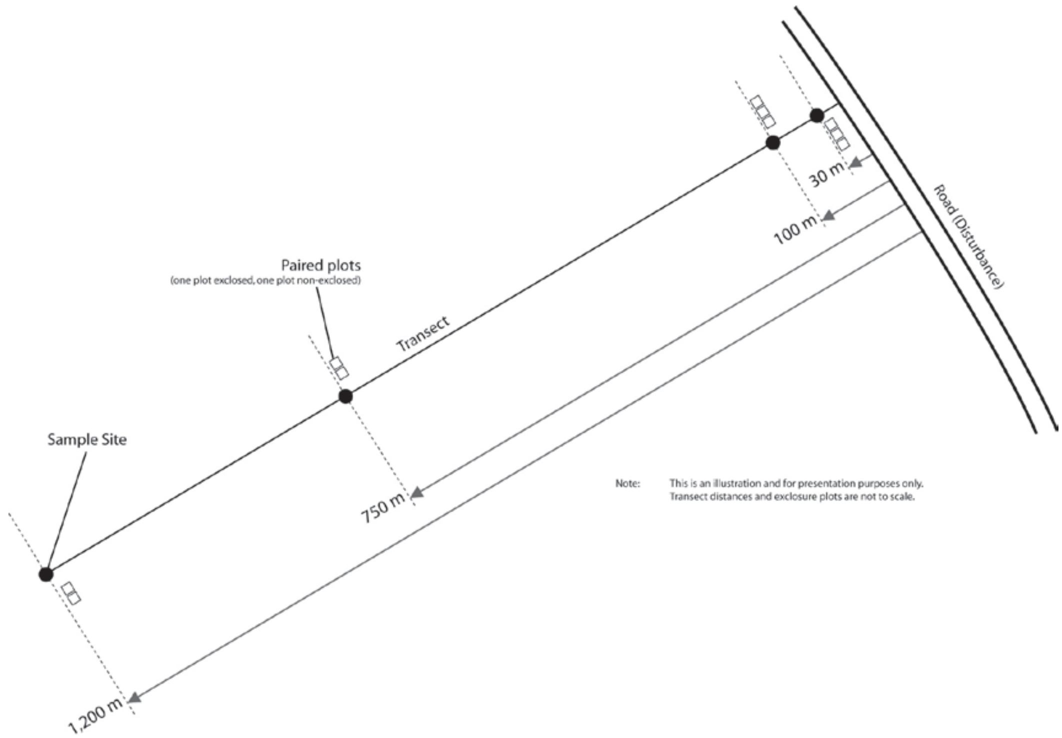


Figure 18 Schematic diagram showing the location of sample sites and plots along a transect.

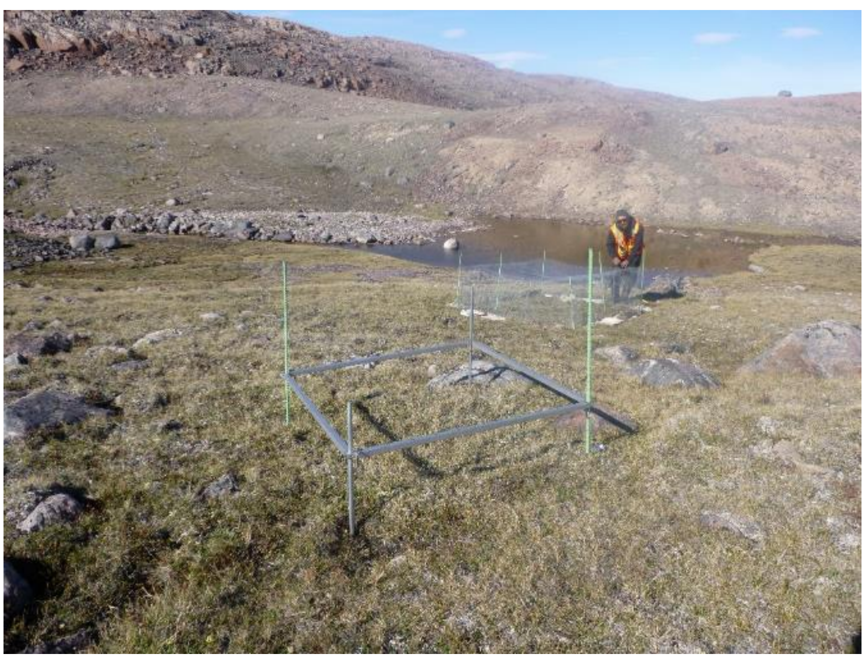


Photo 3 Representative site photo of general plot layout and site conditions.
This is site T14D750 with one closed plot and one open plot located at Milne Inlet, 20 July 2018.

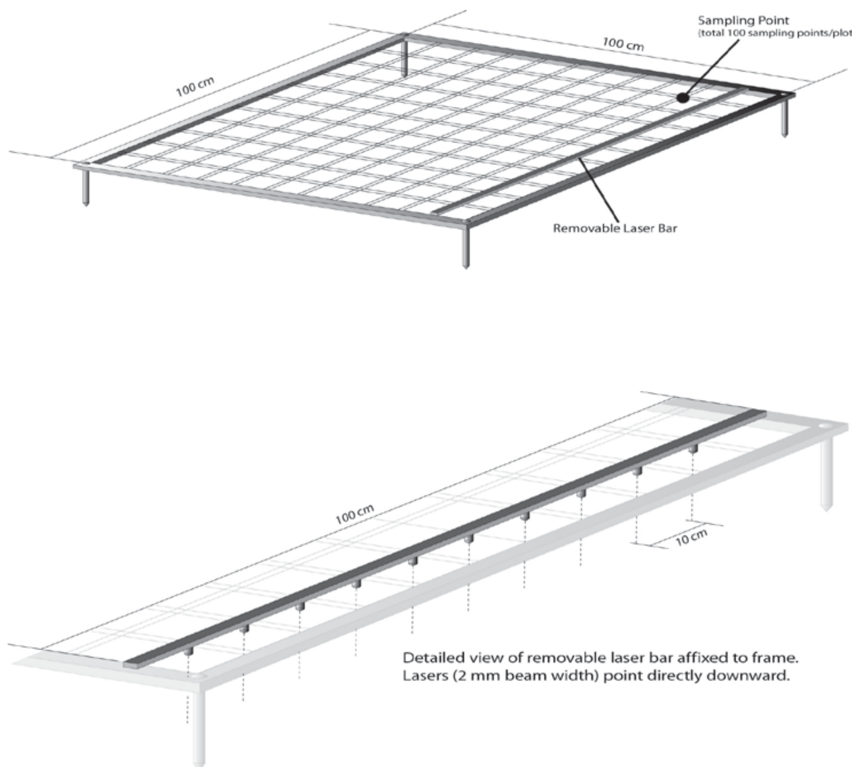


Figure 19 Illustration of the point quadrat frame used to measure percent plant cover.

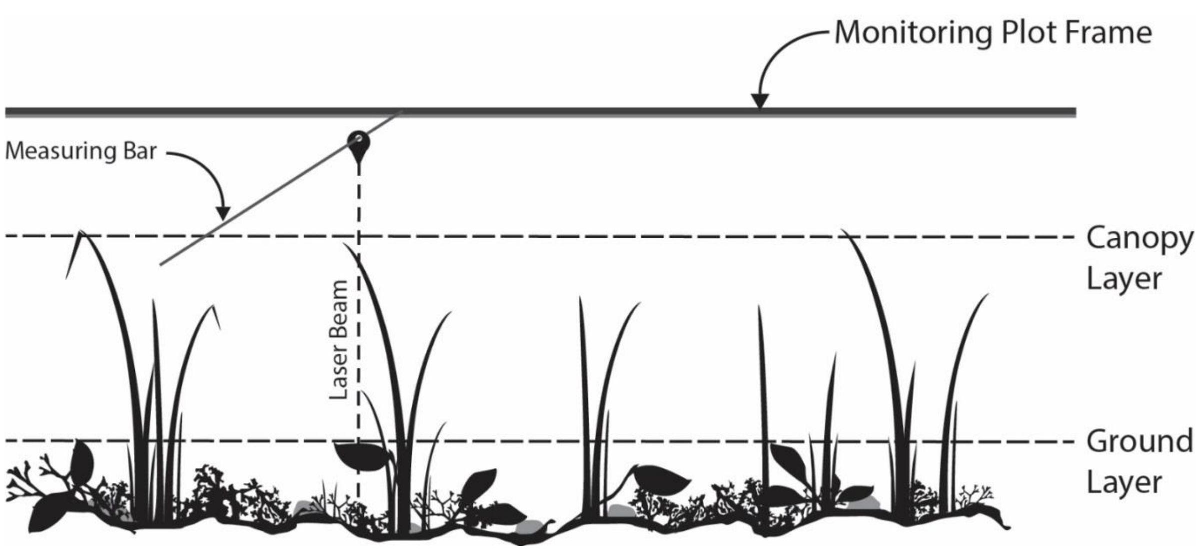


Figure 20 Schematic diagram of canopy and ground cover.

Showing the laser beam of the monitoring plot frame "hitting" the first plant in the canopy layer and then the first plant in the ground layer.

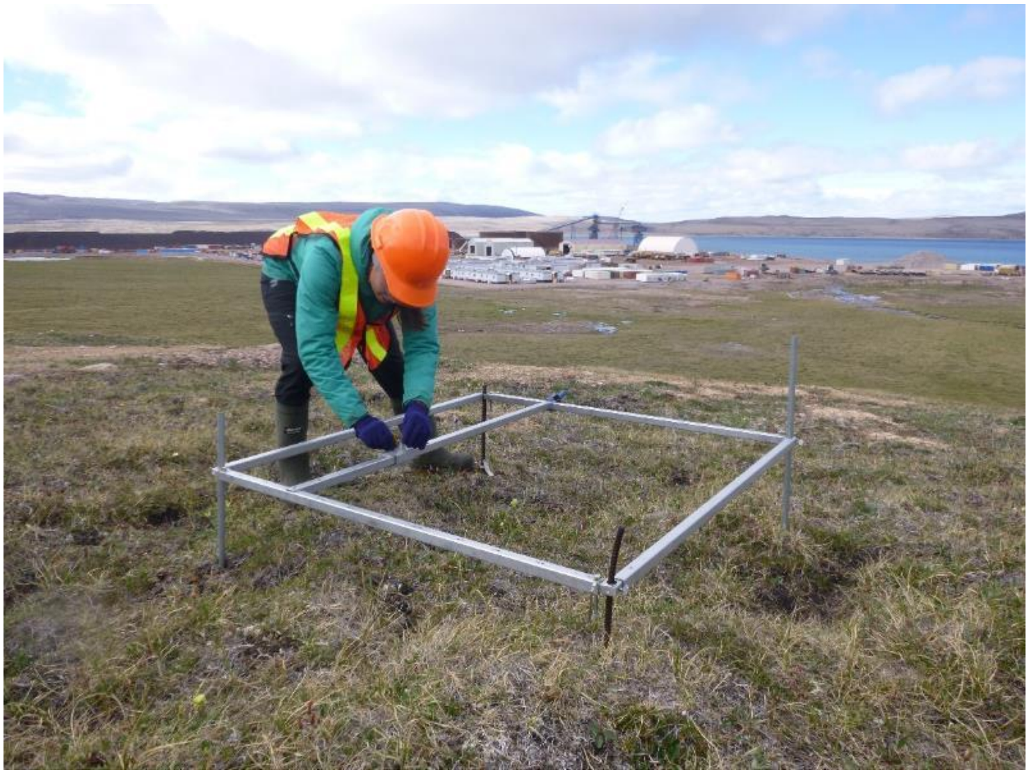


Photo 4 Measuring plot frame erected above the vegetation during sampling, 21 July 2018.

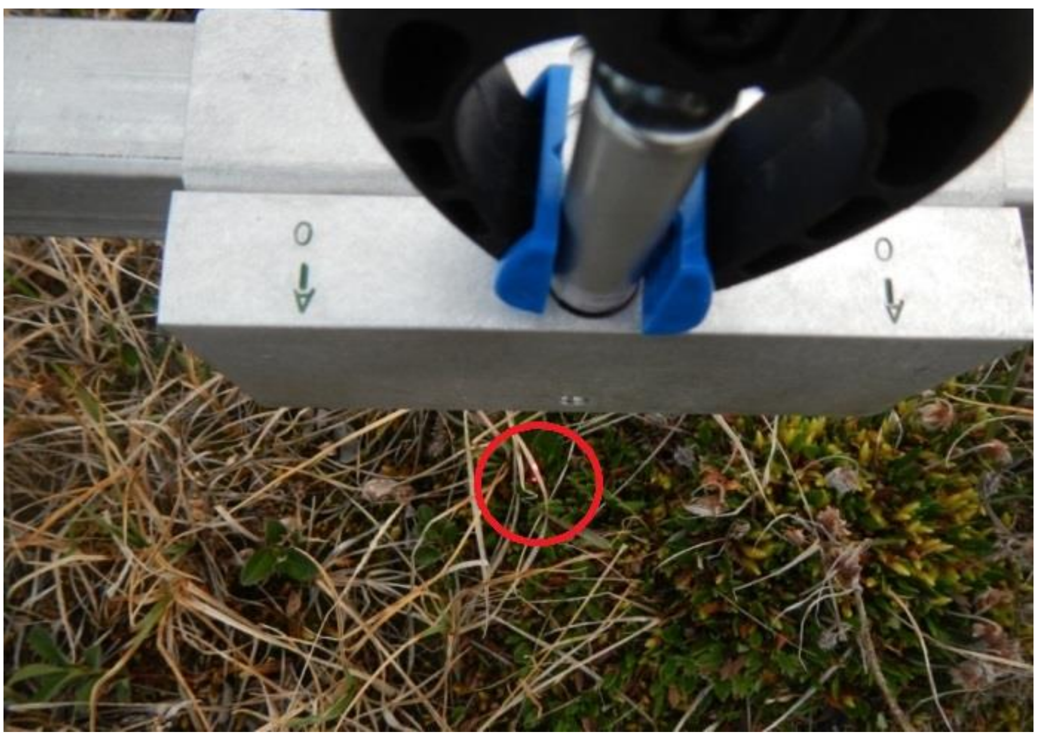


Photo 5 A view showing the diameter of the laser projecting onto the vegetation (2 mm), 27 July 2014.

Analytical Methods — Data were analyzed to investigate the relationship among years in vegetation cover and composition to distance class, while accounting for the potential effect of herbivory (closed- vs. open-plots). An emphasis was placed on caribou forage, such as lichen. Data analyzed included 1) total ground cover, 2) total percent canopy cover and 3) percent cover by plant group.

Since the variability in the individual species data was high, percent plant cover for ground and canopy layers was divided by general plant groups (i.e., deciduous shrubs, evergreen shrubs, forbs, graminoids, moss, and lichen). The percent cover of each plant group was first quantified by adding up all the "hits" from the laser for a plant group within a plot. This was done separately for the ground cover and canopy cover layers. The total number of "hits" within a plot represented overall percent plant cover.

Linear mixed effects models were used to test for differences in total ground cover, total canopy cover and plant group cover. Models included three main effects for year, distance class and plot treatment (i.e. closed- vs. open-plots), and all interactions between these effects. Plots nested within sample sites were included as random effects to account for repeated measurements of the sample plots over multiple years and the possibility that plots from the same sample site were more like one another than plots from different sampling sites. Percent cover values were logit transformed to create a continuous variable with an approximately normal distribution (Warton and Hui 2011). Not all plant groups were present in all plots; therefore, a value of 0.005 was added to plant group values prior to transformation (Warton and Hui 2011).

All estimates were back-transformed to the original scales and are reported as average plant cover with 95% confidence intervals. F-tests were used to determine the statistical significance of model parameters. Residual plots were visually examined to confirm that models met the assumptions of normality and equality of variance. All analyses were performed using R, version 3.3.1 (R Core Team 2018). Mixed effects models were run using the 'nlme' package (Pinheiro et al. 2016). Pairwise comparisons within groups and confidence intervals were calculated using the 'lsmeans' package (Lenth 2014).

3.1.1.2 Evaluation of Vegetation Abundance Monitoring Methods

To successfully monitor vegetation abundance, the method used must be able to detect small changes in percent plant cover and composition (Godínez-Alvarez et al. 2009). The ability to detect small changes depends on the precision of the measurements, where measurements with high precision are less variable and more repeatable (Brady et al. 1995, Elzinga et al. 2001). Studies have shown that the point quadrat method (described above in Section 3.1.1.1) is an inherently objective and repeatable method for sampling percent plant cover and composition when the objective is to obtain information on plant groups (i.e., lichen) not individual species (Buckner 1985).

A repeatability study was conducted in 2017 and 2018 at previously established vegetation abundance monitoring sites in the Project area. Sites were randomly selected to be remeasured by returning to the site later the same day or the following day. Plots were remeasured using the point quadrat method and by following the same protocol described above in Section 3.1.1.1.

Analytical Methods — Data were analyzed to evaluate the repeatability of vegetation abundance monitoring methods using the point quadrat method. Repeatability is a standard approach to quantify measurement error for repeated measurements on the same entity, while controlling for other sources of variation that may be introduced through the measurement process. (Wolak et al. 2012, Stoffel et al. 2017). Data analyzed included percent cover by plant group for the ground cover and canopy cover layers.

Statistically, repeatability is known as the intra-class correlation coefficient. Repeatability, R, is the variance among group means (V_G) over the sum of the group variance and the residual variance (V_R):

$$R = V_R/(V_G + V_R)$$

In this context, the grouping variable is plot ID, and R measures how consistently each plant group can be measured using the point-quadrat method employed in this project. We used the R package 'rptR' (Stoffel et al. 2017) to calculate repeatability estimates and confidence intervals. All analysis was done in the program R, version 3.3.1 (R Core Team 2018).

3.1.2 RESULTS AND DISCUSSION

3.1.2.1 Vegetation Abundance Monitoring

Monitoring completed in 2018 marked the second year that vegetation abundance data were analyzed among years including data from 2014, 2016, 2017, and 2018. A trends analysis of only four years of data should be interpreted with caution, due to the lack of a full sample size in all four years. Refer to Section 3.1 — Vegetation Abundance Monitoring for details on the vegetation abundance monitoring program schedule.

There were statistically significant declines in total percent ground cover between 2014 and subsequent monitoring years. Although statistically significant, differences in total percent ground cover were consistent across all distance classes indicating that changes in ground cover were not due to Project effects. Annual differences in total ground cover were less than 3%, which represents a modest change that is likely not biologically significant.

A detailed examination of changes in ground cover for the major plant groups also found annual differences in cover; however, differences were consistent across distance classes indicating that the changes in plant cover were not due to Project effects. Ground litter was low in 2014 and higher in 2016, 2017, and 2018. Moss cover was high in 2014 and lower in the other three years. Lichen cover was high in 2014 and lower in subsequent years; however, the difference between the highest (2014: 2.8%) and lowest year (2016: 1.6%) was small.

There were statistically significant differences in total percent canopy cover among years and a weak interaction between year and distance class. Differences in total percent canopy cover between year and distance class were inconsistent; therefore, we conclude that differences were driven by annual variation in plant cover. There is no evidence to support a Project related effect. Total canopy cover was higher in 2016 and 2017 than in 2014 and 2018. The 30 m, 100 m, and 1,200 m distance classes followed this trend where canopy cover was higher in 2016 and 2017. The 750 m distance class had higher canopy cover in 2016 than 2018, with no other differences among years. The reference distance class had higher canopy cover in 2017 than 2014, with no other differences among years.

A detailed examination of changes in canopy cover for the major plant groups also found annual differences in cover; however, differences were consistent across distance classes indicating that the changes in plant cover were not due to Project effects. Standing dead litter increased between 2014 and 2016 – 2018, while graminoids decreased during the same period. Although deciduous shrub cover was high in 2014 and lower in subsequent years, there were no distinct trends across distance class; therefore, we conclude that differences were driven by annual variation in plant cover. Future monitoring will pay attention to deciduous shrub cover.

In summary, there is annual variation in vegetation abundance in the Project area, but there is no evidence of changes in vegetation abundance because of a Project-related effect.

Total Percent Ground Cover — Differences in total percent ground cover were consistent across all distance classes, indicating that changes in ground cover were not due to Project effects. There was no main effect of distance class on total ground cover ($p = 0.77$). There was no interaction between distance class and year ($p = 0.24$), treatment and year ($p = 0.38$). or distance class and treatment ($p = 0.34$). There was also no three-way interaction between year, distance, and treatment ($p = 0.80$).

Statistically, there was a significant difference among years in total ground cover ($p < 0.001$, Figure 21). Averaging across distance classes and treatment, total ground cover was 94.6% (CI = 92.8 – 96.0) in 2014, 91.6% (CI = 89.1 – 93.6) in 2016, 90.2% (CI = 87.4 – 92.4) in 2017, and 92.2% (CI = 89.9 – 94.0) in 2018. Total ground cover in 2014 was higher than in the three other years (all $p < 0.001$). There was no difference between 2016 and 2017 ($p = 0.14$) or 2016 and 2018 ($p = 0.70$); however, ground cover was higher in 2018 than in 2017 ($p = 0.003$).

There was also a statistically significant difference in treatment on total ground cover ($p = 0.006$, Figure 22). After accounting for year, average ground cover in closed plots was 91.5% (CI = 88.9– 93.5) and open plots was 93.1% (CI = 91.1 – 94.7).

Although statistically significant, differences in total percent ground cover are small and consistent across all distance classes; therefore, changes in cover among years is likely the result of climatic variation across all sites in the Project area.

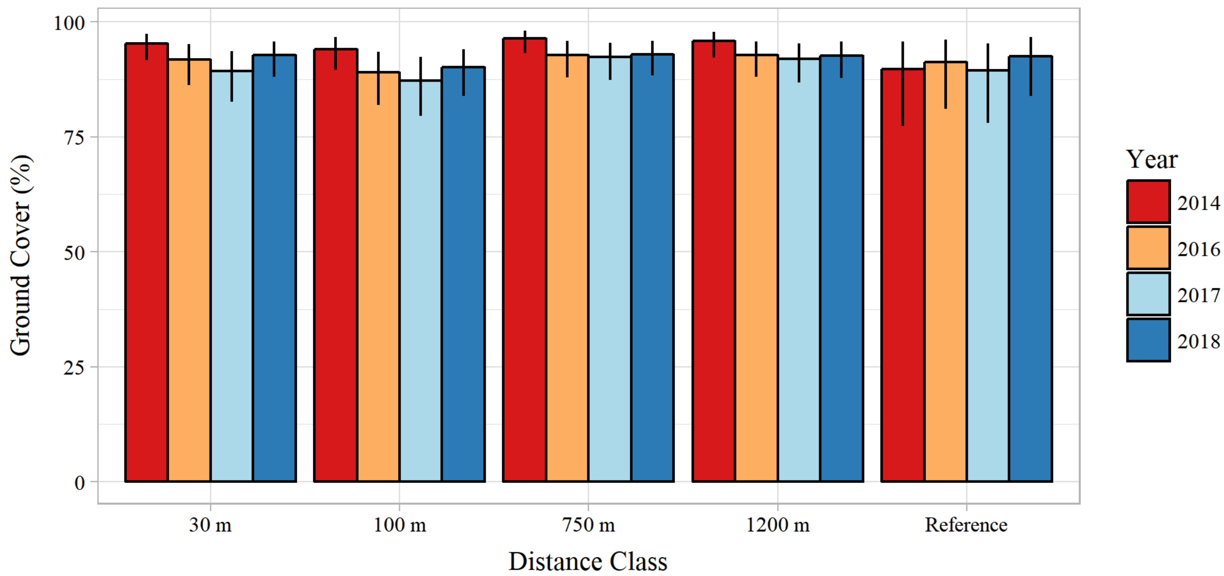


Figure 21 Total ground cover by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

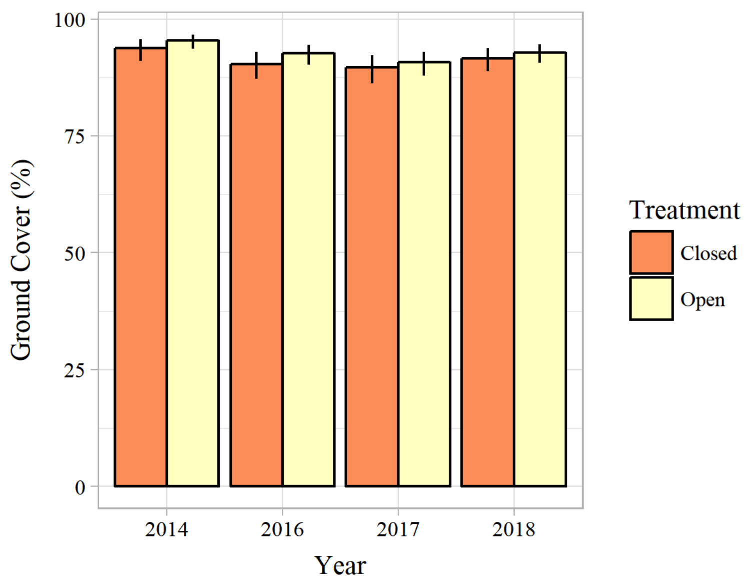


Figure 22 Total ground cover by treatment and year.
Bar heights show average cover and error bars show 95% confidence intervals

Ground Cover Plant Groups — Differences in plant group cover were examined by year to look at overall changes in cover and to determine which plant groups in the ground layer warranted detailed examination. The average cover of plant groups changed among years ($p < 0.001$, Figure 23). Based on this analysis, the following plant groups were considered for detailed analysis including ground litter, moss, evergreen shrubs, and lichen. Deciduous shrubs, forbs, and graminoids each had less than 1% cover in all three years; therefore, these plant groups were not investigated further.

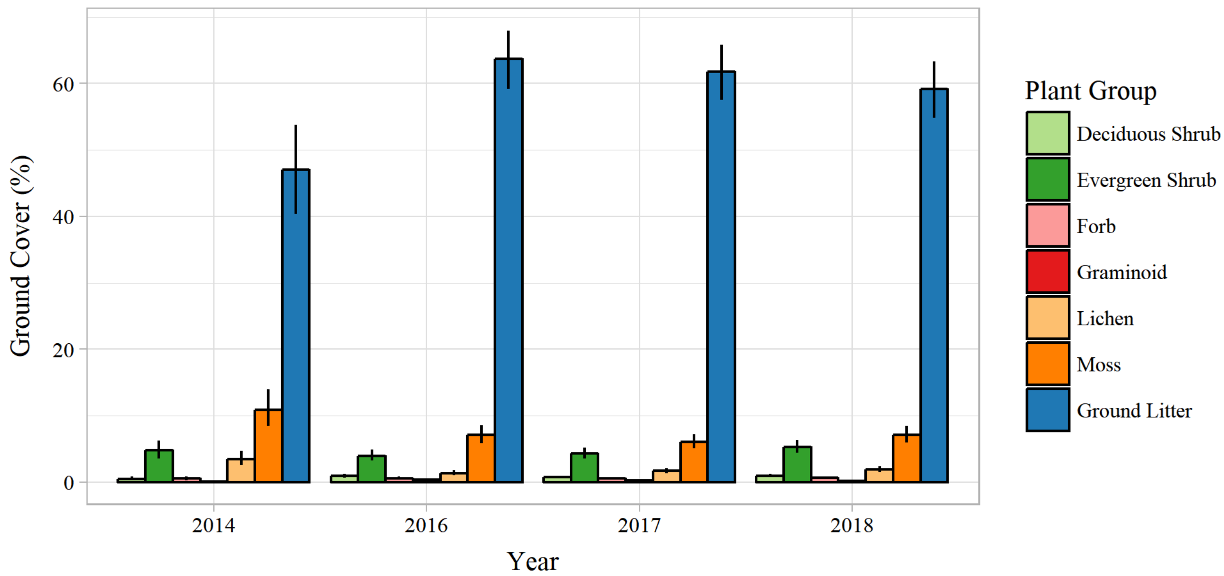


Figure 23 Ground cover by plant group and year.
Bar heights show average cover and error bars show 95% confidence intervals.

Ground Litter — Ground litter (dead, unattached material) made up most of the ground cover in all years (Figure 23). Although ground litter is not considered caribou forage, it was included in the analysis because it is related to and may help explain potential changes in the standing dead litter group for the canopy layer. Factors such as wind or the amount of standing dead litter in a plot can influence ground litter cover from year to year.

A detailed examination of changes in ground litter cover indicates that differences were not a result of Project effects. There were differences in cover among years; however, there was no main effect of distance class ($p = 0.56$) or treatment ($p = 0.36$). There was no interaction between distance class and year ($p = 0.11$), treatment and year ($p = 0.15$), or distance class and treatment ($p = 0.38$). There was also no three-way interaction between year, treatment, and distance class ($p = 0.66$).

Statistically, there was a difference among years for ground litter ($p < 0.001$, Figure 24). Ground litter was lowest in 2014 at 50.4% (CI = 47.0 — 53.8) and highest in 2016 at 62.5% (CI = 59.7 — 65.2; $p < 0.001$). Ground litter in 2017 was 61.6% (CI = 58.8 — 64.3), this was higher than 2014 ($p < 0.001$), but comparable to 2016 ($p = 0.77$). In 2018, ground litter was 59.3% (CI = 56.5 — 62.1), this was higher than 2014 ($p < 0.001$) but lower than 2016 ($p = 0.005$) and comparable to 2017 ($p = 0.06$). This shows that ground litter cover peaked in 2016, remained high in 2017 and 2018 with a small decrease in 2018 relative to the high in 2016.

Increased ground cover from 2014 to 2016 may be the result of a high growth year in 2015 adding standing dead litter to the canopy and then to the ground litter layer. Higher ground litter in 2016 means there was potential to obscure moss and lichen, thus reducing the number of hits of moss and lichen across sites in the other years. Although statistically significant, differences in ground litter cover are consistent across all distance classes; therefore, changes in cover among years is likely the result of climatic variation across all sites in the Project area.

Moss — Moss was the second highest cover in the ground layer for all years. A detailed examination of changes in moss cover indicates that differences were not a result of Project effects. There were differences in cover among years; however, there was no main effect of distance class ($p = 0.20$) or treatment ($p = 0.36$). There was no interaction between distance class and year ($p = 0.14$, Figure 25), treatment and year ($p = 0.56$), or distance and treatment ($p = 0.95$). There was also no three-way interaction between year, treatment, and distance class ($p = 0.54$).

There was evidence of a year effect on moss in the ground cover layer ($p < 0.001$). Moss cover was highest in 2014, at 13.9% (CI = 9.7 – 19.4); this was higher than in 2016 at 7.2% (CI = 5.0– 10.3; $p < 0.001$), in 2017 at 6.7% (CI = 4.6 – 9.5; $p < 0.001$), and 2018 at 7.7% (CI = 5.3 – 10.9, $p < 0.001$). There were no differences in moss cover between 2016, 2017, and 2018 (all $p > 0.14$).

Although statistically significant, differences in moss cover are consistent across all distance classes. Moss was highest in 2014 and similar in 2016, 2017, and 2018. Differences between 2014 and the other years may be the result of a high plant growth year of other vegetation in 2015 adding standing dead litter to the canopy and then to the ground litter layer. High ground litter cover has to potential to obscure moss during measurements. Ground litter cover was low in 2014 (50.4%) then spiked in 2016 (62.5%) and 2017 (61.6%) and then was slightly lower in 2018 (59.3%). The next round of monitoring will closely evaluate percent cover of moss relative to ground litter, as well as overall trends of moss cover.

Evergreen Shrubs — A detailed examination of changes in evergreen shrub cover indicate that differences were not a result of Project effects. There were differences in cover among years; however, there was no main effect of distance class ($p = 0.19$) or treatment ($p = 0.68$). There was no interaction between distance class and year ($p = 0.20$, Figure 26), treatment and year ($p = 0.85$), or treatment and distance class ($p = 0.88$). There was also no three-way interaction between year, treatment, and distance class ($p = 0.71$).

Statistically, there was a significant difference among years in evergreen shrub cover in the ground layer ($p = 0.004$). Evergreen shrub cover was 4.3% (CI = 2.9 – 6.2) in 2014, 3.9% (CI = 2.7 – 5.5) in 2016, 3.9% (CI = 2.7 – 5.5) in 2017, and 4.8% (CI = 3.4 – 6.8) in 2018. Evergreen shrub cover was higher on average in 2018 than in 2016 ($p = 0.03$) and in 2017 ($p = 0.02$), but not significantly different from 2014 ($p = 0.65$). There were no differences in evergreen shrub cover between 2014, 2016, and 2017 (all $p > 0.65$).

Although statistically significant, differences in evergreen shrub cover are consistent across all distance classes; therefore, changes in cover among years is likely the result of climatic variation across all sites in the Project area.

Lichen — A detailed examination of changes in lichen cover indicate that differences were not a result of Project effects. There were differences in cover among years; however, there was no main effect of distance class ($p = 0.74$) or treatment ($p = 0.56$). There was no interaction between distance class and year ($p = 0.47$), treatment and year ($p = 0.32$, Figure 27), or treatment and distance class ($p = 0.82$). There was also no three-way interaction between year, treatment, and distance class ($p = 0.75$).

Statistically, there was a significant difference in lichen cover among years ($p < 0.001$). Lichen cover was 2.8% (CI = 2.0 – 4.0) in 2014, 1.6% (CI = 1.1 – 2.3) in 2016, 1.6% (CI = 1.1 – 2.3) in 2017, and 1.9%

(CI = 1.3 – 2.7) in 2018. Lichen cover was higher on average in 2014 than in 2016 ($p < 0.001$) in 2017 ($p < 0.001$), and in 2018 ($p = 0.002$).

Although statistically significant, differences in lichen cover are consistent across all distance classes. Lichen was highest in 2014 and similar in 2016, 2017, and 2018. Differences between 2014 and the other years may be the result of a high plant growth year of other vegetation in 2015 adding standing dead litter to the canopy and then to the ground litter layer. High ground litter cover has the potential to obscure lichen during measurements. Ground litter cover was low in 2014 (50.4%) then spiked in 2016 (62.5%) and 2017 (61.6%) and then was slightly lower in 2018 (59.3%). The next round of monitoring will closely evaluate percent cover of lichen relative to ground litter, as well as overall trends of lichen cover.

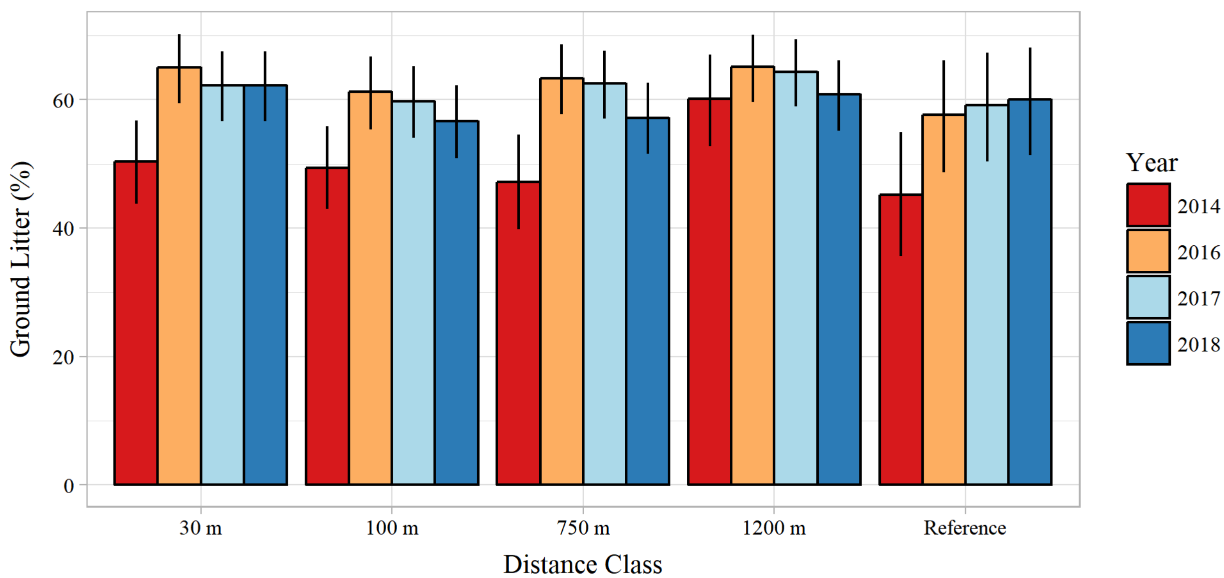


Figure 24 Ground litter cover in the ground layer by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

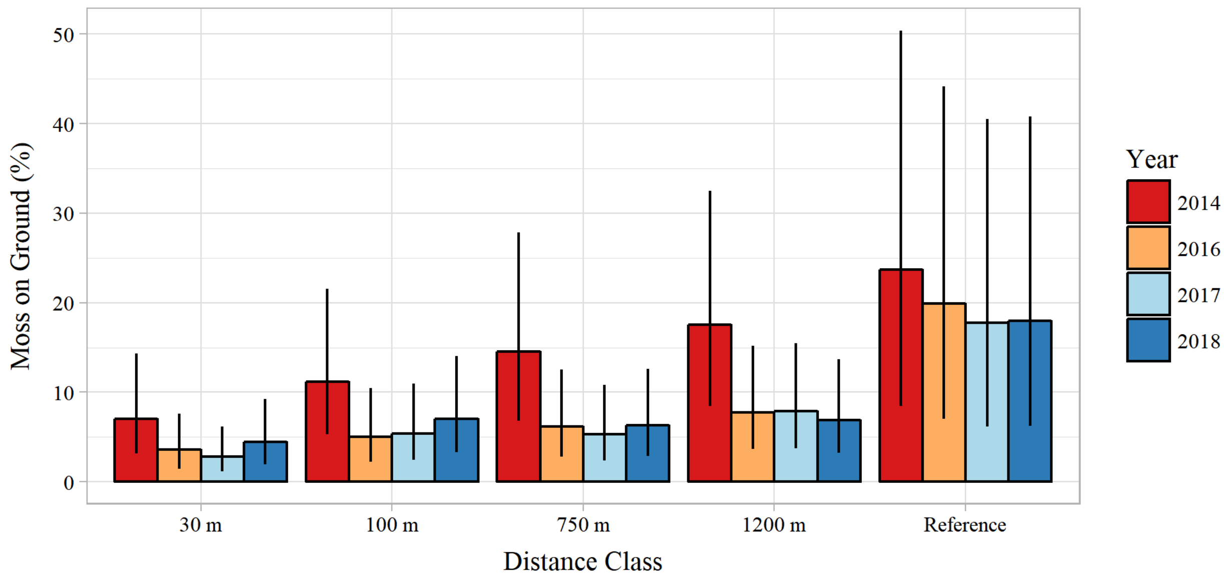


Figure 25 Moss cover in the ground layer by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

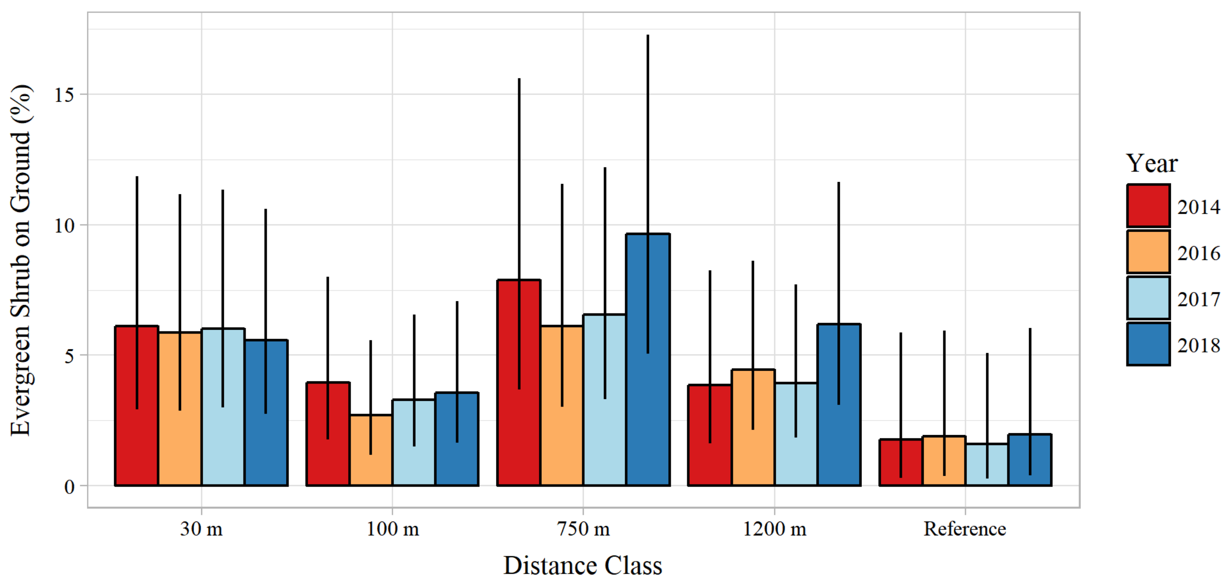


Figure 26 Evergreen shrub cover in the ground layer by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

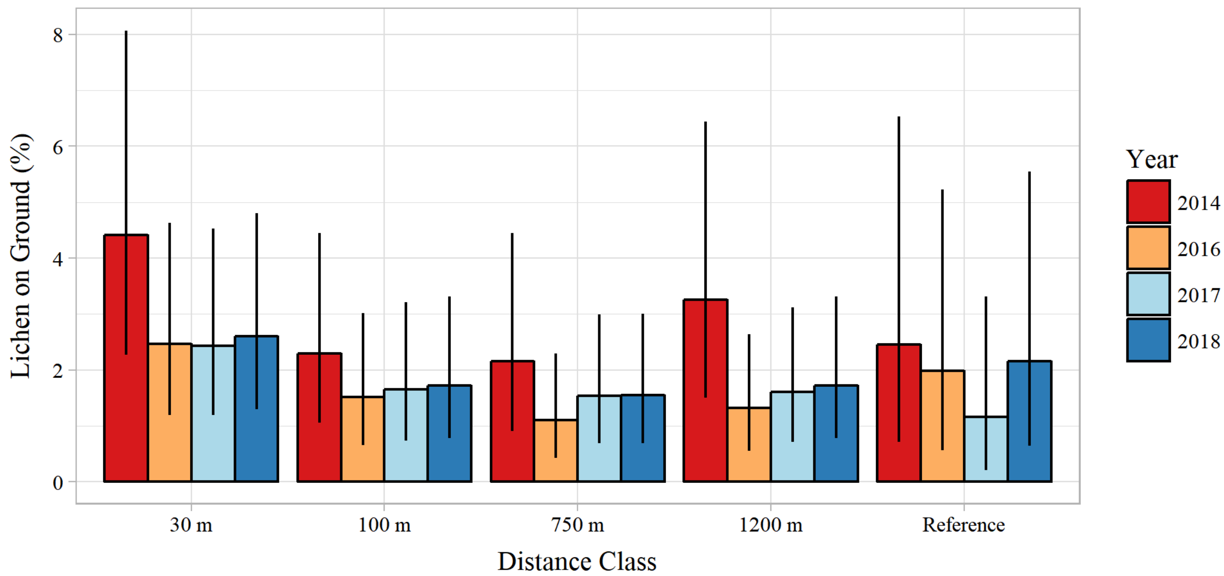


Figure 27 Lichen cover in the ground layer by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

Total Percent Canopy Cover — There was a statistically significant difference among years in total percent canopy cover ($p < 0.001$). Averaging across distance classes and treatments, total canopy cover was 43.5% (CI = 39.8 – 47.3) in 2014, 51.7% (CI = 48.3 – 55.0) in 2016, 50.7% (CI = 47.4 – 53.9) in 2017, and 46.2% (CI = 42.9 – 49.4) in 2018. Total canopy cover in 2014 was significantly lower than in 2016 ($p < 0.001$) and 2017 ($p < 0.001$). There was no difference between 2016 and 2017 ($p = 0.78$). In 2018, total canopy cover was lower than in 2016 ($p < 0.001$) and 2017 ($p < 0.001$), but not significantly different than canopy cover in 2014 ($p = 0.24$).

There was a weak interaction between year and distance class ($p = 0.02$, Figure 28) in total percent canopy cover. Most distance classes (30 m, 100 m, and 1200 m) followed the overall annual trend described above with higher canopy cover in 2016 and 2017. At 750 m, the only statistically significant interaction was between year and distance class whereby canopy cover was lower in 2018 than 2016 ($p < 0.001$). For the reference sites, there was a trend of increasing canopy cover from 2014 to 2018; however, the difference was only statistically significant between 2014 and 2017 ($p = 0.05$). The interaction between year and distance class is weak and differences are inconsistent with a distance-based Project effect; therefore, no link can be applied.

There was also a statistically significant interaction between year and treatment class for total canopy cover ($p = 0.03$; Figure 29). In 2014, canopy cover was higher in the open plots, 41.2% (CI = 36.6 – 45.9) than in the closed plots, 45.9% (41.8 – 50.2; $p = 0.05$). In subsequent years there were no significant differences in total canopy cover between treatments (2016: $p = 0.75$; 2017: $p = 0.87$; 2018: $p = 0.14$).

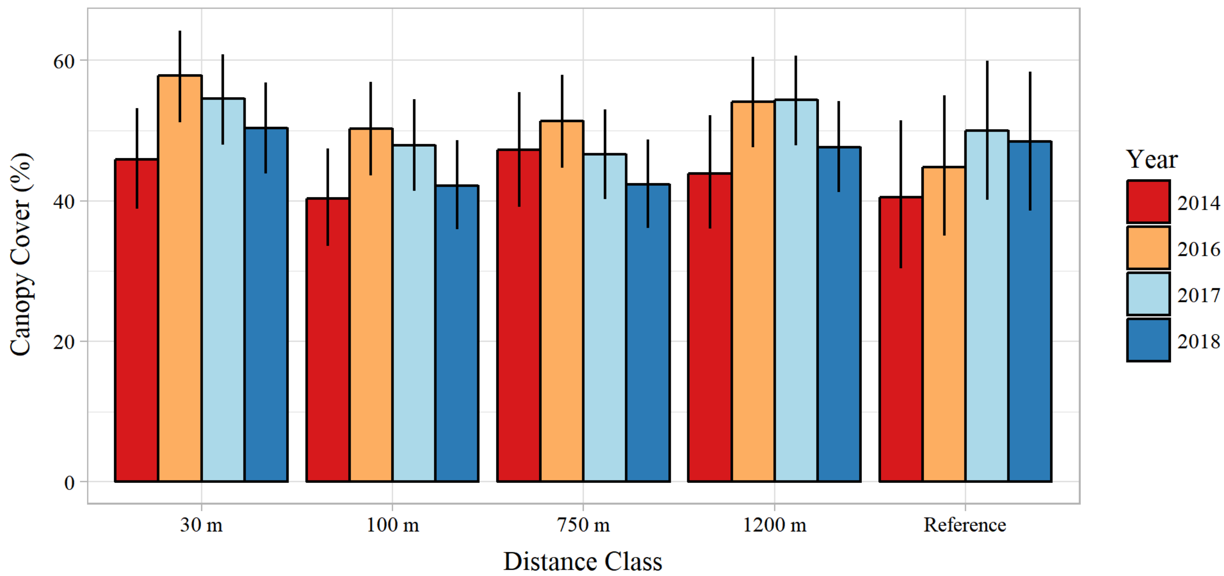


Figure 28 Total canopy cover by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

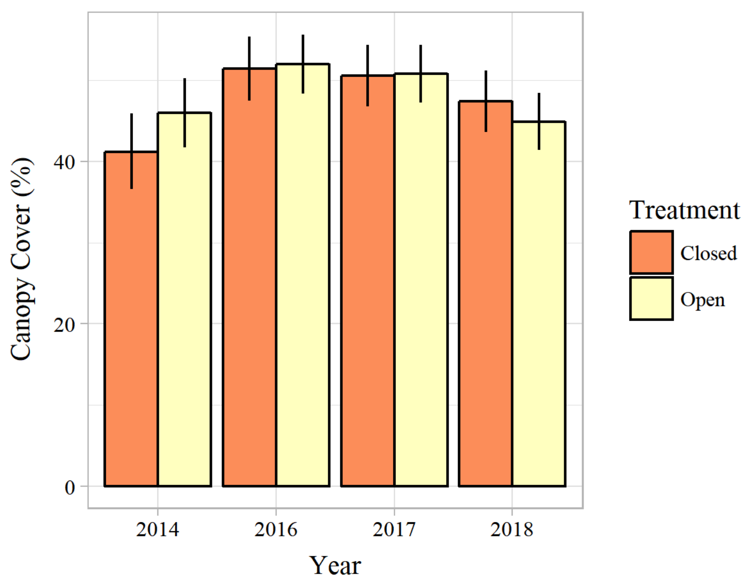


Figure 29 Total canopy cover by treatment and year.
Bar heights show average cover and error bars show 95% confidence intervals.

Canopy Cover Plant Groups — Differences in plant group cover were examined by year to look at overall changes in cover and to determine which plant groups in the canopy layer warranted detailed examination. The average cover of plant groups changed among years ($p < 0.001$, Figure 30). Based on this analysis, the following plant groups were considered for detailed analysis including standing dead litter, graminoids, and deciduous shrub cover. Average cover of evergreen shrubs and forbs was less than 2% in all years; therefore, these plant groups were not investigated further.

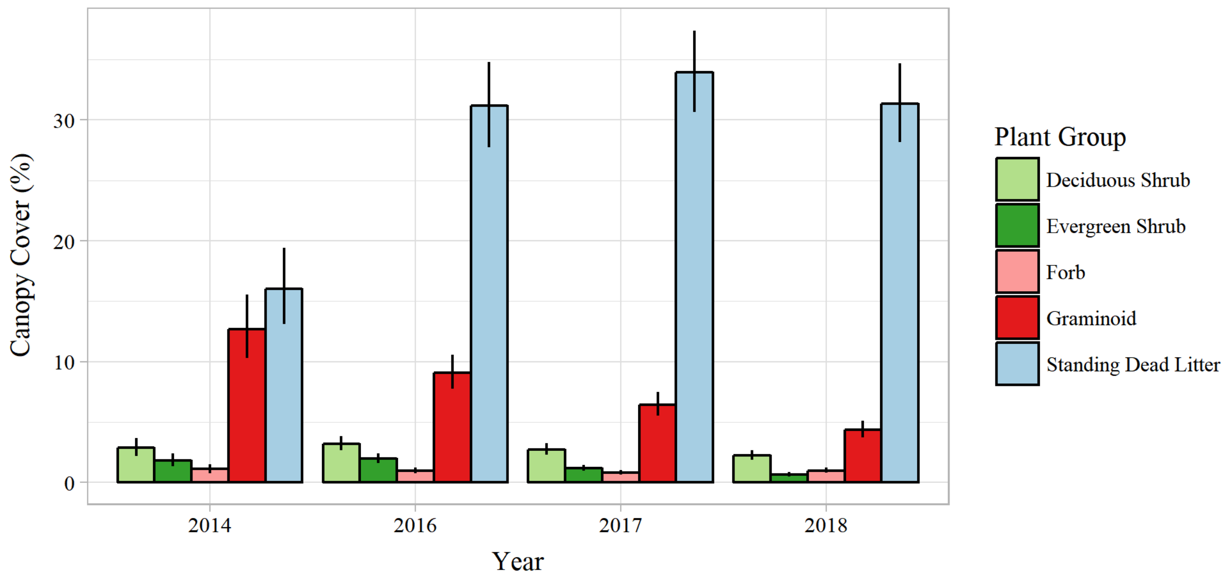


Figure 30 **Canopy cover by plant group and year.**
Bar heights show average cover and error bars show 95% confidence intervals.

Standing Dead Litter — A detailed examination of changes in the cover of standing dead litter indicate that differences were not a result of Project effects. There were differences in cover among years; however, there was no main effect of distance class ($p = 0.71$) or treatment ($p = 0.92$). There was no interaction between year and treatment ($p = 0.48$). There was also no three-way interaction between year, treatment, and distance class ($p = 0.73$).

Statistically, there was a significant difference in the cover of standing dead litter among years ($p < 0.001$). Standing dead litter cover was low in 2014, at 16.1% (CI = 14.0– 18.6), and higher in the next three monitoring years: 30.3% (CI = 27.3– 33.5) in 2016, 33.5% (CI = 30.4– 36.8) in 2017, and 31.1% (CI = 28.1 – 34.3) 2018. Standing dead litter in 2014 was significantly lower than in all other years (all $p < 0.001$). This suggests that 2014 was a low growth year relative to the other years. There was also a weak interaction between year and distance class ($p = 0.09$, Figure 31); however, inter-annual trends in all distance classes followed the same pattern described above.

Graminoids — A detailed examination of changes in graminoid cover indicate that differences were not a result of Project effects. There were differences in cover among years; however, there was no main effect of treatment ($p = 0.55$) or distance class ($p = 0.40$). There was no interaction between distance class and year ($p = 0.66$) treatment and year ($p = 0.62$), or treatment and distance class ($p = 0.51$). There was also no three-way interaction between year, treatment, and distance class ($p = 0.99$).

Statistically, there was a significant difference in graminoid cover among years ($p < 0.001$); however, annual declines in graminoid cover were consistent across all distance classes (Figure 32). Graminoid cover was highest in 2014 at 12.0% (CI = 10.1 – 14.3) and declined significantly every year with only 4.3% (CI = 3.7 – 4.9) graminoid cover in 2018. Declines in graminoid cover could be explained by the inherent difficulty in classifying a graminoid as green, living plant material or standing dead litter. Particularly in the Arctic, graminoids go through a rapid process of green up and senescence (turning into dead litter) where the leaves of the plants can be half green and half standing dead litter. This leads to a discrepancy on whether individual plants are categorized as living plant material (graminoid) or standing dead litter. Given the small surface area of graminoid leaves and the inherent difficulty in categorizing a single leaf as living or dead, it is recommended that future monitoring combine graminoid and standing dead litter data.

Deciduous Shrub — A detailed examination of changes in deciduous shrub cover indicate that there were statistically significant differences in deciduous shrub cover among years ($p < 0.001$; Figure 33). Averaging across distance class and treatment, deciduous shrub cover was 3.5% (CI = 2.6 – 4.7) in 2014, 3.1% (CI = 2.4 – 4.1) in 2016, 2.9% (CI = 2.2 – 3.7) in 2017, and 2.5% (CI = 1.9 – 3.2) in 2018.

There was a weak interaction between year and distance class ($p = 0.01$); however, trends in the data were not consistent. There were no significant annual differences for the 30 m and reference distance classes (all $p > 0.59$). In the 100 m distance class, there was a trend for declining deciduous shrub cover from 2014 to 2018; deciduous shrub cover in 2018 was significantly lower than 2014 ($p < 0.001$) and 2016 ($p = 0.002$). In the 750 m distance class, deciduous shrub cover was higher in 2017 than in 2018 ($p = 0.01$), but there were no other inter-annual differences. In the 1,200 m distance class, deciduous shrub cover was significantly higher in 2016 than in 2018 ($p = 0.001$).

There was no main effect of treatment ($p = 0.80$). There was no interaction between year and treatment ($p = 0.41$) or distance class and treatment ($p = 0.43$). There was also no three-way interaction between year, treatment, and distance class ($p = 0.26$).

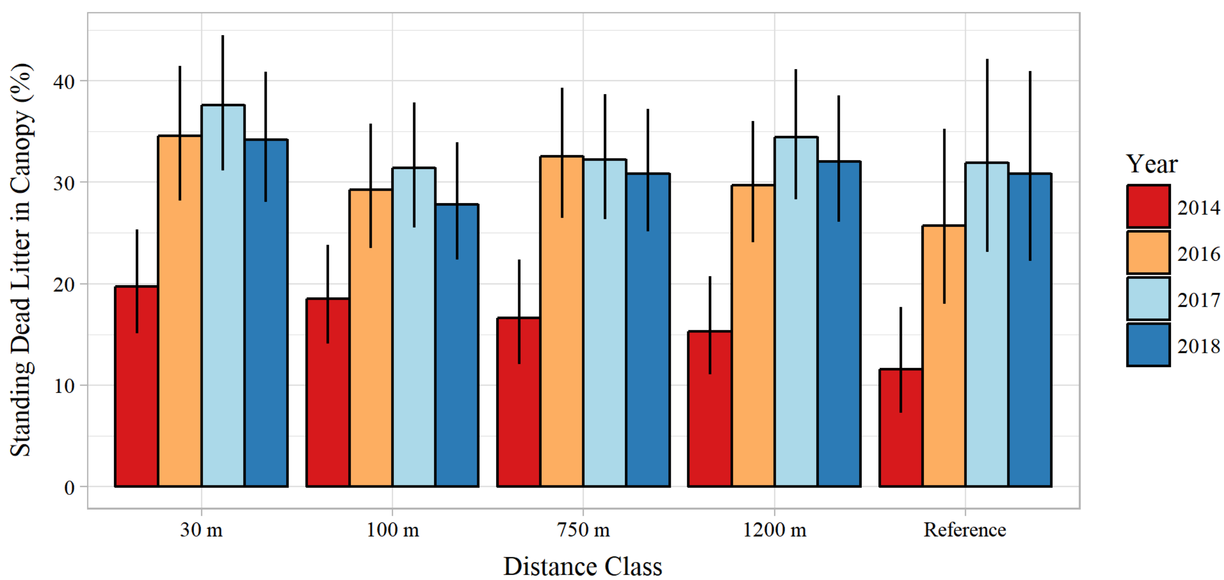


Figure 31 Standing dead litter in the canopy layer by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

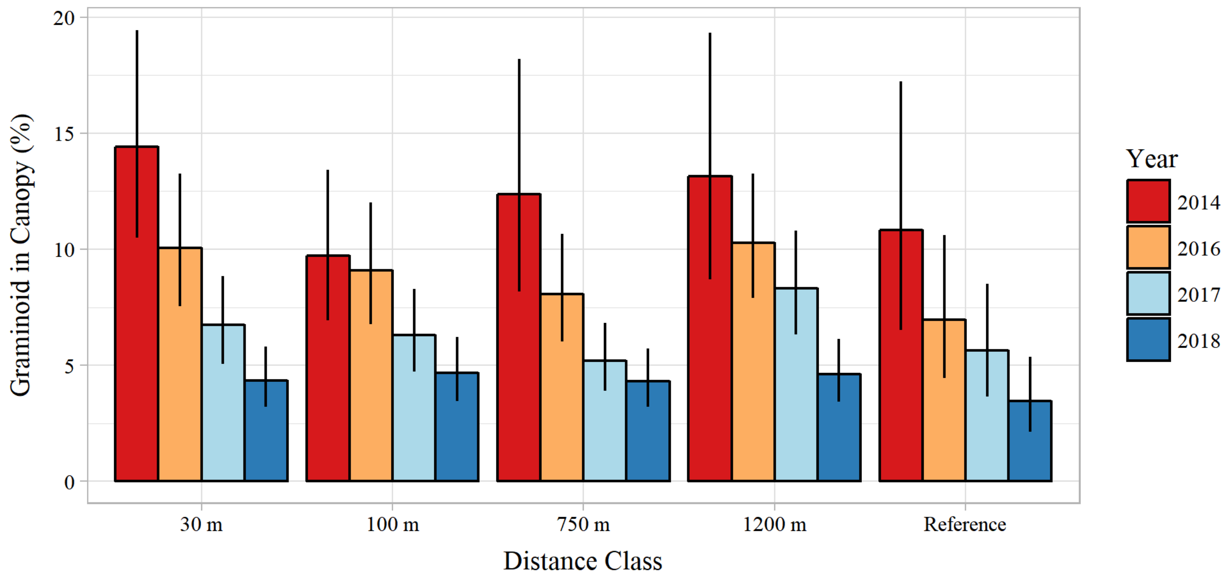


Figure 32 Graminoid cover in the canopy layer by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

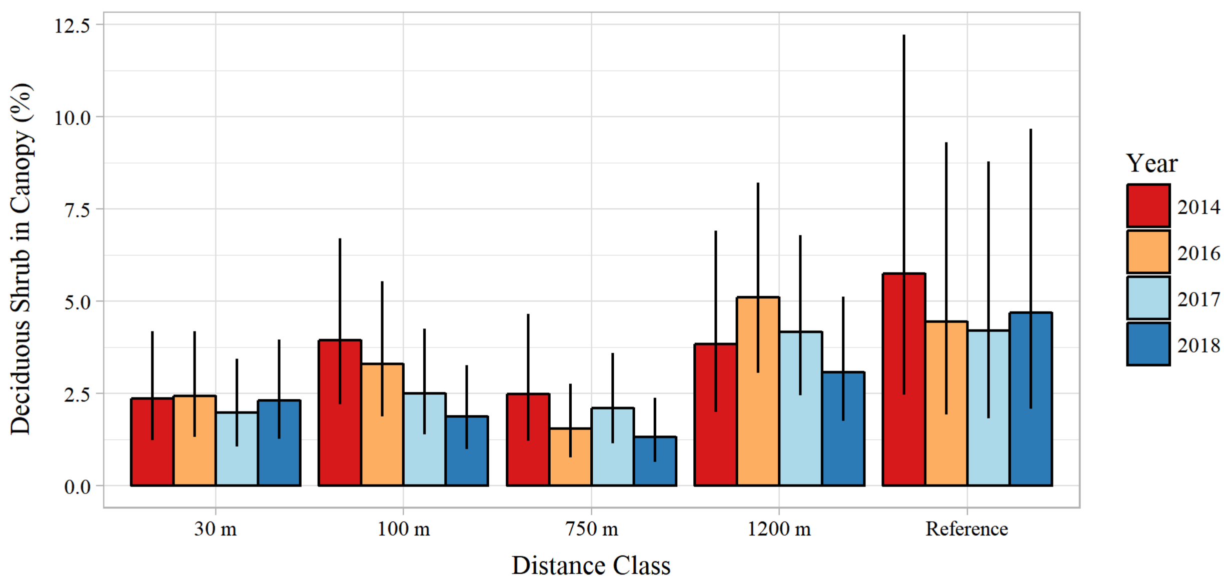


Figure 33 Deciduous shrub cover in the canopy layer by distance class and year.
Bar heights show average cover and error bars show 95% confidence intervals.

3.1.2.2 Evaluation of Vegetation Abundance Monitoring Methods

In 2018, measurement methods for the vegetation abundance monitoring program were evaluated. Results show that the point quadrat method is a highly objective and repeatable method for monitoring changes in percent plant cover and composition of plant groups (i.e., lichen) in the Project area.

Measurement repeatability was high for total ground cover, 90.3% (CI = 77.2 – 96.3, Figure 34). Lichen had the highest measurement repeatability of any of the plant groups in the ground layer, at 99.2% (CI = 98.1 – 99.7). This was followed closely by moss, which had a repeatability of 97.4% (CI = 93.3 – 99.0), and evergreen shrubs, which had a repeatability of 93.0% (CI = 83.1 – 97.0). Forbs, ground litter, and deciduous shrubs each had estimated repeatability higher than 75% (forbs: 85.6%, ground litter: 80.8%, deciduous shrubs: 75.4%), although these estimates had more uncertainty associated with them than the other plant groups, demonstrated by the large confidence intervals around each estimate (forbs: CI = 67.5 – 93.7, ground litter: CI = 60.5 – 91.9, deciduous shrub: CI = 48.1 – 89.2). Repeatability of graminoid measurements in the ground layer was very low, 32.9% (CI = 0 – 65.1); this demonstrates that graminoids in the ground layer cannot be measured reliably. This is not surprising since there is inherent difficulty in classifying a graminoid as green, living plant material or standing dead litter. As discussed in Section 3.1.2.1, in the Arctic, graminoids go through a rapid process of green up and senescence (turning into dead litter) where the leaves of the plants can be half green and half standing dead litter. Combined with factors such as wind and small leaf area, graminoids cannot be measured with confidence using the point quadrat method in the Project area. Graminoid and standing dead litter data may be combined for analysis in future reporting.

Measurement repeatability for total canopy cover was high, 83.6%, but relatively uncertain (CI = 61.3 – 93.2, Figure 35). Measurements of deciduous shrubs had the highest repeatability in the canopy layer (96.7%, CI = 92.1 – 98.6), followed by standing dead litter (88.4%, CI = 73.6 – 95.0), forbs (84.9%, CI = 95.4 – 93.5), and evergreen shrubs (74.9%, CI = 47.3 – 89.4). As with the ground layer, graminoids had the lowest measurement repeatability of all the plant groups (54.3%, CI = 17.0 – 77.8%), although repeatability of graminoid measurements was higher in the canopy layer than in the ground layer.

In summary, the point quadrat method used to measure vegetation abundance in the Project area is a highly objective and repeatable method for measuring percent plant cover and composition of plant groups such as lichen. The point quadrat method emphasizes major species and provides percent cover values that can be expected to be repeatable (Godínez-Alvarez et al. 2009). This method is appropriate for addressing the objectives of the vegetation abundance monitoring program.

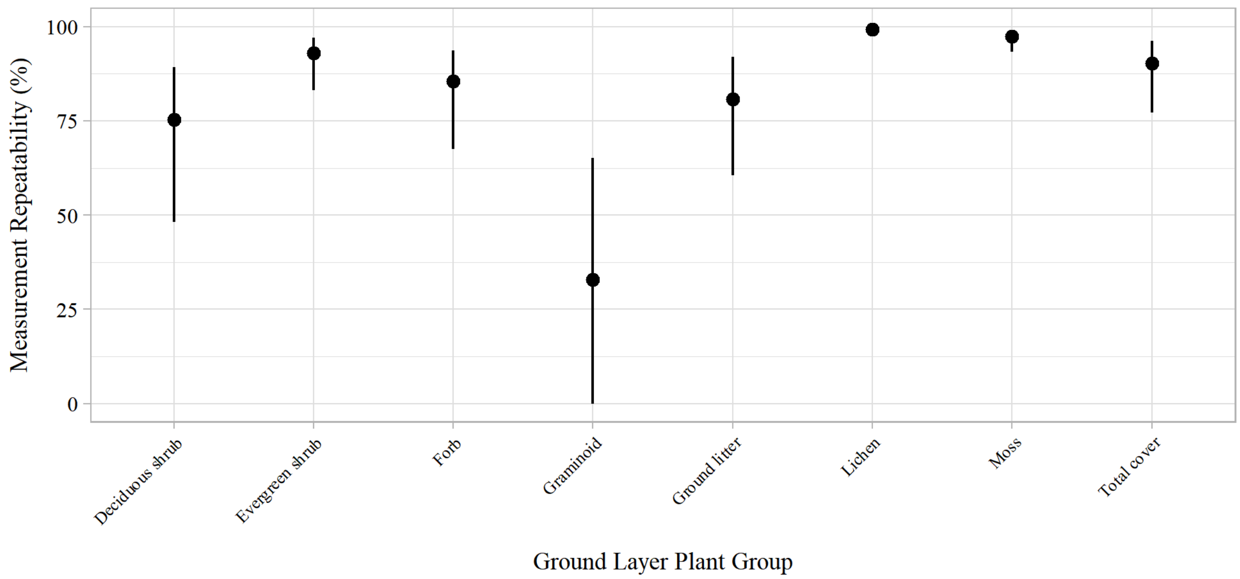


Figure 34 Measurement repeatability for plant groups and total cover in the ground layer.
Points represent estimated repeatability and error bars show the 95% CI.

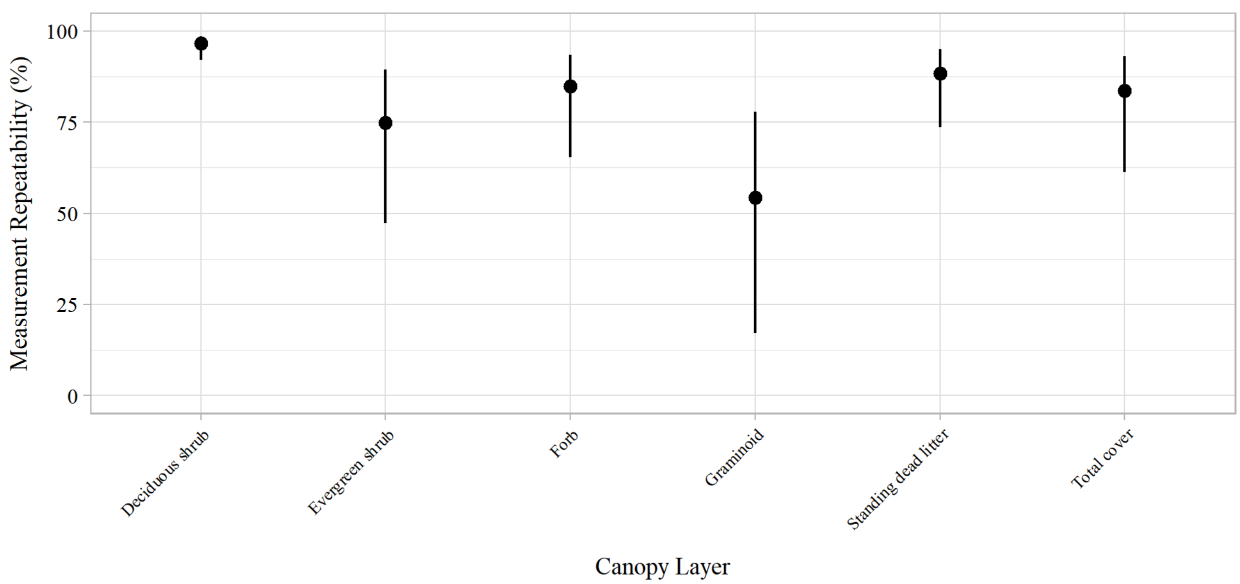


Figure 35 Measurement repeatability for plant groups and total cover in the canopy layer.
Points represent estimated repeatability and error bars show the 95% CI.

Rare Plant Observations — Although surveys for rare plants are not required as part of the NIRB Project Certificate No. 005, incidental observations of a territorial "May Be At Risk" plant species for Nunavut were recorded from 2014–2018 during other vegetation surveys. This finding represents a large range extension for North Baffin Island and significant contribution to the overall knowledge of the species (Brouillet, pers. comm., 2014). Horned Dandelion (*Taraxacum ceratophorum*) is a dandelion species native to Baffin Island. It was previously listed as "May Be At Risk" in Nunavut (Photo 6; CESCC 2011). However, in 2017 the status for Horned Dandelion changed from "May Be At Risk" to "Unrankable" (Government of Canada 2016). The reason for this change is because of a lack of survey information on the abundance and distribution of Horned Dandelion on Baffin Island (Government of Canada 2016).

Horned Dandelion was first found in the Project area in 2014 at two locations close to the Mine Site consisting of two populations and 31 individuals. In 2016, additional Horned Dandelion populations were observed along the Tote Road from km 84.6 to 85.2. Five subpopulations were found growing along and up to 50 m from the road totalling approximately 750–800 plants. The habitat was open and dominated by sand. All plants were in flower and appeared healthy

In 2018, incidental observations of Horned Dandelion along the Tote Road were like those of 2017. There is no update to population numbers in 2018. Location details and population numbers for Horned Dandelion in the Project area are summarized in Table 8.

Photo 6 Horned Dandelion.
A previously reported "May Be At Risk" plant species in Nunavut was found during other vegetation surveys, 2014–2018.

Table 8 Locations and population update of Horned Dandelion, a previously reported "May Be At Risk" species found incidentally during vegetation surveys in the Project area.

Year	Name	Location Description	Habitat	Latitude	Longitude	Abundance and Distribution	Present in 2017/2018
2014	TARACER1_2014	Edge of PDA near KM 93.5, along Tote Road, sea can storage area	Sandy, exposed slope and small drainage leading down to delta	71.32708	-79.45897	25 scattered flowering plants in close vicinity	Yes
2014	TARACER2_2014	Near KM 98, along Tote Road	Sandy, exposed soil bank	71.33159	-82.59750	6 scattered flowering plants in close vicinity	Yes
2016	TARACER1_2016	South edge of PDA near KM 84.6, along Tote Road	Sandy, exposed soil near stream	71.37605	-79.70719	13 flowering plants in close vicinity	Yes
2016	TARACER2_2016	North edge of PDA near KM 84.6, along Tote Road	Sandy, exposed soil near stream	71.37662	-79.70661	65 flowering and vegetative plants scattered along slope of tributary	Yes
2016	TARACER3_2016	North edge of PDA and on plateau above slope near KM 84.7, along Tote Road	Sandy, exposed plateau	71.37643	-79.70499	96 flowering and vegetative plants scattered on sandy plateau	Yes
2016	TARACER4_2016	South edge of PDA near KM 84.7, along Tote Road	Sandy, exposed slope	71.3761	-79.70442	150 flowering and vegetative plants scattered along edge of Tote Road	No
2016	TARACER5_2016	South edge of PDA from approximately KM 85.1 to 85.2, along Tote Road	Sandy, exposed slope above lake	71.37571	-79.69231	420 flowering and vegetative plants scattered along edge of Tote Road	Yes

3.2 INTER-ANNUAL TRENDS

There is annual variation in vegetation abundance in the Project area, but there is no evidence of changes in vegetation abundance because of a Project-related effect. Differences in the cover of major plant groups such as ground litter, standing dead litter, moss, and lichen may be explained by the potential that 2015 was a large plant growth year contributing more standing dead litter in the canopy layer which then translated to more litter in the ground layer. Standing dead litter and ground litter were low in 2014 and higher in subsequent years and the opposite was true for moss and lichen cover. Differences were consistent across all distance classes in the Project area.

There were statistically significant declines in total percent ground cover between 2014 and subsequent monitoring years which were consistent across all distance classes in the Project area. Annual differences in total ground cover were less than 3%, which represents a modest change that is likely not biologically significant. A detailed examination of changes in ground cover for the major plant groups also found annual differences in cover: ground litter was low in 2014 and higher in 2016, 2017, and 2018; moss cover was high in 2014 and lower in the other three years; lichen cover was high in 2014 and lower in subsequent year. All differences were consistent across distance classes in the Project area, indicating that changes were not due to Project-related effects. There were statistically significant differences in total percent canopy cover among years and a weak interaction between year and distance class. Differences in total percent canopy cover between year and distance class were inconsistent; therefore, we conclude that differences were driven by annual variation in plant cover. A detailed examination of changes in canopy cover for the major plant groups also found annual differences in cover: standing dead litter increased between 2014 and 2016 – 2018, while graminoids decreased during the same period; although deciduous shrub cover was high in 2014 and lower in subsequent years, there were no distinct trends across distance class. Future monitoring will continue to evaluate deciduous shrub cover closely.

3.3 VEGETATION SUMMARY

- The vegetation abundance monitoring program design was finalized in 2016 and provided a statistically robust program that will be able to detect Project-related changes in abundance should that effect occur.
- All vegetation abundance plots have been measured consistently for three years, and some for four years.
- To date, while annual changes in vegetation abundance in the Project area have been observed, there is no suggestion of changes in vegetation abundance because of a Project-related effect.
- In 2018, measurement methods for the vegetation abundance monitoring program were evaluated.
- Evaluation of vegetation abundance monitoring methods show that the method used to measure vegetation is highly objective and repeatable, confirming that it is appropriate for addressing the objectives of the vegetation abundance monitoring program. Future monitoring will combine graminoids and standing dead litter to more appropriately capture graminoid cover.

- Vegetation and soil base metals monitoring was not conducted in 2018 and is scheduled for 2019.
- Some previously reported rare plants have been found in the study area, and it is likely that more will be found as vegetation surveys continue in the Project area. Known populations will continue to be monitored in the Project area and newly discovered populations will be documented as they are found on an opportunistic basis. There is no evidence to suggest that the Mary River Project is affecting the population of these plants. Currently, there is not enough information on the Nunavut population of horned dandelion to determine a federal status through the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the *Species at Risk Act* (SARA) or a territorial status through the Canadian Endangered Species Conservation Council, National General Status Working Group.

4 MAMMALS

The 2018 monitoring for mammals included several surveys designed to enhance baseline data and monitor the effects of construction activities on caribou. Specific surveys included:

- Snow track survey;
- Snow bank height monitoring;
- Height of land caribou surveys; and
- Incidental observations and wildlife log.

4.1 REGIONAL MONITORING IN 2018

In August 2018, the GN released a summary report on caribou composition surveys conducted throughout Baffin Island from 2015 – 2018, which included a spring aerial caribou survey in the North Baffin Region in 2018. Through 18.9 hours of survey effort, a total of 100 caribou were observed in North Baffin during the 2018 spring survey (Ringrose 2018). Community consultations are planned for fall 2018 to inform on the results of the last four years of surveys and will include open discussions regarding future management and monitoring (Ringrose 2018). Baffinland has provided financial and logistical support for the GN's North Baffin Island caribou surveys on several occasions since 2009, including the 2018 spring survey.

4.2 SNOW TRACK SURVEY

During the review of both the original Project application and the Early Revenue Phase proposal, the QIA and other reviewers expressed concerns that Project activities would have a negative effect on caribou movement patterns. Specific concerns included human infrastructure as well as human presence deterring, constraining, or altering the natural movement of wildlife with concern for caribou. Because of concerns that caribou would potentially avoid crossing due to train or vehicle presence and the potential for constraining wildlife movement across roadways, Project conditions were issued to address this concern including:

- Project condition #54dii) *"The Proponent shall provide an updated Terrestrial Environmental Management and Monitoring Plan which shall include…Snow track surveys during construction and the use of video–surveillance to improve the predictability of caribou exposure to the railway and Tote Road. Using the result of this information, an early warning system for caribou on the railway and Tote Road shall be developed for operation."*
- Project condition #58f) *"Within its annual report to the NIRB, the Proponent shall incorporate a review section which includes… Any updates to information regarding caribou migration trails. Maps of caribou migration trails, primarily obtained through any new collar and snow tracking data, shall be updated (at least annually) in consultation with the Qikiqtani Inuit Association and affected communities, and shall be circulated as new information becomes available."*

Snow track surveys were conducted in April 2018 to study the movement of caribou and other wildlife in relation to the road and document behavioural reactions to human activities near the Project footprint.

4.2.1 METHODS

The snow track survey took place on April 28, 2018 and was conducted by two BIM employees. The purpose of the snow track survey was to collect data on caribou response to Project activities based on patterns of movement observed by their tracks. The survey was conducted by light truck, with one BIM employee driving and the other observing. The surveyors drove slowly (30 km/hr) along the Tote Road, looking for tracks from the vehicle from Mary River to Milne Inlet. When wildlife tracks were observed, surveyors would get out of the truck to confirm the species and then follow the tracks towards and away from the road to observe behaviour, habitat use and possible divergence of travel paths. When tracks were near or crossed the Tote Road, surveyors would record the following information:

- Latitude and longitude at the point where the tracks crossed the road;
- Species the tracks were from;
- Number of sets of tracks counted (i.e. group size);
- A designation describing travel in relation to the road (e.g., deflected, travelled along, or crossing the Tote Road);
- Height of the snow bank measured at either the crossing point or likely point of deflection; and,
- Often photos and additional relevant information were recorded.

4.2.2 RESULTS AND DISCUSSION

The survey was completed in one day in good weather conditions with excellent visibility for most of the survey, however, survey conditions were not ideal for snow tracking, as the survey was completed approximately one week after a fresh snow fall. Wind speeds recorded at Mary River and Milne Inlet during April were considered typical for the area and ranged between 0 to 17.59 m/s and 0 to 100 m/s, respectively, which likely re-distributed the snow shortly after the snow fall event, resulting in a light dusting of fresh/windswept snow. There is currently no reliable system for measuring winter precipitation at Mary River, so the information gathered on snow conditions prior to the survey is highly reliant on observations from on-site staff. Visibility and tracking conditions were good for the first ~50 km of the Tote Road but declined as the survey crew progressed closer to Milne Inlet due to fading light and intermittent wind gusts, causing snow drifts in some areas. Snow cover was consistent throughout the Tote Road, though some sections experienced more windswept patches where it was difficult to detect tracks. Along some sections of the Tote Road the crew experienced conditions that made parking and observations unsafe at the time of the program (km 45–41 and km 27). If tracks were seen in these sections, observations were taken from the vehicle.

Surveyors observed over 100 distinct Arctic fox crossings containing 1–5 sets of tracks each. Although many individual tracks were observed, many of the tracks detected were not considered “fresh”, as they appear to have been made prior to the most recent snowfall. At least 14 of the crossings were considered “fresh”. Surveyors observed 23 sets of Arctic hare tracks, only three of which appeared to be fresh. Nine sets of ptarmigan tracks were also recorded; however, no signs of caribou or other mammal tracks were observed. The windswept conditions limited surveyors' ability to determine if tracks were recent or relatively old, as fresh tracks in more exposed areas tend to look older if exposed to high winds. Crossings containing multiple track sets likely represent one or a few individuals moving back and forth on the same trail. Tracks often followed either side of the road before and after crossing. Only one potential deflection was noted, where a set of Arctic hare tracks appeared to change direction after approaching the road in an area with very high snow banks (> 2 m) that had not been pushed-back yet (see section 4.3 for more information on snow bank height monitoring). Typical site conditions and examples of observed tracks are displayed in Photo 7, Photo 8, Photo 9 & Photo 10.

Snow track surveys will continue annually and will occur more often by on-site staff once caribou are observed near site on a consistent and regular basis (e.g. based on trends observed from the Height of Land monitoring data, or incidental monitoring data), or on observations of local harvesters and as reported to Baffinland and the TEWG.

Photo 7 **Arctic fox tracks observed crossing the Tote Road with no deflection, April 28, 2018.**

Photo 8 **Fresh Arctic hare tracks observed crossing the Tote Rd with no deflection, April 28, 2018.**

Photo 9 Example of snow bank heights >2 m near km 40, April 28, 2018.

Photo 10 Many Arctic hare and fox tracks observed along the Tote Road, April 28, 2018.

4.3 SNOW BANK HEIGHT MONITORING

During review of the project, QIA and NIRB expressed concerns that Project activities could have a negative effect on caribou movement patterns. Specific concerns included caribou avoiding crossing due to vehicle presence and snow bank heights and the potential for constraining wildlife movement across roadways. In conjunction with the snow track survey (Section 4.2), and the concerns expressed by the QIA and other reviewers during the assessment of the original Project application to NIRB and the Early Revenue Phase proposal, the following Project conditions were issued to address these concerns including:

- Project condition #53ai) *"Specific measures intended to address the reduced effectiveness of visual protocols for the Milne Inlet Tote Road and access roads/trails during times of darkness and low visibility must be included."*
- Project condition #53c) *"The Proponent shall demonstrate consideration for…Evaluation of the effectiveness of proposed caribou crossing over the railway, Milne Inlet Tote Road and access roads as well as the appropriate number."*

To address these concerns, Baffinland committed to various mitigation measures allowing for effective caribou crossings of the Tote Road. Mitigation measures were developed to reduce the likelihood of a barrier effect on caribou movement which involves snow bank management and maintaining the snow bank heights at less than 1 m along the railway and roadways as well as smoothing the snow banks on the edges of roadways to reduce the probability of drifting snow. These mitigations allow for wildlife, specifically caribou, to cross the transportation corridor without being blocked by steep snow banks, as well as allowing greater visibility for drivers to help reduce wildlife-vehicle collisions.

4.3.1 METHODS

In response to reviewer comments, the 2018 snow bank height monitoring was conducted at approximately monthly intervals (four surveys) instead of only once annually. Monitoring was conducted by BIM by driving the Tote Road and stopping at the same kilometre markers as previous survey years. At the set locations, surveyors would measure the height of the east and west snow banks. Snow bank measurements were collected from the solid road surface to the top of the snow bank using survey rulers and were measured in centimetres. Surveyors would record the kilometre post marker number, photo number, bank height measurement (centimeters) for the east and west banks as well as any relevant comments. During each survey, snow depth measurements were collected at 45 kilometre post markers along the Tote Road, resulting in 90 measurements during each standard survey (Photo 11 and Photo 12). During some surveys, measurements were not taken when kilometre post markers could not be located.

4.3.2 RESULTS AND DISCUSSION

Snow bank height monitoring was conducted in January, February, April and May of 2018 by on site staff. All surveys were completed in one day, except for the February survey, which took place over two days due to poor visibility and driving conditions on the afternoon of the first day. Measurements across all surveys were as low as 0 cm in height and were as high as 250 cm. The January survey reported 76 compliant snow bank measurements, and 10 exceedances of the maximum snow depth of 100 cm, resulting in 84% compliance (Table 9; Figure 36). It was also noted during the January survey that many of the snow banks were feathered out to reduce banks from catching windborne snow. The February survey reported 88 compliant measurements and only two exceedances, resulting in 98% compliance. Similarly, the April survey had 84 compliances and only six exceedances, resulting in 93% compliance (Table 9; Figure 36). The May survey had 65 compliances and 21 exceedances, resulting in the lowest percent compliance out of all 2018 surveys, at 72% (Table 9; Figure 36). However, the May survey was conducted a few days after a large snowfall, and it was noted that snow bank height management was still in progress during the survey. A March survey was not conducted due to operational constraints. Overall, most of the sites measured complied with the snow bank height recommendations (Photo 13, Photo 14); however, several were greater. Percent compliance for all surveys combined was 87% (Table 9).

Table 9 Summary of snow bank height monitoring survey results for 2018.

Survey Date	# of measurements taken	Compliances	Exceedances	Percent Compliance
January 19, 2018	86[1]	76	10	84%
February 6, 2018	90	88	2	98%
April 5, 2018	90	84	6	93%
May 13, 2018	86[1]	65	21	72%
2018 Total	**352**	**313**	**39**	**87%**

[1] Measurements were not taken at two set points (east and west sides), as km posts could not be located. These points were considered 'non-compliant' when calculating percent compliance.

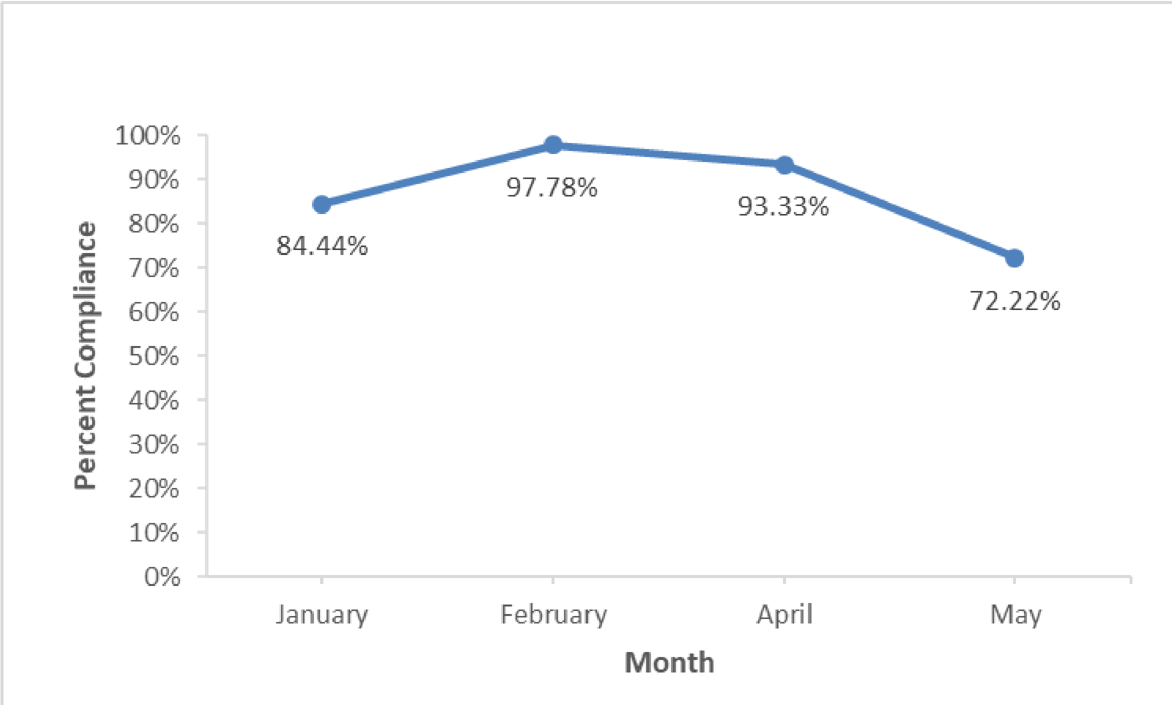


Figure 36 Percent compliance for 2018 snow bank height monitoring surveys.

Photo 11 Snow bank heights measured from the road surface up to the top of the bank on both the east and west banks at set locations (km 78), January 19, 2018.

Photo 12 Snow bank heights measured from the road surface up to the top of the bank on both the east and west banks at set locations, February 6, 2018.

Photo 13 Example of snow bank management on east and west sides of Tote Rd to ensure they do not exceed the maximum snow depth, May 13, 2018.

Photo 14 Example of typical snow bank conditions at km 64 on the Tote Road, January 19, 2018.

4.4 HEIGHT–OF–LAND SURVEYS

Project conditions 54b requires "Monitoring for caribou presence and behavior during railway and Tote Road construction" while Project condition 58b requires "A detailed analysis of wildlife responses to operations with emphasis on calving and post-calving caribou behaviour and displacements (if any), and caribou responses to and crossing of the railway, the Milne Inlet Tote Road and associated access roads/trails." Similarly, #53b requires "monitoring and mitigation measures at points where the railway, roads, trails, and flight paths pass through caribou calving areas, particularly during caribou calving times."

To address the Project conditions, height-of-land (HOL) surveys were initiated in 2013 to study caribou use and their behavioural reactions to human activities near the Project footprint, especially during the calving season. The focus of the HOL surveys is to examine how or if caribou, especially cows with calves, respond to Project activities and infrastructure. HOL surveys allow for long-term monitoring and observation of caribou behaviour throughout the life of the Project, providing information to verify and monitor predicted Project effects on caribou movement and habitat use. Among other things, behaviour sampling can provide insight into responses to environmental stimuli (Martin and Bateson 1993).

4.4.1 METHODS

The HOL surveys use a basic survey technique that involves observing an area from a high point of land (to increase the amount of observable area) for a prescribed amount of time, using binoculars and/or a spotting scope to detect and record caribou and their proximity to Project infrastructure. The 2018 HOL surveys were conducted in June to observe caribou during the calving period. Late winter surveys were not conducted in 2018. Two to three observers were present during all HOL surveys in 2018. The surveys followed the 2013 HOL survey design as closely as possible; however, due to resource constraints on site, sometimes a helicopter was used to access sites normally accessed by foot. Surveys included two to three observers travelling within the Project footprint, stopping at predetermined HOL stations along the way and scanning the landscape for approximately 20 minutes.

All twenty-four HOL stations were visited at least once in 2018. The HOL stations were established at the highest point possible, although a 360-degree view was rarely achievable. Project components (e.g. the road, camp, or deposit) were visible from each station. Stations were chosen based on their location along the road, gain in height (e.g. improved view), and accessibility in spring conditions. Stations 1–16 are generally accessible by foot under good conditions, and stations 17–24 would be inaccessible if not for helicopter support due to waterbodies and long travel time by foot.

At each station, the following information was recorded:

- Station number;
- Location description (direction from road, aspect, terrain, other identifying features);
- General habitat description (vegetation and soil);
- Photograph numbers (taken in multiple directions);
- Observation start and end time;
- Snow cover on landscape.

Observations were made with one spotting scope and 1 to 2 sets of binoculars (Photo 15 to Photo 18). Generally, observations were made continuously for 20–46 minutes by scanning the viewable landscape. If caribou were observed, the crew would begin monitoring behaviour following protocols established and described in the 2013 Annual Terrestrial Monitoring Report (EDI Environmental Dynamics Inc. 2014). Observations would be made as either a focal or scan sample (depending on the number of caribou; Martin and Bateson 1993), and observations would be recorded on field data sheets. For scan sampling, activity categories (i.e., walking, foraging, running, lying, etc.) would be assigned and tallied every two minutes. For the focal sample, activity observations would be recorded every two minutes; however, certain events (e.g. a truck passing by) would also be recorded to document any unique response. The individual's or group's distance to Project infrastructure and directional movement would also be recorded when possible. Distance from the observers would either be estimated by sight or by using a GPS.

In 2016, viewshed mapping was completed to demonstrate how far and to what extent surveyors could actively observe while conducting HOL surveys (EDI Environmental Dynamics Inc. 2017). The viewshed was modelled to determine the amount of viewable area while conducting HOL surveys. A total of 227 km^2 were surveyed within the viewshed area, survey coverage ranging from 5 km^2 to 22 km^2 from each HOL station (Map 5). For more details on the viewshed mapping methodology, see section 4.3.1 in the 2016 Terrestrial Environment Annual Monitoring Report (EDI Environmental Dynamics Inc. 2017).

Photo 15 Height of land surveys conducted in June during peak calving were accessed by helicopter or hiking from the Tote Road, June 7, 2018.

Photo 16 Height of land surveys conducted in June during peak calving were accessed by helicopter or hiking from the Tote Road, June 9, 2018.

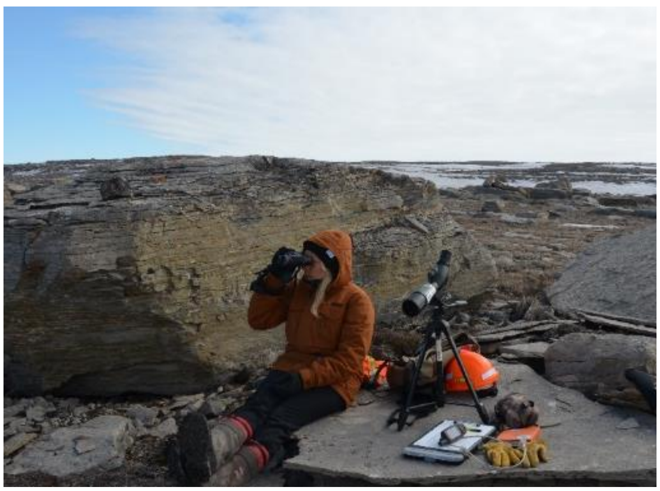
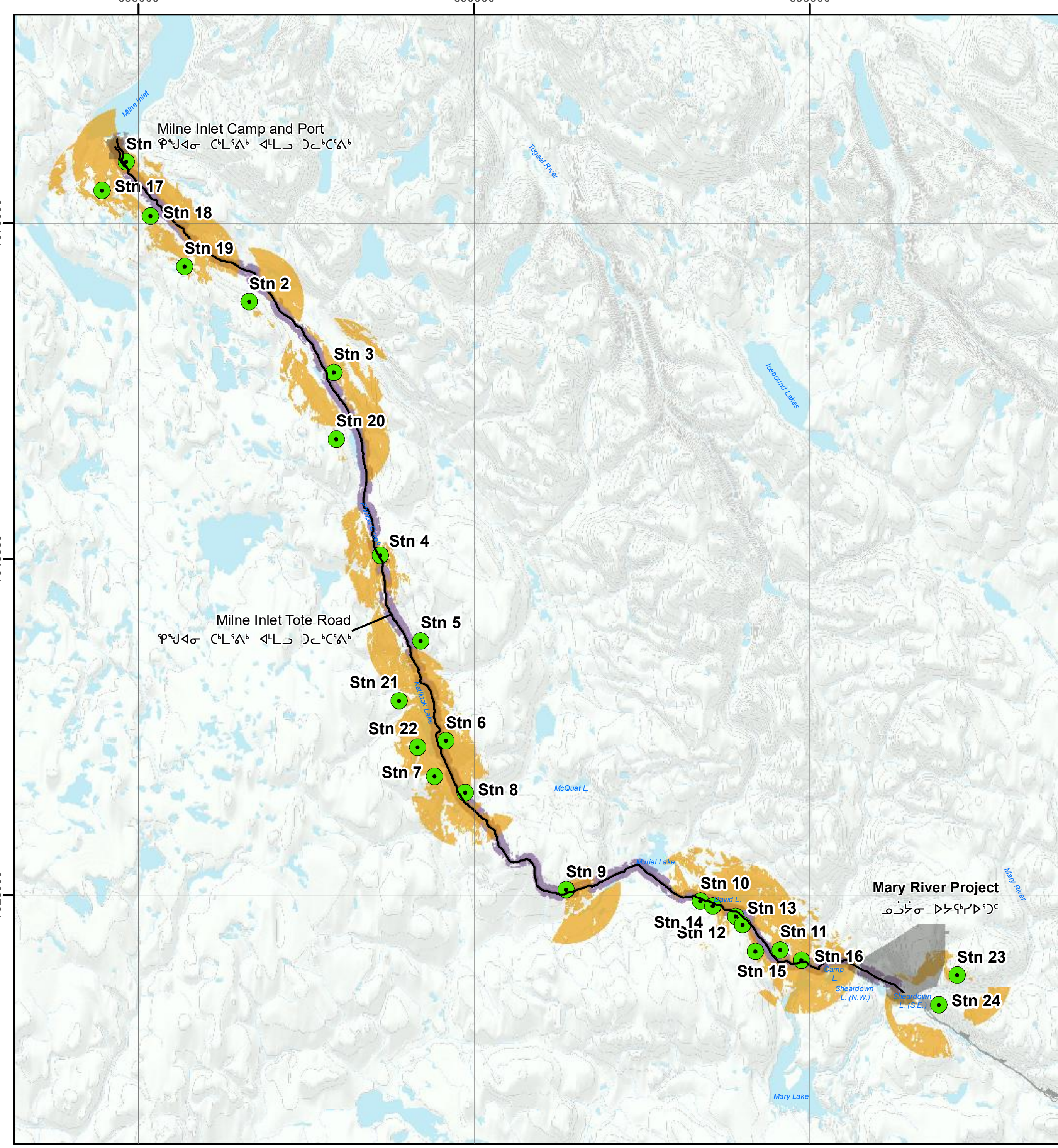


Photo 17 Height of land surveys conducted in June during peak calving were conducted using binoculars and a spotting scope, June 11, 2017.

Photo 18 View of the Tote Road from height of land Station 15, which was accessed by helicopter, June 13, 2018.



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- Milne Tote
- Potential Development Area
- Caribou Height of Land
- Viewshed from Tote Road (500 m distance)
- Viewshed from Height of Land Sites (4 km radius)

Caribou Height of Land Viewshed Mapping

NOTES

Viewsheds created by EDI Environmental Dynamics Inc. (2016).

Updated PDA provided by Hatch (25 April 2013).

Scale

0 5 10 20

Km

Map Scale: 1:434,708 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N

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Baffinland EDI

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4.4.2 RESULTS AND DISCUSSION

There were no caribou observed during HOL surveys in 2018. A total of 18 hours and 20 minutes of HOL surveys were conducted, with all surveys completed in June during peak calving (Table 10). All twenty-four HOL stations were visited at least once and 15 stations were visited twice during the June site visit. In 2018, stations 2, 5, 7, 15, and 17–24 were accessed by helicopter, and the remainder of the stations were accessed by foot.

Weather conditions during the HOL surveys ranged from excellent, clear viewing conditions to overcast or partly cloudy conditions with wind. Temperatures during the surveys ranged from 0˚C to 8˚C, snow was still present with 10–60% cover in June. Snow cover was enough to allow for observation of tracks in the snow for most areas, however, no caribou tracks or fresh signs of caribou were observed during surveys or on route to survey stations. Survey times ranged from 20–46 minutes in duration, with observation times typically exceeding 20 minutes if observers were attempting to distinguish an unidentifiable object on the landscape (e.g. a suspected animal).

Table 10 Summary details of height-of-land surveys conducted in the Mary River Project study area in 2018.

Method of transportation to HOL station	Dates of observation	Number of observers per survey	Survey Effort (hh:mm)
Helicopter; Truck and hiking from Tote Road	June 07, 08, 09, 10, 11, 12, 13, 14	1–3	18:20
Total	**8 Days**		**18:20**

4.4.2.1 Inuit Qaujimajatuqangit

During the 2018 HOL surveys, the following subset of information, derived from Inuit Qaujimajatuqangit from an MHTO member, was used as training material for BIM staff members who assisted with the surveys:

Caribou behaviour

- When windy, male caribou sometimes go down into valleys to hide from wind, but pregnant females usually stay on top of hills because they don’t want to walk up and down as much.
- In the morning caribou are more active and can be seen walking around and feeding, whereas around noon time they are often seen sitting and resting.

How to look for caribou on the North Baffin landscape

- From a distance, caribou look white like snow geese at this time of year with a bit of brown on top. When seen against the snow, they look light brown, and when seen against the land they tend to look whiter.

- Calves are born brown and can be seen running around. In spring, caribou split apart into individuals or small groups, and in fall/winter they tend to group together in groups of 30–40.
- Look for caribou on gentler rolling slopes as opposed to steeper rockier slopes. Look on top of slopes, and on slopes with more vegetation and less rocks, as they contain more food resources.

The training material was developed based on contributions from Inuit participants in the 2018 HOL survey program, see section 4.3.2.1 in the 2017 Terrestrial Environment Annual Monitoring Report (EDI Environmental Dynamics Inc. 2018).

4.5 INCIDENTAL OBSERVATIONS

Site personnel are asked to record wildlife sightings in the camp's wildlife logs – at both Mary River camp and at Milne Port camp. These logs provide an indication of the wildlife species that occur in proximity to Project infrastructure or areas where exploration may be occurring. Wildlife species recorded in the camp wildlife logs in 2018 are summarized in Table 11. A total of 16 caribou observations were reported in 2018, all of which were outside the PDA. Most of the caribou were observed in sampling and exploration areas south of Mary River; however, a group of five caribou were observed from the Mary River camp to the west of Sheardown Lake (Table 11). Several birds were also recorded on the wildlife logs including common eider, long-tailed duck, yellow-billed loon, red-throated loon, common raven, snow buntings, American pipit, semipalmated plover, sandhill cranes, Canada/cackling geese, snow geese, gulls, ptarmigan, and peregrine falcon.

Table 11 Wildlife species observations recorded in the 2018 Mary River and Milne Port camps wildlife logs.

Species	Number of observations			
	Mary River Camp	Tote Road	Milne Inlet	Outside PDA[1]
Arctic hare	12	5	–	2
Arctic fox	96	8	18	4
Caribou	–	–	–	16
Caribou (tracks)	–	–	–	–
Wolf (tracks)	–	–	–	many
Polar Bear	–	–	–	1

[1] Wildlife sightings in areas outside the PDA.

4.6 HUNTERS AND VISITORS LOG

Baffinland monitors human use by maintaining a log of visitors to site, with notation for those travelling through and hunting within the RSA. However, there is no certainty of a complete data set, as it is not compulsory for individuals to check in with Baffinland security unless they are stopping in and using the Baffinland facilities. A total of 539 individuals stopped and checked in at either Mary River or Milne Port camps in 2018, the majority of which stopped at Milne port (393 individuals in 78 groups) while only 45 groups were recorded at Mary River (1–7 individuals per visit). Individuals frequenting the area were often passing through, dog sled racing or were hunting, while the activities of most visitors were not recorded.

Baffinland provided food, beverages, transportation, fuel and mechanical assistance to hunters and other visitors if requested.

In 2018, several groups of caribou were observed by local Inuit hunters in various locations outside the PDA. In September, five caribou were observed from Mary River camp on the west side of Sheardown lake; six caribou were harvested by hunters in late November on their way back to Pond Inlet (exact location of harvest was not reported); and a group of 20 caribou were observed north of Angajurjualak Lake in early December, with reports of 15 caribou harvested during the month of December. Visitor numbers were somewhat higher in 2018 compared to previous years, likely due to the influx of hunters in the Angajurjualak Lake area and improved documentation of hunters and visitors by Baffinland.

4.7 INTER-ANNUAL TRENDS

In June 2013, a group of five caribou were observed in the PDA during HOL surveys; however, caribou have not been observed during surveys conducted between 2014 and 2018 (Figure 37). Lack of caribou observations on site likely follow low regional caribou numbers reported through Inuit Qaujimajatuqangit received at workshops held in November 2015 and April 2016. Caribou abundance surveys conducted in 2014 by the Government of Nunavut also reported low abundance throughout Baffin Island.

No caribou, wolf or other large mammal tracks were observed during snow tracking surveys conducted between 2014 and 2018; however, similar numbers of Arctic fox and Arctic hare tracks were observed throughout all survey years (Figure 38).

Most snow bank height measurements complied between 2014 and 2018. The number of snow bank height exceedances were similar from 2014–2016 and 2018, with between 80% – 87% compliance. The 2017 survey had the lowest rate of compliance at 66% (Figure 39).

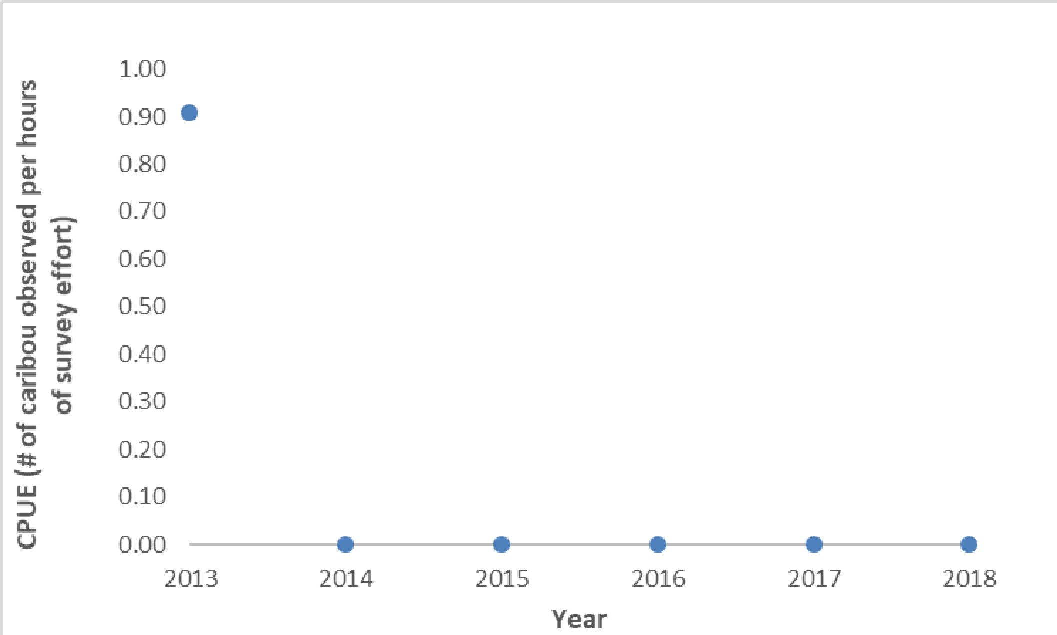


Figure 37 Caribou HOL survey trends 2013 – 2018.

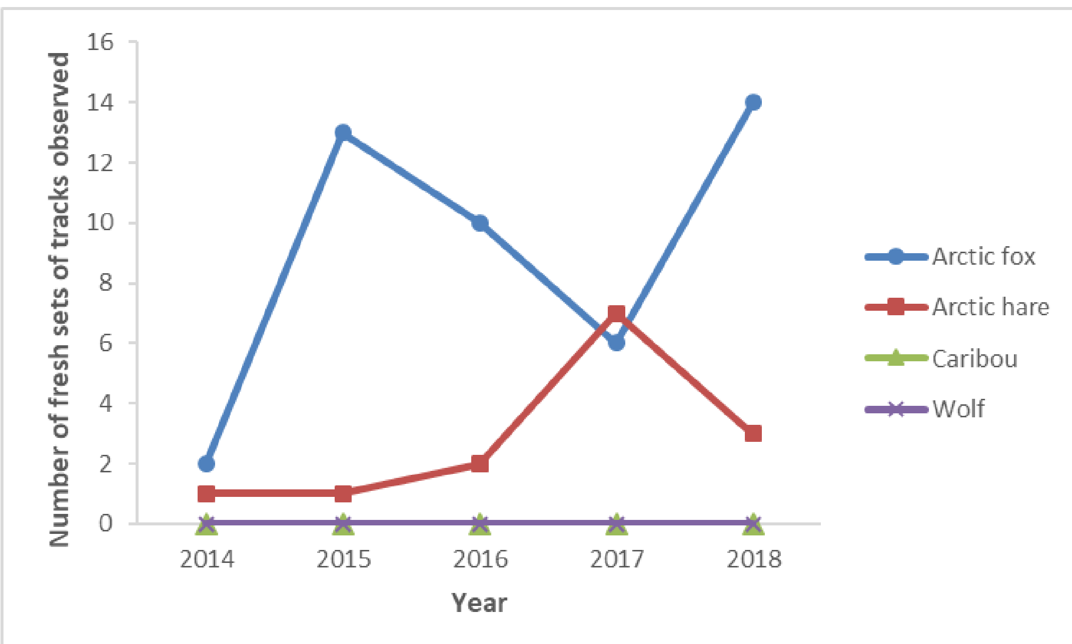


Figure 38 Snow track survey trends 2014 – 2018.

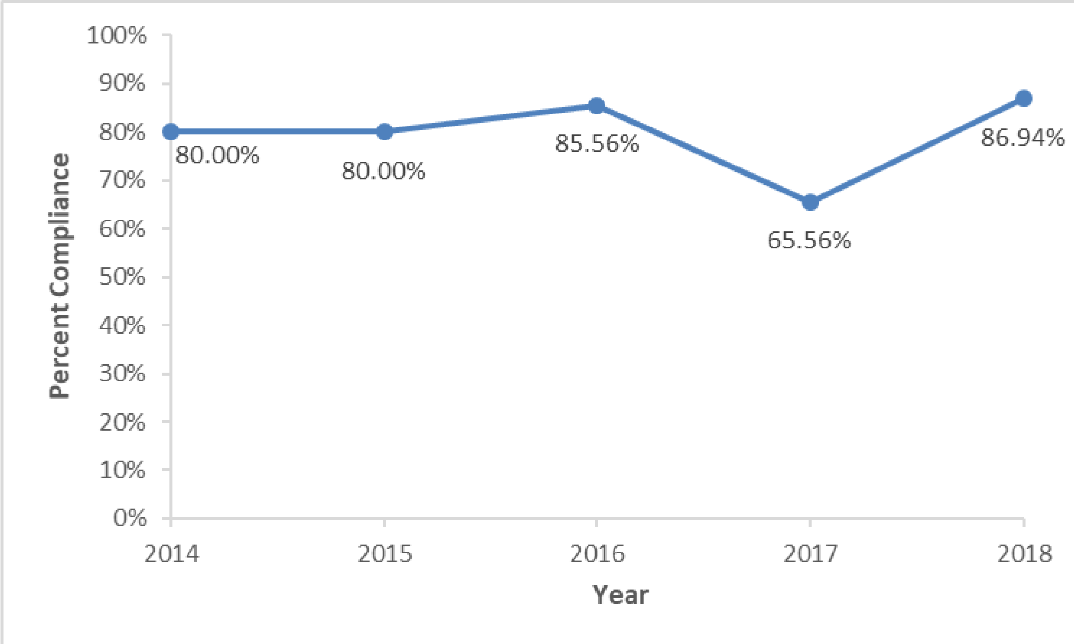


Figure 39 **Snow bank monitoring survey trends 2014 – 2018.**
**Snow bank height monitoring was conducted once yearly from 2014 – 2017, and ~monthly in 2018.*

4.8 MAMMALS SUMMARY

- Ground-based surveys continue to be used to monitor potential wildlife interactions with the Project. These include Height of Land surveys, snow track surveys, snow bank height surveys and incidental sighting reports from on-site personnel.
- In June 2013, a group of five caribou were observed in the PDA during HOL surveys; however, caribou have not been observed during surveys conducted between 2014 and 2018. Lack of caribou observations on site follow the trends of low numbers recorded in regional observations and have been confirmed through collaboration with the Government of Nunavut who conducts caribou aerial surveys and through local observations received at workshops held in November 2015 and April 2016. Spring caribou surveys were conducted in the North Baffin Region by the GN in 2018.
- Low numbers of incidental observations of caribou between the Mine Site and Milne Inlet between 2013 and 2018 also coincided with the lack of caribou observations during the HOL surveys.
- No caribou, wolf or other large mammal tracks were observed during 2018 snow tracking surveys; however, Arctic fox and Arctic hare tracks were observed in similar numbers to previous surveys.
- 2018 snow bank height monitoring was conducted at approximately monthly intervals (four surveys) instead of only once annually, as in previous years. Percent compliance for all surveys

combined in 2018 was 87%, which was like previous years, except for 2017, where compliance was only 66%.

- Height-of-Land, snow tracking, snow bank height, and incidental observations will continue in 2019.

5 BIRDS

The 2018 Project surveys for birds included pre-clearing nest surveys for birds when necessary, and continued monitoring and baseline data collection for cliff-nesting raptors. Specific surveys included:

- Pre-clearing nest surveys for breeding birds; and
- Cliff-nesting raptor occupancy and productivity surveys.

Project Condition #74 requires that "The Proponent shall continue to develop and update relevant monitoring and management plans for migratory birds…key indicators for follow up monitoring…will include: peregrine falcon, gyrfalcon, common and king eider, red knot, seabird migration and wintering, and songbird and shorebird diversity." During previous years, bird surveys included several surveys for songbirds and shorebirds to meet that portion of Project Condition #74. However, analysis of the survey results from the 2012 and 2013 PRISM plots and the 2013 bird encounter transects indicated that monitoring of Project effects on songbirds and shorebirds was unlikely to detect an effect of disturbance due to the low number of birds present. Subsequent discussions with the Terrestrial Environment Working Group (TEWG) and Canadian Wildlife Service (CWS) concluded that effects monitoring for tundra breeding birds could be discontinued but that Baffinland would:

- Contribute to regional monitoring efforts by conducting 20 PRISM plots every five years (completed in 2018, next scheduled for 2023);
- Complete coastline nesting surveys of the identified islet near the proposed Steensby Port Site prior to construction of the port;
- Conduct pre-clearing nest surveys prior to any clearing of vegetation or surface disturbance during the nesting season; and
- Continue with monitoring programs for cliff-nesting raptors (annual occupancy and productivity) and inland waterfowl survey when qualified biologists are available and onsite (roadside waterfowl survey).

5.1 REGIONAL MONITORING IN 2018

In 2018, CWS conducted 14 PRISM plot surveys within a 100 km radius of the Mary River Mine Site, and another 24 plots in other areas of North Baffin Island. No new species were observed during the surveys that haven't already been reported during other monitoring at Mary River. Some of the plots surveyed was good red knot habitat; however, no red knot were observed. Preliminary results provided by CWS indicated that 2018 was considered a low productivity year for shorebirds in the Mary River area and densities appeared lower than previous surveys in 2012/2013 (Smith, pers. comm., 2018). Baffinland contributed funds and logistical support in the form of helicopter re-fuels for these surveys.

The deployment of passive sound recording devices to detect red knot vocalizations was also scheduled for 2018, but due to logistical constraints, the deployment was deferred to 2019/2020. CWS is recommending that the sound recorders be deployed for at least two breeding seasons, in suitable red knot habitats at different locations to achieve the best results. If red knot are detected, CWS may recommend future monitoring. Although red knot specific surveys were not conducted in 2018, when qualified biologists were on site they were aware of the potential for red knot to occupy the area and were vigilant during all other surveys. Additionally, all BIM environmental staff were trained in conducting active migratory birds nest surveys (AMBNS) which included recognition of red knot as well as other listed species. A list of all bird species observed within the Project area from 2006–2018 can be found in APPENDIX B.

5.2 PRE–CLEARING NEST SURVEYS

Project condition #66 states that "*If Species at Risk or their nests and eggs are encountered during Project activities or monitoring programs, the primary mitigation measure must be avoidance. The Proponent shall establish clear zones of avoidance based on the species-specific nest setback distances outlined in the Terrestrial Environment Management and Monitoring Plan.*" Project condition #70 states "*The Proponent shall protect any nests found (or indicated nests) with a buffer zone determined by the setback distances outlined in its Terrestrial Environment Mitigation and Monitoring Plan, until the young have fledged. If it is determined that observance of these setbacks is not feasible, the Proponent will develop nest–specific guidelines and procedures to ensure bird's nests and their young are protected.*"

In accordance with those Project conditions, pre-clearing nest surveys were done prior to any disturbance to ensure no bird nests were in areas where clearing or disturbance was scheduled. In 2018, Baffinland attempted to clear potential development areas in advance of the breeding bird window as much as possible, therefore reducing the likeliness of interaction with nesting birds. Within any proposed disturbance, pre-clearing nest surveys are necessary between May 31st and August 15th while birds are actively nesting (TEMMP Section 3.2, Baffinland Iron Mines Corporation 2017).

5.2.1 METHODS

Pre-clearing nest surveys were conducted by Baffinland environmental staff over the 2018 nesting season in areas that had to be disturbed for approved construction activities during the nesting season. In early June at the beginning of pre-clearing surveys, EDI biologists trained on site staff. Training included methods to conduct nest searching surveys as well as common species found in the areas. The CWS provided advice to increase detection of nests during surveys at the TEWG meeting in 2015, BIM adopted the procedural advice) to increase the likelihood of nest/nesting adult detection during surveys. Rope drags were constructed following the template provided by CWS (Rausch 2015).

Pre-clearing surveys were conducted with a minimum of three observers. Observers would conduct surveys by pulling the rope drag back and forth through the area in a systematic fashion, stopping regularly to note incidental observations. Areas were surveyed for active nests a maximum of five days prior to clearing. If nests were found, then development was delayed until the nest and/or nesting areas were no longer active. If no nests were found and the area was not developed within the five-day window, surveys were conducted again to ensure no birds had started nesting. While nest searching, observers looked for signs of nesting bird behaviour including broken wing displays, alarm calls, or carrying food indicating a nest was within the area. Surveyors recorded all incidental bird observations during surveys, but identification was limited to the skills of the individual observers.

5.2.2 RESULTS AND DISCUSSION

To ensure that birds were not nesting in the area during the 2018 nesting season, Baffinland conducted pre-clearing active migratory bird nest searches (AMBNS). Ten pre-clearing surveys were conducted that comprised a total of 9.35 person-hours and 163,358 m² (16.3 ha) in the Mine Site, Tote Road and Milne Port development areas (Table 12). Two bird nests (snow bunting and American pipit) were located during 2018 AMBNS. The snow bunting nest was found on July 26, near the Mine Site. The young had already left the nest but had not fully fledged yet and were observed hopping around the nesting area. A 100 m buffer was applied to the nest site, according to ECCC's recommended setback distances for roads/ construction/ industrial activity, and development was delayed until it was confirmed that the birds had left the area. The American pipit nest was found near the Mine Site on July 27 and contained newly hatched young. A 100 m buffer was applied to the nest site, according to ECCC's recommended setback distances for roads/ construction/ industrial activity, and development was delayed until July 31, when it was confirmed that the nest had failed. During other AMBNS, environmental staff did note that songbirds were in the area, however, there was no indication of nesting behaviours observed (e.g., carrying food, carrying nesting material).

In 2018, approximately 232,355 m² was disturbed for Project infrastructure. Of the approximate areas cleared, 36% of the work was done outside of the breeding bird window. During the breeding bird window, approximately 83,388 m² of land was cleared while 163,358 m² was surveyed through AMBNS (Table 12).

Table 12 Summary of AMBNS surveys conducted in 2018 during bird nesting season.

Location	Date (dd/mm/yy)	Site Description	Nest located	Birds observed	Surveys effort (hours)	Area surveyed (m²)
Milne Port	08/06/18	R3 laydown area	–	–	4 surveyors, 1.0 hours	23705
Milne Port	15/06/18	R3 laydown area	–	–	3 surveyors, 1.15 hours	23854
Milne Port	22/06/18	R1 laydown area	–	–	3 surveyors, 1.5 hours	25548
Milne Port	25/06/18	R2 laydown area	–	–	3 surveyors, 1.0 hours	19893
Mary River	26/07/18	MS-08 waste rock pond expansion	1 snow bunting nest (empty)	12 young hopping around nest area	3 surveyors, 0.9 hours	15404
Mary River	27/07/18	Crusher pond access road	1 American pipit nest	4 young (in nest), 1 adult	4 surveyors, 0.5 hours	5709
Mary River	31/07/18	Landfill fence construction	–	Unidentified songbirds	3 surveyors, 1.0 hours	13644
Mary River	31/07/18	Crusher pond access road	Failed American pipit nest	4 young (deceased)	3 surveyors, 1.0 hours	10738
Mary River	31/07/18	MS-08 waste rock pond expansion	–	Snow bunting	4 surveyors, 0.5 hours	15404
Mary River	08/08/18	Old snow dump (truck wash bay)	–	Unidentified songbird	3 surveyors, 0.8 hours	9459

Table 12 Summary of AMBNS surveys conducted in 2018 during bird nesting season.

Location	Date (dd/mm/yy)	Site Description	Nest located	Birds observed	Surveys effort (hours)	Area surveyed (m^2)
Total Survey Effort (Person Hours) and Total Area surveyed (m^2)					**9.35**	**163,358**

5.3 RAPTOR EFFECTS MONITORING

The Baffinland FEIS states that a monitoring program for raptors will be used to assess the accuracy of predictions by comparing measurable parameters from within the footprint to those documented at appropriate control sites (Baffinland Iron Mines Corporation 2012). NIRB Project Condition #74 identifies peregrine falcon and gyrfalcon as key indicators for follow up monitoring of birds (Nunavut Impact Review Board 2014). Further, during the final hearing, Baffinland committed to monitoring relevant sections of the project area for peregrine falcon nesting activities (Commitment #75).

5.3.1 BACKGROUND 2011–2018

Arctic Raptors Inc. (ARInc.) personnel have conducted raptor monitoring as part of the Baffinland Iron Mine terrestrial baseline surveys and terrestrial effects monitoring efforts from 2011 through 2018. In general, surveys of known nesting sites were conducted by helicopter, boat, and on foot in the Steensby Inlet area, and by truck and helicopter along the Tote Road from the Mine Site to Milne Inlet. Over this period, monitoring objectives have been modified periodically to align with priorities for each phase of the Project (e.g., pre-FEIS, Early Revenue Phase).

The main goal of the 2011 survey was to revisit locations provided by Baffinland to substantiate and undertake quality control of monitoring data that had been collected from 2006–2008 in the Regional Study Area (RSA; extending from Milne Inlet in the north to Steensby Inlet in the south). A second goal was to gauge the potential for establishing a dedicated study area to be based at Steensby Inlet that could serve as a replicate for the long-term monitoring program located near Rankin Inlet, Nunavut. ARInc. initiated a banding program of breeding adults and nestlings, collected blood samples, searched for nesting locations that had not been previously identified, and conducted small mammal trapping following protocols already in place at Rankin Inlet. Surveys were conducted in 2012 of all known nesting sites with the same goals that had been identified in 2011. Surveys conducted in 2013 investigated nesting habitat selection of peregrine falcons (PEFA) and rough-legged hawks (RLHA). Fieldwork in 2014 involved ongoing extensive surveys (occupancy and productivity) of known nesting sites in the RSA and additional coverage of areas not previously surveyed to validate habitat selection models.

Prior to the 2015 breeding season, Arctic Raptors Inc. was tasked with providing a monitoring program to estimate potential effects of the Project. This marked a departure from extensive monitoring of known nesting sites throughout the RSA to monitoring nests within a 10 km buffer of the PDA, hereafter referred to as the Raptor Monitoring Area (RMA). Prior to the start of the 2015 field season, a total of 131 nesting sites (65 PEFA and 66 RLHA) were known to exist within the RMA. The density of nesting sites was distributed disproportionately with higher densities located within 3 km of anthropogenic disturbance and much lower density beyond 3 km of disturbance. Thus, starting in 2015, survey effort shifted from extensive monitoring of known nesting sites throughout the RSA to monitoring of nesting sites only within the RMA as well as searching for previously unknown nesting sites. In 2015, efforts to locate previously unknown nest sites focused on those areas further from disturbance to address the limitation associated with small sample size further from disturbance. Survey effort in 2016 similarly focused on monitoring of known nesting sites within the RMA, as well as searching for previously unknown nesting sites, but also placed greater effort on multiple visits to address detection error. Fieldwork in 2017 followed the same methodology as 2016 and additional effort was placed on addressing issues raised in previous reports (terminology, and methodology to address the effect of alternative nesting sites on estimates of occupancy and productivity).

Fieldwork in 2018 followed methods used in 2016 and 2017 and included additional work based on recommendations from the 2017 Annual Monitoring Report; specifically, conducting three surveys (rather than two), and adding small mammal monitoring. Ashton Bradley, a graduate student registered in the Department of Biological Science at the University of Alberta, began his thesis research that will focus on investigating the effects of both anthropogenic (distance to disturbance) and natural disturbance regimes (nearest neighbor distance, weather, and prey abundance) on occupancy and reproductive success of peregrine falcons and rough-legged hawks in the RMA. The 2018 report summarizes data collected only within the RMA and focuses on effects monitoring.

5.3.2 TERMINOLOGY

The terminology used throughout this report follows Franke et al. (2017). The following terms are highlighted given their frequent use in this report:

alternative nesting site — One of potentially several nests within a nesting territory that is not a used nest in the current year (Millsap et al. 2015).

minimum acceptable age for assessing success — A standard nestling age at which a nest can be considered successful. An age when young are well grown but not old enough to fly and after which mortality is minimal until actual fledging. Typically 80% of the age that young of a species normally leave the nest of their own volition for many species, but lower (65–75%) for species in which age at fledging varies considerably or for species that are more likely to leave the nest prematurely when checked (Steenhoff and Newton 2007).

nesting site — The substrate which supports the nest or the specific location of the nest on the landscape (Ritchie and Curatolo 1982, Millsap et al. 2015, Steenhof et al. 2017).

nesting territory — An area that contains, or historically contained, one or more nests within the home range of a mated pair: a confined locality where nests are found, usually in successive years, and where no more than one pair is known to have bred at one time (Newton and Marquiss 1984, Steenhoff and Newton 2007). Note that a nesting territory may or may not be defended (Postupalsky 1974), and probably does not include all of a pair's foraging habitat (Newton and Marquiss 1984, Steenhoff and Newton 2007).

occupancy — The quotient of the count of occupied nesting territories and the count of known nesting territories that were fully surveyed in a given breeding season (Franke et al. 2017).

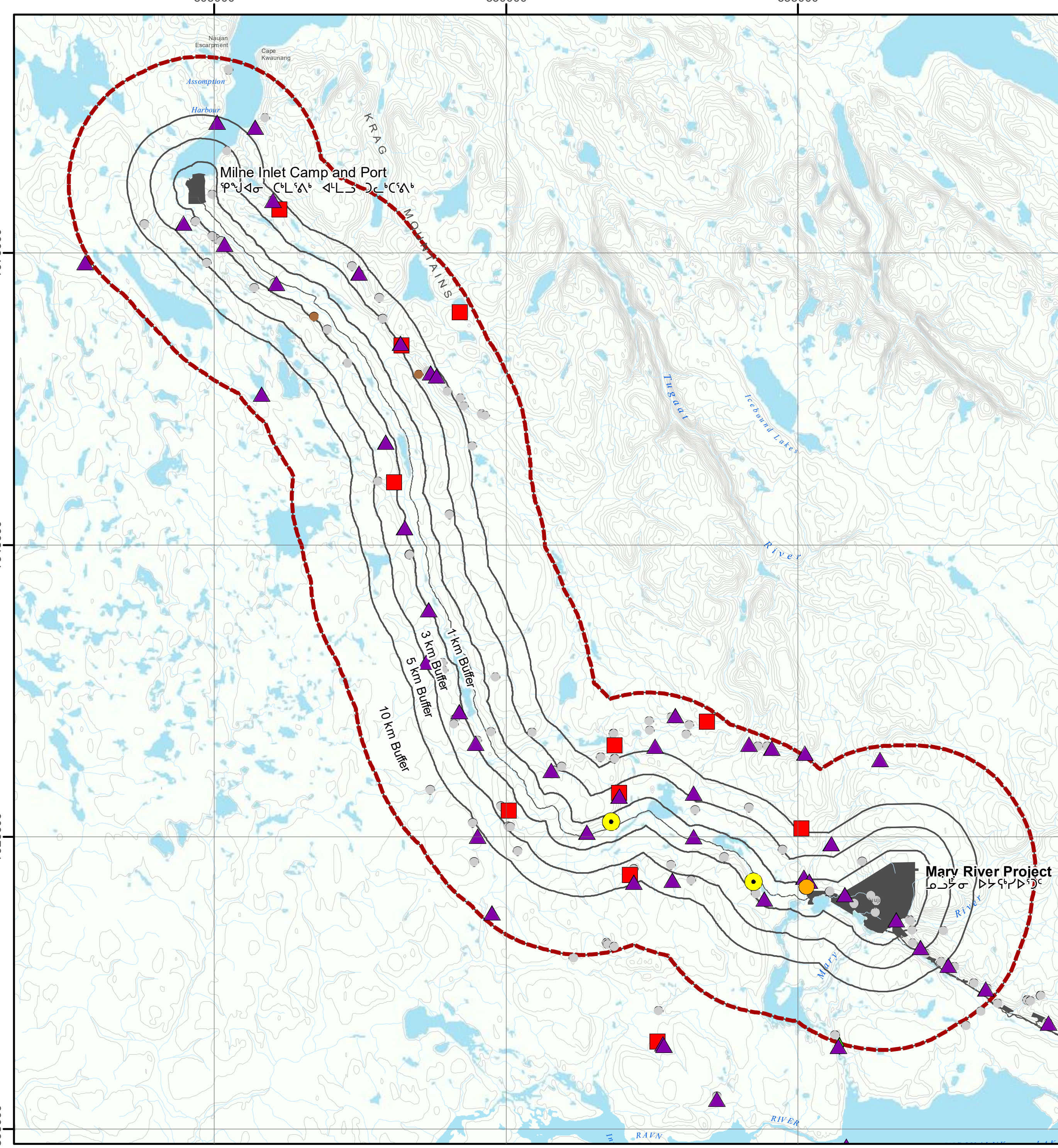
productivity — The number of young that reach the minimum acceptable age for assessing success; usually reported as the number of young produced per territorial pair or per occupied territory in a particular year (Steenhoff and Newton 2007, Steenhof et al. 2017).

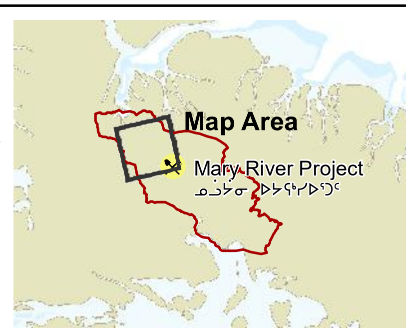
5.3.3 BREEDING PHENOLOGY

Breeding phenology is an important determinant of the timing of occupancy and productivity surveys. In Nunavut, the earliest documented arrival for peregrine falcons is May 10 at a known breeding site near Rankin Inlet. Although arrival timing varies with spring conditions, most sites are occupied during the third week of May. Median laying date in Rankin Inlet (June 9 ± 4.0 days) was earlier than Igloolik (June 15 ± 3.6 days; $Chi^2 = 31.56$, $p < 0.001$) and north Baffin Island (June 16 ± 3.5 days; $Chi^2 = 35.56$, $p < 0.001$) with no difference observed between Igloolik and Baffin ($Chi^2 = 0.77$, $p = 0.38$) (Jaffré et al. 2015). The incubation period of the fourth laid egg (33 days) is similar to what has been reported elsewhere (Burnham 1983). Rough-legged hawk breeding phenology is very similar to peregrine falcons but is typically advanced by a week to 10 days (Poole and Bromley 1988). Additionally, the presence of breeding pairs in locations where ground squirrels are absent (as is the case on Baffin Island) is typically cyclic in association with lemming abundance. The timing of surveys on Baffin Island was conducted to match the phenology of local breeding birds.

5.3.4 RAPTOR MONITORING DATA

The landscape is generally rugged, and elevation varies ranging from sea-level to 685 metres. The area includes a wide valley associated with Philip's Creek surrounded by high plateaus and mountains. The valley extends southward into poorly drained plains and rolling tundra. Vegetation is patchy, and dominated by mountain avens and arctic willow, along with alpine foxtail, wood rush, and saxifrage. Dry or high elevation sites are very sparsely vegetated, whereas wet areas have a continuous cover of sedge, cottongrass, saxifrage, and moss. Peregrine falcon (*Falco peregrinus tundrius*) and rough-legged hawk (*Buteo lagopus*) are the most common raptor species. Gyrfalcon (GYRF; *Falco rusticolus*), snowy owl (SNOW; *Bubo scandiacus*) and common raven (CORA; *Corvus corax*) are also encountered. The spatial extent of the 2018 surveys was limited to nesting sites within the RMA (Map 6).





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- Common Raven Nesting Site (1)
- Peregrine Falcon Nesting Site (48)
- Rough-legged Hawk Nesting Site (11)
- Gyrfalcon Nesting Site (1)
- Unoccupied Nesting Site (102)
- Not visited (3)
- Lemming Trapping Stations
- 2017 Raptor Monitoring Area
- Potential Development Area ᓄᓇ ᐊᒃᑐᕐᑕᐅᑐᐃᓇᑎᐊᓗᒃ ᓴᕕᒃᓴᕐᓯᐅᕐᑐᓂᑦ

Distribution of nesting sites during occupancy and productivity surveys in 2018

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PDA provided by KP, July 11, 2017.

This document is not an official land survey and the spatial data presented is subject to change without notice.

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Map Scale ᐊᖏᓂᖓ: 1:500,000 (printed on 8.5 x 11)
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5.3.5 METHODS

Raptor surveys from 2011 through 2014 were conducted through the region extending from Milne Inlet to Steensby Inlet, and results of those surveys were reported in previous annual monitoring reports (EDI Environmental Dynamics Inc. 2013, 2014, 2015, 2016). Survey efforts from 2015 to 2018 focused on monitoring of occupancy and reproductive success only within the RMA, and opportunistically documented previously unknown nesting sites.

5.3.5.1 Helicopter Survey

Three surveys were conducted in 2018: June 16–19 (~19 hours), July 12–15 (~21 hours), August 16–20 (~18.5 hours). The focus of these surveys was to search known nesting sites for the presence of cliff-nesting birds. In addition to the structured surveys, favourable habitat was searched opportunistically when ferrying between known sites, camps or other mine infrastructure and when raptors or signs of site use (e.g., whitewash, orange-colored lichen, and unused nests) were observed. Sites were considered occupied if one or more adults displayed territorial or reproductive behavior (e.g. vocalization and/or flight behavior associated with defense of breeding territory or presence of nest building, nest, or eggs). Locations with partially built or unused nests without detection of breeding aged adults were noted as such (i.e., no birds detected).

5.3.5.2 Distance to Disturbance

Within the spatial extent of the 2015 study area, ESRI ArcGIS for Desktop v.10.3 (ESRI 2010) was used to calculate the distance from all raptor nest sites to the nearest mapped disturbance features (e.g., Project infrastructure). Shapefiles were derived from CAD drawings provided by HATCH, the onsite procurement and engineering contractors. From the CAD files, the Mine Site, Milne Port and Tote Road footprints were used to represent current and proposed disturbance as of September 2014. The ArcGIS Near Tool was used to calculate the Euclidean distance for each nest site (i.e., point location) to the nearest point of the Project footprint. Sites that were located within the spatial extent of the PDA received a distance value of 0 meters. Distance to disturbance (DD) values for only those sites within the RMA were retained for effects analysis on occupancy and reproductive success.

5.3.5.3 Distance to Nearest Neighbour

Nearest neighbour distances (NND) were calculated in R (R Development Core Team 2017) using the sp, rgeos, and geosphere packages to transform the geographic coordinates describing nesting site locations into spatial objects, calculate pairwise distances and identify the shortest distance between each point and its nearest neighbouring point. Nearest neighbour distances were then used to assign nesting sites to nesting territories.

5.3.5.4 Assigning Nesting Sites to Nesting Territories

In the absence of marked individuals, it can be challenging to definitively identify alternative nesting sites. Failure to account for alternative nesting sites can lead to underestimating demographic parameters such as annual productivity. To address this problem, a rule-based approach was used to estimate the number of alternative nesting sites within the RMA. Mean Nearest Neighbor Distance within the RMA equalled 1.2 km, and this information was used in conjunction with the following rule set to identify clusters of nesting sites that were potential alternative nesting sites (Figure 40):

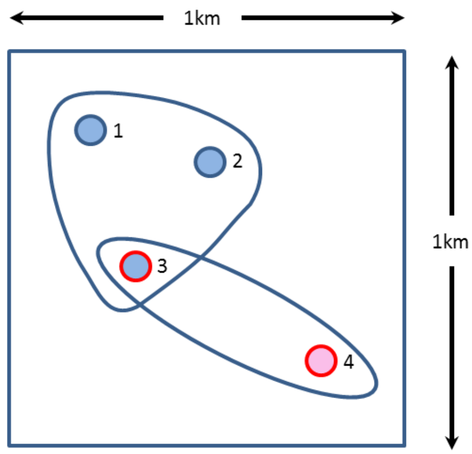
- If two species-specific nesting sites were separated by a distance of ≤ 1 km they were considered alternative nesting sites in a single nesting territory.
- If two nesting sites within 1 km of each other were occupied by the same species in a given year, they were considered separate territories.
- If multiple species-specific nesting sites were within 1 km of one another, discrete geographic landforms or discontinuities in cliff structure were used to separate or combine sites into territories.

Temporal patterns of multi-species occupancy were used to assess the plausibility of decisions based on the application of the three rules listed above. For example, if two nesting sites were located within 1 km of each other and were occupied by two different species in alternating years, these nesting sites were identified as distinct alternative nesting sites for each species.

Assigning Identification Numbers (ID) to Nesting Territories was conducted according to the following rule set:

- Nesting Territory IDs were assigned within species only (e.g., Nesting Territory IDs for PEFA and RLHA were never shared).
- Nesting Territory IDs were assigned using the Identification Number of one of the Nesting Sites in the cluster according to the following rule set, in order of priority:
- Length of tenure (i.e., nesting sites with the longest tenure)

    i. First tenure (i.e., nesting sites with the first tenure in the event length of tenure was equal).



NS ID	PEFA NT ID	RLHA NT ID	2011	2012	2103	2014	2015	2016	2017
1	**1**	**-**	PEFA	PEFA	NBD	NBD	NBD	PEFA	PEFA
2	1	-	NBD	NBD	PEFA	NBD	PEFA	NBD	NBD
3	1	4	NBD	NBD	NBD	PEFA	RLHA	RLHA	NBD
4	-	4	RLHA	RLHA	NBD	RLHA	NBD	NBD	RLHA

Figure 40 Rule-based approach used to assigning nesting sites to nesting territories. Occupancy Modelling.
A cluster of four nesting sites within 1 km of one another that exhibit a site occupancy history among seven years for two species (PEFA and RLHA). Nesting Sites 1 and 2 (blue circles with blue borders) have been occupied solely by PEFA. Nesting Site 4 (red circle with red border) has been occupied solely by RLHA. Nesting Site 3 (blue circle with red border) has been occupied by both PEFA and RLHA. In this example, Nesting Sites 1, 2 and 3 are grouped into a single PEFA Nesting Territory and assigned Nesting Territory ID 1 based on PEFA–specific tenure length (Nesting Site 1 has the longest tenure) and first tenure. Nesting Sites 3 and 4 are grouped into a single RLHA Territory and assigned Nesting Territory ID 4 based on RLHA–specific tenure length (Nesting Site 4 has the longest tenure) and first tenure. Unique nesting locations are ultimately defined by a Nesting Territory ID and a Nesting Site ID (E.g., NT ID 1, NS ID 2). NBD = no birds detected.

5.3.5.5 Occupancy Modelling

Although estimation of nesting site occupancy can serve as a metric of population status (MacKenzie et al. 2002, 2003), detection of nesting pairs is invariably imperfect, and estimating the proportion of occupied sites without accounting for detection error can lead to underestimation of true occupancy (Kéry and Schmidt 2008). Hierarchical occupancy modelling can estimate parameters that influence occupancy and simultaneously account for detection probability <1 (Marsh and Trenham 2008).

Occupancy at a nesting sites is limited to one of only two outcomes (occupied or not occupied), and is therefore a Bernoulli trial, and estimates of colonization (i.e., an unoccupied site becomes occupied), extinction (i.e., an occupied site becomes unoccupied), and survival (i.e., an occupied site remains occupied) can be generated for the time series, and covariates can be added to the model to test whether they influence the parameters by linking specific covariates to each of the three parameters using a logit link function.

Mutli-year occupancy was calculated in R (R Development Core Team 2017) using the *unmarked* package. Where appropriate, data were standardized (e.g., DNN was standardized by subtracting the mean from each distance value and dividing by the standard deviation) and then formatted specifically for *unmarked* using the unmarkedMultFrame function. Model fitting of candidate models was performed using the colext function. Akaike Information Criterion (AIC) was used for model selection. Fifteen candidate models were selected *apriori* to address anthropogenic (i.e., distance to disturbance) and ecological factors (i.e., distance to a nearest neighbour), and interactions among factors with the potential to influence model parameters (initial colonization, annual colonization, annual extinction, and detection probabilities). For example, the effect of distance to disturbance may vary with distance to nearest neighbour (i.e., the effect of distance to disturbance may depend on the proximity of neighbouring nesting sites). The aim of this analysis was twofold: 1) to estimate the proportion of occupied nesting sites and identify factors that may influence whether sites are occupied or not, and 2) to estimate the overall trend in occupancy from 2012 – 2018 (2011 was dropped from the analysis as only four nesting sites were fully surveyed in 2011). The trend was estimated using annual occupancy probabilities to calculate the average rate of change at the population level (MacKenzie et al. 2003) where a mean value < 1 indicates population decline and > 1 indicates an increase.

5.3.5.6 Reproductive Success

The minimally acceptable age (MAA) for peregrine falcons based on recommendations in Steenhof et al. (2017) is 26 days, but 25 days of age is typically used (Anctil et al. 2014, Franke et al. 2016, 2017, Lamarre et al. 2017), to ensure nestlings do not fledge prematurely. Based on an average at 40 days of age (range 31 - 45; Parmelee et al. 1967), the MAA for rough-legged hawks is 32 days.

Given that nestling age during the survey period varied annually among years and sites, measures of annual productivity *per se* are biased high (i.e., counts of nestlings are often done when nestlings are <MAA), but should still allow for comparison among years within the RMA. Estimates of productivity reported here should not be compared to estimates of productivity in other regions. For this report, any nesting site that was surveyed once in either the pre-laying period or early during the incubation period, and once during the brood rearing period, was considered "fully surveyed", and estimates of productivity were calculated as:

$$\text{Productivity} = N_{\text{Chicks}}/N_{\text{NestingTerritoriesOccupied}}$$

where N_{Chicks} is equal to the total count of chicks observed in the summer survey and $N_{\text{NestingTerritoriesOccupied}}$ is equal to the count of nesting territories occupied (Parmelee et al. 1967). Surveys were conducted in the first week of August when nestlings are expected to range between 15 and 25 days of age and are conspicuous.

Distance to disturbance and distance to nearest neighbour individually, and as an interaction term were used as covariates to model the effect on count of nestlings at fully surveyed peregrine falcon and rough-legged hawk nesting territories from 2012 – 2018 in R (R Development Core Team 2017) using the *glm* command with Poisson link in Package MASS.

5.3.5.7 Small Mammal Monitoring

Two small mammal trapping sessions were conducted from July 16-22, 2018 and August 9-15, 2018 following the procedure outlined by Cadieux *et al.* (2015). Two trapping sites were selected based on habitat thought to be suitable for both brown and collared lemmings (presence of old lemming nests, runways and burrows, seed-bearing plants, wet and dry tundra, and a total area that is equal to or larger than 700 m in length). In addition, we selected areas accessible by a light vehicle along the Tote Road.

Two permanent line transects were staked (GPS-located) at each trapping site. Line transects were 300 m long with 20 stations, 15 m apart. Each station consisted of a flagged stake and three museum special snap traps attached to the stake using string (1 m in length), for a total of 240 traps. Traps were evenly distributed around the stake at a distance no further than 1 m and baited with peanut butter.

All traps were checked once daily for six trap-nights, resulting in 1,440 trap-nights per trapping session. We recorded all captures, misfires, or missing bait from each trap.

5.3.6 RESULTS

5.3.6.1 Nesting Site Detections

A total of 166 unique nesting sites have been detected in the RMA including five new nesting sites detected in 2018. Three were within 1 km of previously known nesting sites and were considered likely alternative nesting sites, one unoccupied nesting site had evidence of recent use (likely a failed/fledged gyrfalcon or common raven nesting site), and one was a unique nesting territory. Among years, the greatest number of previously unknown nesting sites detected occurred in 2014 (N=19) and 2015 (N=32) due to efforts associated with the model validation aspect of the nesting habitat selection study and efforts to increase sample sizes in regions further from a disturbance in 2014 and 2015, respectively. The number of known nesting sites has increased considerably in the RMA since 2011 (from N=96 to N=166); the percentage of known sites checked annually has remained high (range of 83% to 100%). In 2018, 163 nesting sites (98%) were surveyed at least twice. Annually, cliff-nesting birds are detected at over half of known nesting sites that are checked. However, in years when detections of rough-legged hawks are very low (i.e., 2013, 2017, and 2018), cliff-nesting birds are detected at approximately one-third of known nesting sites. Of the 163 nesting sites visited in 2018, cliff-nesting birds were detected at 61 sites; 48 held peregrine falcons, 11 held rough-legged hawks, one held gyrfalcons, and one held common ravens. Raptors were not detected at 102 known nesting sites (Table 13).

Table 13 Summary statistics for survey effort and detections at known raptor nesting sites within the RMA from 2011 to 2018.

Variable		Year							
		2011	2012	2013	2014	2015	2016	2017	2018
Effort	Total nesting sites known annually	96	106	107	126	158	161	166	166
	New sites found annually	0	10	1	19	32	3	5	0
	Count of sites checked	87	106	89	124	148	141	166	163
	% known sites checked	91%	100%	83%	98%	94%	88%	100%	98%
	Count of checked sites occupied	56	72	30	77	99	70	61	61
	% checked sites occupied	64%	68%	34%	62%	67%	50%	37%	37
	Count of sites checked ≥2 times annually	4	71	59	97	127	106	166	163
Detections	Count of sites no raptors detected	31	34	59	47	49	71	105	102
	Count of sites PEFA detected	27	26	29	43	50	48	50	48
	Count of sites RLHA detected	26	44	1	31	47	18	5	11
	Count of sites GYRF detected	3	0	0	1	1	2	2	1
	Count of sites CORA detected	0	1	0	1	0	1	4	1
	Count of sites GLGU detected	0	1	0	0	1	1	0	0
	Count of sites SNOW detected	0	0	0	1	0	0	0	0

5.3.6.2 Assigning Nesting Sites to Nesting Territories

Of the 166 nesting sites detected within the RMA, 95 sites were within 1 km of one or more neighbouring nesting sites and were assigned to 34 clusters. Of the 95 nesting sites at which peregrine falcons were detected, 53 were within 1 km of one or more neighbour nesting sites and assigned to 35 nesting territories. Of the 94 nesting sites at which rough-legged hawks were detected, 57 were within 1 km of one or more neighbour nesting sites and assigned to 39 nesting territories. Of the six nesting sites at which gyrfalcons were detected, two were within 1 km of one or more neighbour nesting sites but none were considered alternative nesting sites based on the rule sets outlined previously, and thus all six were by default considered nesting territories *per se*. Thus, across all years, the estimated number of nesting territories within the RMA was 79, 81 and six for peregrine falcons, rough-legged hawks and gyrfalcons, respectively.

5.3.6.3 Occupancy

From 2012 – 2018 the top model for the raptor guild (peregrine falcons, rough-legged hawks and gyrfalcons) indicated that colonization and extinction were best explained by yearly variation (Table 14). Minimum distance to disturbance appeared in the fourth top model with an ΔAIC of 33.81; a large difference compared to the top model and indicates that neither of the covariates explains colonization and extinction better than natural variation from year to year. The time-series (Figure 41) is long enough to identify a single peak in occupancy in 2015 but it is likely that a similar peak occurred in 2011.

Although four peregrine falcon models included the covariates distance to nearest a neighbor and distance to disturbance were ranked higher than the null, their improvement was marginal (2.02 ΔAIC, Table 15). The explanatory power of the covariates within the top models is therefore likely to be weak, and indeed, estimates for distance to the nearest neighbour and distance to disturbance are close to zero with confidence intervals overlapping zero (Table 15). Multi-year occupancy for peregrine falcons (Figure 42) potentially indicated a slight decline with $\lambda = 0.92 \pm 0.09$.

With highly varied occupancy across years, the best model for rough-legged hawks included a year effect for colonization and extinction (Table 16). Multi-year occupancy for rough-legged hawks (Figure 43) indicated $\lambda = 1.11 \pm 1.35$ from 2012 – 2018. Considerable annual variation exists with lows in 2013 and 2018.

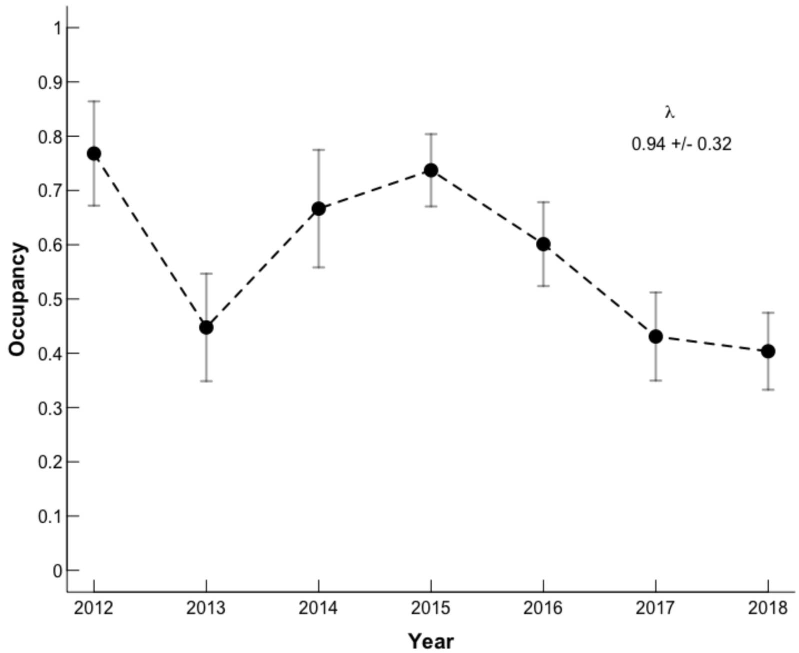


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Figure 41 Annual estimates (± 95% confidence intervals) of nesting territory occupancy at the guild level within the RMA from 2012 –2018.

Model estimates indicate a slight decline in this period ($\lambda = 0.94 \pm 0.32$), however, this estimate varies widely, and confidence intervals overlap 1.

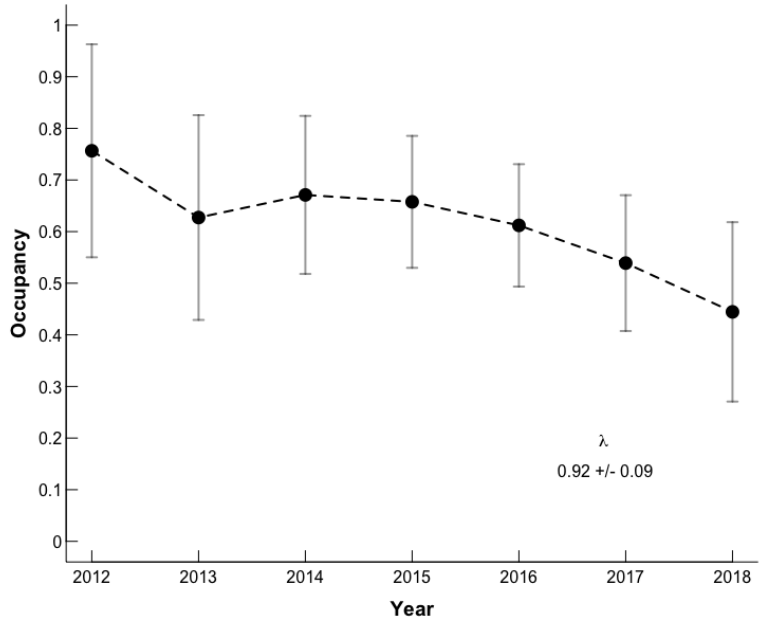


Figure 42 Annual estimates (± 95% confidence intervals) of nesting territory occupancy peregrine falcons within the RMA from 2012 – 2018.

Although the confidence interval overlaps 1.0, occupancy among peregrine falcons may have declined slightly from 2012-2018, with $\lambda = 0.92 \pm 0.09$.

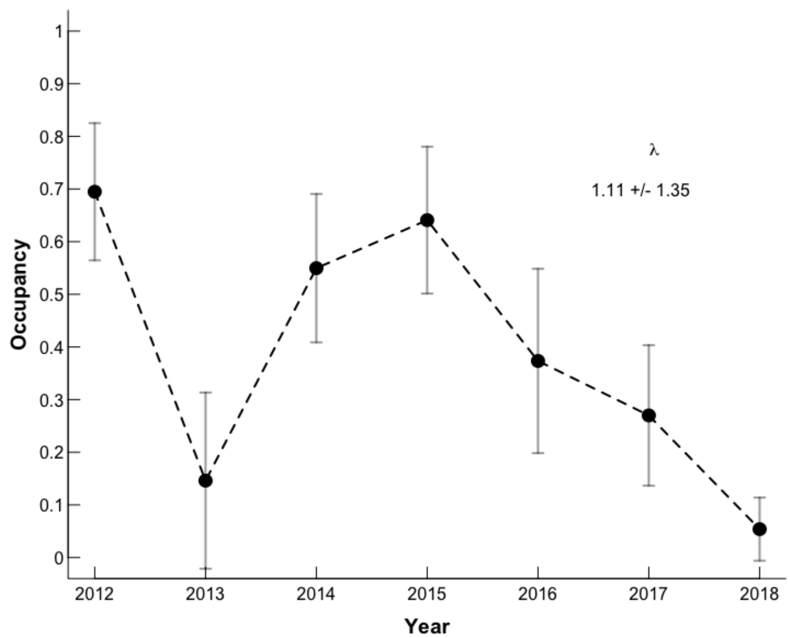


Figure 43 Annual estimates (± 95% confidence intervals) of nesting territory occupancy for rough-legged hawks within the RMA from 2012 – 2018.

As is typical among specialists like rough-legged hawks, occupancy can vary widely across years as is the case here. Although λ is positive, 95% confidence intervals overlap with 1.0 indicating that the overall trend is likely stable, and that 2018 represent a cyclic low. Derived parameters of occupancy indicate an increase, albeit with substantial variation ($\lambda = 1.11 \pm 1.35$).

Table 14 Site occupancy modelling at the guild level incorporates the main parameters inherent to metapopulation dynamics (i.e., colonization (γ), and extinction (ε)).

Model selection was conducted using Akaike Information Criterion (AiCc). Model parameters reflect first-year occupancy, colonization, extinction and detection where -yr, dtn, md and sp refer to surveyed year, distance to nearest neighbor, minimum distance to disturbance and survey period, respectively.

Model	Model number	K	AICc	Delta_AICc	ModelLik	AICcWt	LL	Cum.Wt
-.yr.yr.sp	7	15	1724.32	0	1	0.74	-845.34	0.74
md.yr.yr.sp	4	16	1726.46	2.14	0.34	0.25	-845.15	1
-.yr.yr.-	3	14	1738.7	14.38	0	0	-853.77	1
-.md.md.sp	8	7	1758.12	33.81	0	0	-871.66	1
md.md.md.sp	2	8	1759.87	35.55	0	0	-871.42	1
-.-.-.-	1	4	1770.72	46.4	0	0	-881.22	1
-.-.md.-	13	5	1772.29	47.97	0	0	-880.93	1
-.md.-.-	12	5	1772.64	48.32	0	0	-881.11	1
-.dtn.-.-	14	5	1774.03	49.71	0	0	-881.8	1
dtn.yr.yr.sp	5	16	1777.53	53.21	0	0	-870.69	1
-.-.dtn.-	15	5	1785.08	60.76	0	0	-887.33	1
-.-.md*dtn.-	11	7	1849.77	125.45	0	0	-917.48	1
-.dtn.dtn.sp	9	7	1934.76	210.44	0	0	-959.98	1
-.md*dtn.md*dtn.sp	6	11	2176.71	452.39	0	0	-1076.38	1
-.md*dtn.-.-	10	7	2236.21	511.89	0	0	-1110.71	1

Table 15 Site occupancy modelling for peregrine falcons incorporate the main parameters inherent to metapopulation dynamics (i.e., colonization (γ), and extinction (ε)).

Model selection was conducted using Akaike Information Criterion (AiCc). Model parameters reflect first-year occupancy, colonization, extinction and detection where -yr, dtn, md and sp refer to surveyed year, distance to nearest neighbor, minimum distance to disturbance and survey period, respectively. Covariate estimates from the top models are presented below.

Model	Model number	K	AICc	Delta_AICc	ModelLik	AICcWt	LL	Cum.Wt
-,md,md,sp	8	7	696.59	0	1	0.3	-340.05	0.3
-,dtn,dtn,sp	9	7	696.74	0.14	0.93	0.28	-340.12	0.58
-.md.-.-	12	5	697.95	1.36	0.51	0.15	-343.34	0.73
-.dtn.-.-	14	5	698.26	1.67	0.43	0.13	-343.49	0.86
-.-.-.-	1	4	698.61	2.02	0.36	0.11	-344.89	0.97
-.-.md.-	13	5	700.89	4.3	0.12	0.03	-344.81	1
-.yr.yr.sp	7	15	712.1	15.51	0	0	-334.57	1
-,yr.yr.-	3	14	714.98	18.39	0	0	-337.96	1
md.yr.yr.sp	4	16	716.23	19.64	0	0	-334.56	1
dtn.yr.yr.sp	5	16	737.65	41.06	0	0	-345.27	1
md.md.md.sp	2	8	738.85	42.26	0	0	-359.79	1
-.md*dtn.-.-	10	7	753.91	57.31	0	0	-368.71	1
-.-.dtn.-	15	5	830.77	134.18	0	0	-409.75	1
-.-.md*dtn.-	11	7	835.98	139.39	0	0	-409.75	1
-.md*dtn.md*dtn.sp	6	11	841.49	144.89	0	0	-406.52	1

	β		
	colonization	extinction	*p*
distance to disturbance	0.12 ± 0.08	-0.0006 ± 0.05	0.10, 0.99
distance to nearest neighbour	-0.0015 ± 0.00092	-0.00016 ± 0.00072	0.11, 0.82

Table 16 Site occupancy modeling for rough-legged hawks incorporate the main parameters inherent to metapopulation dynamics (i.e., colonization (γ), and extinction (ε)).

Model selection was conducted using Akaike Information Criterion (AiCc). Model parameters reflect first-year occupancy, colonization, extinction and detection where -yr, dtn, md and sp refer to surveyed year, distance to nearest neighbor, minimum distance to disturbance and survey period, respectively.

Model	Model number	K	AICc	Delta_AICc	ModelLik	AICcWt	LL	Cum.Wt
-.yr.yr.sp	7	15	566.55	0	1	0.54	-262.42	0.54
-,yr.yr.-	3	14	566.84	0.3	0.86	0.46	-264.42	1
md.yr.yr.sp	4	16	590.15	23.61	0	0	-272.28	1
dtn.yr.yr.sp	5	16	598.4	31.85	0	0	-276.4	1
-.-.md.-	13	5	605.06	38.51	0	0	-296.94	1
-,md,md,sp	8	7	605.53	38.98	0	0	-294.62	1
-.-.-.-	1	4	607.19	40.64	0	0	-299.21	1
md.md.md.sp	2	8	607.79	41.24	0	0	-294.39	1
-.-.dtn.-	15	5	608.59	42.05	0	0	-298.71	1
-.md.-.-	12	5	609.08	42.54	0	0	-298.95	1
-,dtn,dtn,sp	9	7	609.34	42.79	0	0	-296.53	1
-.dtn.-.-	14	5	609.62	43.07	0	0	-299.22	1
-.-.md*dtn.-	11	7	619.22	52.67	0	0	-301.47	1
-.md*dtn.-.-	10	7	704.78	138.23	0	0	-344.25	1
-.md*dtn.md*dtn.sp	6	11	716.36	149.82	0	0	-344.25	1

5.2.6.4 Reproductive Success

Productivity for peregrine falcons and rough-legged hawks within the RMA in 2018 was 0.9±0.2 and 0.5±0.2 nestlings per fully-surveyed occupied site, respectively (Table 17). These values are within the range calculated for all survey years combined (0.6±0.3 to 2.4±0.2 for peregrine falcons, and 0.0 to 2.2±0.2 for rough-legged hawks). It should be noted that, although productivity was within the range of values calculated annually from 2011 – 2018, the count of nestlings (Total Production) should be acknowledged in conjunction with productivity. The count of nestlings for peregrine falcons and rough-legged hawks at fully surveyed nesting territories in 2018 was 43 and 5, respectively.

There is weak evidence ($p = 0.05$) that distance to disturbance has influenced reproductive success at peregrine falcon nesting sites near mine infrastructure (Table 18). There was no evidence (all p values > 0.05) that distance to disturbance and distance to nearest neighbour individually, and as an interaction term influenced the count of nestlings at fully surveyed rough-legged hawk (Table 19) nesting territories from 2012 – 2018.

Table 17 Productivity (number of young per occupied nesting territory per year) for peregrine falcons and rough-legged hawks within the RMA from 2011 – 2018 for fully surveyed sites only.

	PEFA								RLHA							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
Territories known	27	37	44	57	72	73	75	79	26	52	52	61	78	79	79	81
Territories visited	27	33	39	48	61	60	75	79	26	46	46	55	67	66	79	81
Occupied (fully surveyed)	3	10	25	42	49	53	50	48	1	18	8	26	46	17	5	11
Count of nestlings	7	16	33	65	95	114	58	43	0	26	0	58	106	29	5	5
Productivity±SE	2.3±1.2	0.6±0.3	1.3±0.3	1.5±0.2	1.9±0.2	2.4±0.2	1.2±0.2	0.9±0.2	-	1.4±0.3	-	2.2±0.2	2.3±0.2	1.7±0.3	1.0±0.5	0.5±0.2

Table 18 Effects of distance to disturbance and distance to nearest neighbour individually, and as an interaction term on count of nestlings at fully surveyed peregrine falcon nesting territories from 2012 – 2018.

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	2.197e-01	1.067e-01	2.059	0.00
DD	2.391e-05	1.236e-05	1.933	0.05
DN	9.452e-05	5.735e-05	1.648	0.10
DD:DN	-8.345e-09	7.659e-09	-1.090	0.28

Table 19 Effects of distance to disturbance and distance to nearest neighbour individually, and as an interaction term on count of nestlings at fully surveyed rough-legged hawk nesting territories from 2012 – 2018.

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	5.803e-01	1.406e-01	4.128	0.00
DD	1.192e-05	1.887e-05	0.632	0.53
DN	1.623e-07	9.237e-05	0.002	0.99
DD:DN	-6.489e-09	1.449e-0	-0.448	0.65

5.3.6.4 Small Mammal Monitoring

Across all 1,440 trap-nights, zero lemmings were captured, 38 misfires were recorded, and there were three cases where bait was missing without misfire.

5.3.7 DISCUSSION

The raptor section addresses two issues raised previously by reviewers: 1) a need for clear definitions, and; 2) accounting for the effect of increased detection of alternative nesting sites on occupancy and reproductive success. Although annual variation in productivity for peregrine falcons and rough-legged hawks is apparent, it is most likely representative of natural variability associated with variation in prey availability and weather rather than due to any influence of anthropogenic disturbance. A potential ongoing decline in peregrine falcon occupancy and weak evidence that distance to disturbance may be associated with reduced reproductive success, has been flagged. For those nesting sites near the Tote Road and other infrastructure, it would be prudent to mitigate activity as much as possible. It is possible that breeding pairs that were nesting close to mine infrastructure have simply established new nesting sites further away from infrastructure, and if so, the effect is on the distribution of nesting sites, rather than on the size of the breeding population *per se*. For rough-legged hawks, occupancy appears to be cyclical (approximately 4-year oscillation), and strongly suggests that occupancy (and therefore count of nestlings) is associated with the natural small mammal cycle which is also known to cycle approximately every four years (Gilg et al. 2003).

We have incorporated monitoring of small mammal abundance to address whether occupancy and reproductive success of rough-legged hawks do in fact cycle with small mammal abundance. In addition, we anticipate that weather-related environmental variables will be included with distance to anthropogenic disturbance as part of our on-going modelling efforts. Based on the analysis to account for distance to disturbance and distance to nearest neighbour individually, and as an interaction, it appears that there is no negative effect of these factors on occupancy (i.e., estimates ± standard errors of λ overlap with 1.0) or reproductive success (i.e., p values > 0.05) for both species. Future monitoring will continue to focus on multiple nesting territory visits annually. Accounting for detection error is an important component of periodic within-season monitoring (to account for the assumption of closure) and, should be conducted a minimum of twice (early incubation and during brood rearing).

5.4 INTER-ANNUAL TRENDS

Annual variation in productivity for peregrine falcons and rough-legged hawks is apparent, however, it is most likely representative of natural variability associated with variation in prey availability and weather rather than due to any influence of anthropogenic disturbance. For rough-legged hawks, occupancy appears to be cyclical (approximately four-year oscillation), and strongly suggests that occupancy is associated with the natural small mammal cycle, which is also known to cycle approximately every four years. Occupancy of potential nesting sites by gyrfalcon in the RMA have been too low to monitor annual trends.

It appears that factors such as distance to disturbance and distance to nearest neighbour (individually and as an interaction) have no negative effect on occupancy or reproductive success at the raptor guild level for rough-legged hawk. However, there is weak evidence ($p = 0.05$) that distance to disturbance influenced reproductive success at peregrine falcon nesting sites near mine infrastructure.

5.5 BIRDS SUMMARY

- Baffinland contributed funds and logistical support to regional shorebird monitoring in 2018, conducted by the Canadian Wildlife Service (CWS). CWS surveyed 14 PRISM plots within a 100 km radius of the Mary River Mine Site, and another 24 plots in other areas of north Baffin Island. Future surveys are scheduled for 2023. The deployment of passive sound recording devices to detect red knot vocalizations was also scheduled for 2018 but has been deferred to 2019/2020.
- Active migratory bird nest searches (AMBNS) have been conducted since 2013 prior to any proposed land disturbance and/or clearing during the breeding bird window (May 31 – August 15). In 2018, two nests were located during AMBNS, both of which were near the Mine Site. In each of these locations, construction activities were delayed until post-fledging. 2014 is the only other year that nests have been located during AMBNS; three nests were in 2014, one at the Mine Site and two at Milne Port. No nests were located during any other year, so no buffers were required.
- Raptor surveys were conducted in 2011 and 2012 as part of the Project's terrestrial baseline surveys, and annual raptor monitoring surveys have been conducted since 2013.
- In 2018, site occupancy, brood size, and nest success were monitored for all known nest sites located within 10 km of the PDA (the Raptor Monitoring Area). Areas with high nest-site suitability for cliff-nesting raptors located between known nest sites and nearby were also surveyed.
- A total of 166 unique nesting sites were monitored in the RMA. Of these, 61 sites were occupied by raptors in 2018; 48 by peregrine falcon, 11 by rough-legged hawk, one by gyrfalcon, and one by common raven.
- In 2018, small mammal abundance monitoring was incorporated into the raptor monitoring program to confirm the cyclical occupancy of rough-legged hawks in conjunction with the small mammal cycle. No small mammals were captured in 2018.

6 HELICOPTER FLIGHT HEIGHT

Helicopter flight-height management and monitoring are critical for wildlife (particularly calving and post-calving caribou) and staging waterfowl. All wildlife and bird species can be sensitive to disturbance, and low flying helicopters can be stressful for wildlife resulting in increased activity or reduction in forage time. The following Project conditions were issued to address these concerns including:

- Project Condition 59) *"The Proponent shall ensure that aircraft maintain, whenever possible (except for specified operational purposes such as drill moves, take offs and landings), and subject to pilot discretion regarding aircraft and human safety, a cruising altitude of at least 610 metres during point to point travel when in areas likely to have migratory birds, and 1,000 metres vertical and 1,500 metres horizontal distance from observed concentrations of migratory birds (or as otherwise prescribed by the Terrestrial Environment Working Group) and use flight corridors to avoid areas of significant wildlife importance…"*
- Project Condition 71) *"Subject to safety requirements, the Proponent shall require all project related aircraft to maintain a cruising altitude of at least:*
    - *650 m during point to point travel when in areas likely to have migratory birds*
    - *1,100 m vertical and 1500 m horizontal distance from observed concentrations of migratory birds*
    - *1,100 m over the area identified as a key site for moulting snow geese during the moulting period (July–August), and if maintaining this altitude is not possible, maintain a lateral distance of at least 1,500 m from the boundary of this site."*
- Project Condition 72) *"The Proponent shall ensure that pilots are informed of minimum cruising altitude guidelines and that a daily log or record of flight paths and cruising altitudes of aircraft within all Project Areas is maintained and made available for regulatory authorities such as Transport Canada to monitor adherence and to follow up on complaints."*

Baffinland in collaboration with the TEWG committed to "specific measures to ensure that employees and subcontractors providing aircraft services to the Project are respectful of wildlife and Inuit harvesting that may occur in and around Project areas" (Qikiqtani Inuit Association and Baffinland Iron Mines Corporation 2014).

To monitor compliance with these Project Conditions, and Baffinland's commitment, data from helicopter flight logs were analyzed to determine if there was compliance with the Project Conditions.

6.1.1 METHODS

As per Project Condition 71, the analysis includes the following aircraft cruising altitudes in consideration of migratory birds during specific time periods:

- 1,100 metres above ground level (magl) and 1,500 m horizontal distance while travelling through the key moulting area for snow geese during July and August;

- 650 magl during point to point travel in areas outside of the goose area, and in all other months in all areas; and
- 1,100 magl vertical and 1,500 m horizontal distance from observed concentrations of migratory birds at all times.

Canadian Helicopters provided monthly flight tracklog data, as well as daily pilot timesheets (with flight details) to provide context and explain the need for non-compliant transits. Point data was provided in feet above sea level and was converted to metres above sea level (masl). A Digital Elevation Model (DEM) was used to estimate ground-level elevation value above sea level, which provides point elevation data that is used to calculate the helicopter tracklog's altitude above ground level. To find the elevation above ground level in metres, the masl from the DEM was subtracted from the masl from the helicopter track log, resulting in an analysis that provided a helicopter's approximate metres above ground level (magl) at each tracklog point.

To assure the calculated values were correct; a Quality Assurance/Quality Control procedure was done on the data by querying the status field of the flight tracklog data. It was assumed that when the helicopter status was "wheels off" or "wheels on", the elevation would be at or close to 0.0 magl. The average values from the query show that accuracy is ~ ±12 m.

Data were initially split into two categories: 1) data within the snow goose area in July and August in relation to 1,100 magl elevation requirement and 2) data within and outside the snow goose area in all months in relation to 650 magl. The data sets were then analyzed separately to assess specific flight height allowances using the different areas and elevation values. The flight height data was also cross-referenced with pilot logs from daily timesheets, and any flight data with the rationale for flying at lower elevations than required was compliant. Based on this analysis, flight data was organized into the following six categories:

- Those data within the snow goose area in July and August, where the 1,100 magl elevation requirement was achieved (compliant);
- Those data within the snow goose area in July and August where the 1,100 magl elevation requirement was not achieved, but the rationale for lower elevation flying was given (compliant);
- Those data within the snow goose area in July and August where the 1,100 magl elevation requirement was not achieved and no rationale for low-level flying was given (non-compliant);
- Those data within and outside the snow goose area in all months where the 650 magl elevation requirement was achieved (compliant);
- Those data within and outside the snow goose area in all months where the 650 magl elevation requirement was not achieved, but the rationale for lower elevation flying was given (compliant);
- Those data within and outside the snow goose area in all months where the 650 magl elevation requirement was not achieved and no rationale for low-level flying was given (non-compliant).

To comply with the horizontal guidelines, pilots are given the spatial boundaries of any identified concentrations of migratory birds, which are buffered by the required 1,500 m horizontal avoidance distance. Pilots are then asked to avoid flying in these areas. So far, the only area identified for horizontal avoidance is the key moulting area for snow geese.

6.1.2 RESULTS/DISCUSSION

There is a discrepancy between Project Condition 59, suggesting that minimum flight height should be 610 magl in all areas, and Project Condition 71 prescribes a minimum flight height of 650 magl. Considering that most, if not all, areas where Baffinland operated in May through September were likely to have migratory birds, the default minimum altitude for the analysis was 650 magl (during point to point travel).

There were no identified "observed concentrations of migratory birds", nor areas specifically prescribed by the TEWG to avoid for migratory birds in 2018. With exception of the snow goose area, there was no analysis necessary to determine compliance of 1,100 m vertical and 1,500 m horizontal distance of any other location. There were also no known public complaints about helicopter overflights for follow-up as per Project Condition 72. In 2018, Canadian Helicopters operated four helicopters during the summer season, whereas two or three helicopters have been used previously.

There were 2,588 total transits flown within the analysis time frame (May – September), of which 294 (11%) intersected the snow goose area and 2,294 (89%) were outside of the area (Table 20). In 2018, flight height compliance within the snow goose area during the moulting season was 94% (Table 21; Map 8 and Map 9), and compliance within and outside the snow goose area in all months was 98% (Table 22; Map 7 – Map 11).

2018 was the second year that flight height data were cross-referenced with pilot logs from daily timesheets. For analytical purposes, flight height data points were designated "compliant" when elevation requirements were achieved, or where pilot's discretionary rationale for deviating from flight heights was provided. Data points were designated "non-compliant" if they did not meet elevation requirements, and no explanation was given. This additional analysis resulted in an increase in helicopter flight height compliance when compared to previous years, as it provided explanations for transits flown lower than the elevation requirements. Some examples given in 2018 to explain low-level flights included the following:

- Weather
- Slinging
- Geophysical survey
- Other surveys
- Staking
- Drop off/pick up
- Demobilization
- VIP tours (e.g., QIA and INAC inspection tours)
- Sampling, and
- Evacuations.

This additional analysis showed that when considering rationale provided by pilots for low-level flying, most low-level data points were compliant. For example, of all the compliant points within the snow goose area during the moulting season, only 8% were ≥ 1,100 magl, and the other 92% were < 1,100 magl with reasons given by pilots. Similarly, when looking at all compliant points within and outside the snow goose area in all months, only 6% were ≥ 650 magl, and the other 94% were < 650 magl with reasons given by pilots. The high percentage of low-level compliant flights is similar to what was observed in 2017, and will likely continue in future years as the majority of helicopter work conducted at Mary River either requires low-level flying for safety/operational reasons (e.g. slinging, surveys), or involves multiple short distance flights whereby helicopters are unable to reach the required elevations between take-off and landing sites (e.g. staking, sampling, drop offs/pickups). In 2018 the most common reasons stated by pilots for flying below the elevation requirements were: surveys, slinging, and drop offs/pickups. Most compliant transits that met the elevation requirements in 2018 tended to be long distance flights, where pilots were airborne long enough to reach and maintain the required elevations.

Overall, 2018 flight height compliance was high both inside and outside the snow goose area, despite there being nearly eight times more transits outside the snow goose area than inside, and almost double the number of overall transits compared to 2017. The high level of compliance observed in 2018 is largely due to the additional analysis performed, which considered rationale provided by pilots for many of the transits flown below the elevation requirements, as well as improved documentation of the rationale for low-level flights by pilots and Baffinland staff in 2018.

It is evident that pilots made efforts to avoid the snow goose area during the moulting season when possible in 2018, as only 11% of all transits were flown over the snow goose area. Most transits over the snow goose area also appeared to be direct flights between Mary River and Steensby, which only skirted the eastern edge of the boundary, and most flights near the boundary are within a well-defined track, away from habitat areas that have been identified as having higher concentrations of geese within the goose area. Non-compliant transits were those that did not achieve elevation requirements and where no rationale for low-level flights were provided. Baffinland will continue to work with Canadian Helicopters to document flight height compliance and communicate elevation requirements to pilots throughout the flying season. Although most transits were below the recommended elevations, the potential disturbance to birds cannot be described.

Table 20 Number of transits flown per month with a breakdown of transits (№ and %) flown over and outside of the snow goose area, May 1– September 30, 2018.

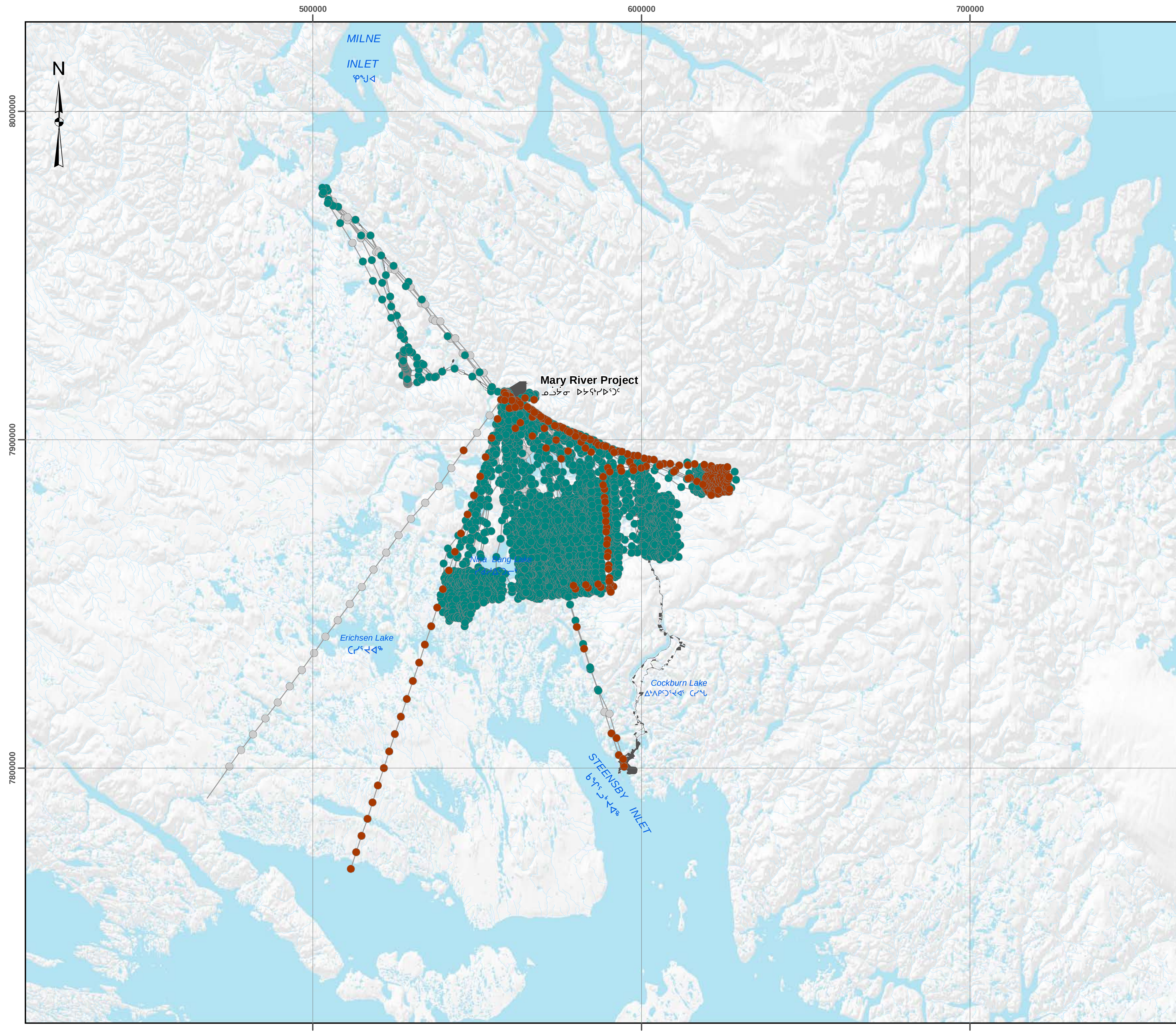
Month	Total № transits	№ transits over snow goose area	% transits over snow goose area	№ transits outside snow goose area	% transits outside snow goose area
May	57	30	53	27	47
June	564	50	9	514	91
July	766	89	12	677	88
August	955	105	11	850	89
September	246	20	8	226	92
Total	**2,588**	**294**	**11**	**2294**	**89**

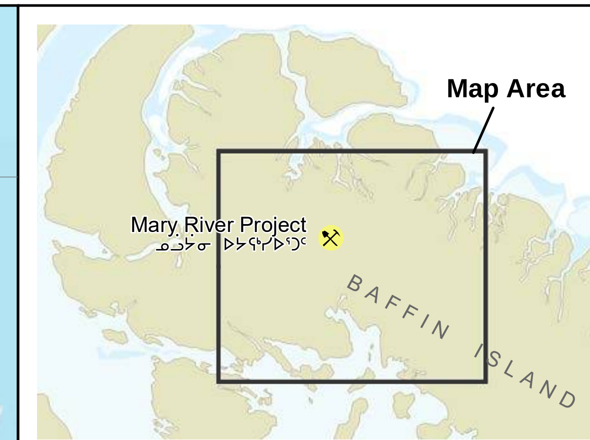
Table 21 Elevation points calculated to obtain flight height compliance over the snow goose area, May 1–September 30, 2018.

Month	Area	Total points	Total compliant points ≥ 1,100 magl	Total compliant points < 1,100 magl with rationale	% compliance	Total non–compliant points	% non–compliance
May	Not applicable (n/a)			n/a			
June	Not applicable (n/a)			n/a			
July	Within SNGO Area	535	39	469	95	27	5
August	Within SNGO Area	553	47	471	94	35	6
September	Not applicable (n/a)			n/a			
Total		**1,088**	**86**	**940**	**94**	**62**	**6**

Table 22 Elevation points calculated to obtain flight height compliance outside the snow goose area, May 1–September 30, 2018.

Month	Area	Total points	Total compliant points≥ 650 magl	Total compliant points < 650 magl with rationale	% compliance	Total non–compliant points	% non–compliance
May	All Areas	3,676	64	3,323	92	289	8
June	All Areas	11,895	915	10,918	99.4	62	0.5
July	Outside SNGO Area	16,892	1,126	15,462	98	304	2
August	Outside SNGO Area	19,860	846	18,611	98	403	2
September	All Areas	4,524	147	4,159	95	218	5
Total		**56,847**	**3,098**	**52,473**	**98**	**1,276**	**2**





LEGEND

- Non-Compliant May Flights (GPS points) Below 650 m (agl)
- Compliant – Low Level Flight Required – May Flights (GPS points) Below 650 m (agl)
- Compliant May Flights (GPS points) Above 650 m (agl)
- Helicopter Flight Path
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Helicopter flight data and tickets collected and provided by Canadian Helicopters (2018).

Potential Disturbance Area provided by Knight Piesold (July, 2017).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 30 40 50 60 Km

Baffinland

Overview Map of Helicopter Flight Paths for May, 2018

EDI

Date: 10/31/2018

MAP 7

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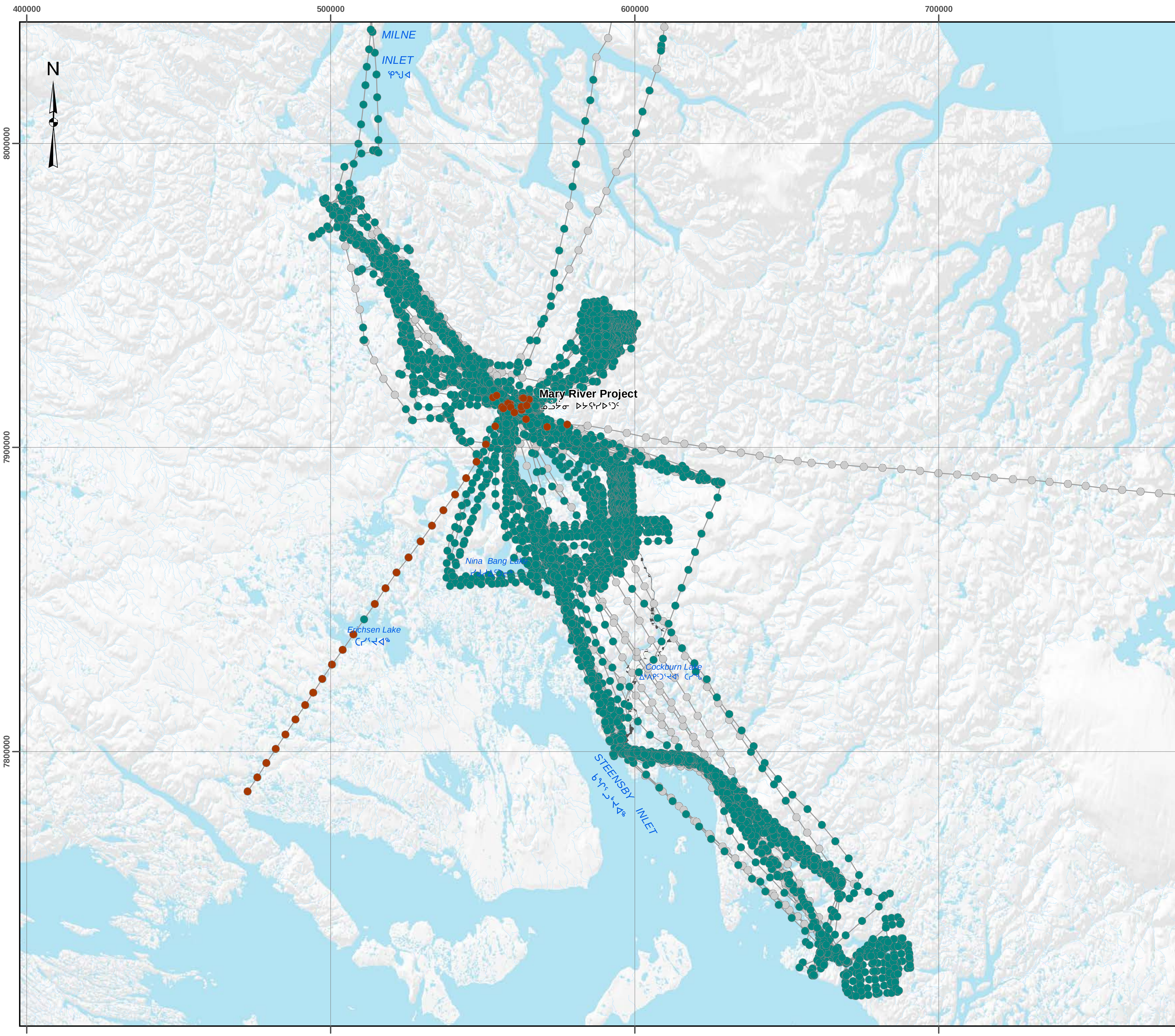
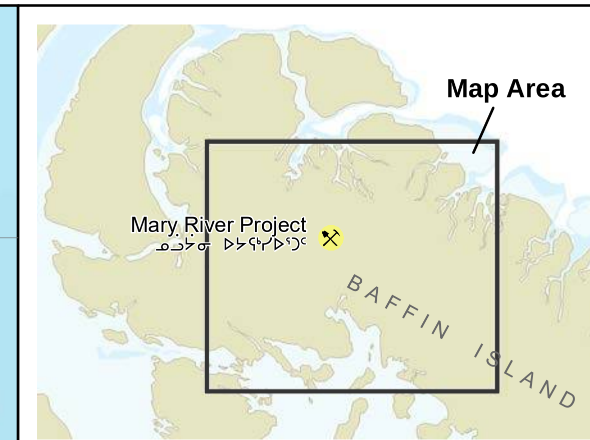




LEGEND

- Non-Compliant June Flights (GPS points) Below 650 m (agl)
- Compliant – Low Level Flight Required – June Flights (GPS points) Below 650 m (agl)
- Compliant June Flights (GPS points) Above 650 m (agl)
- Helicopter Flight Path
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Helicopter flight data and tickets collected and provided by Canadian Helicopters (2018).

Potential Disturbance Area provided by Knight Piesold (July, 2017).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 30 40 50 60 Km

Baffinland

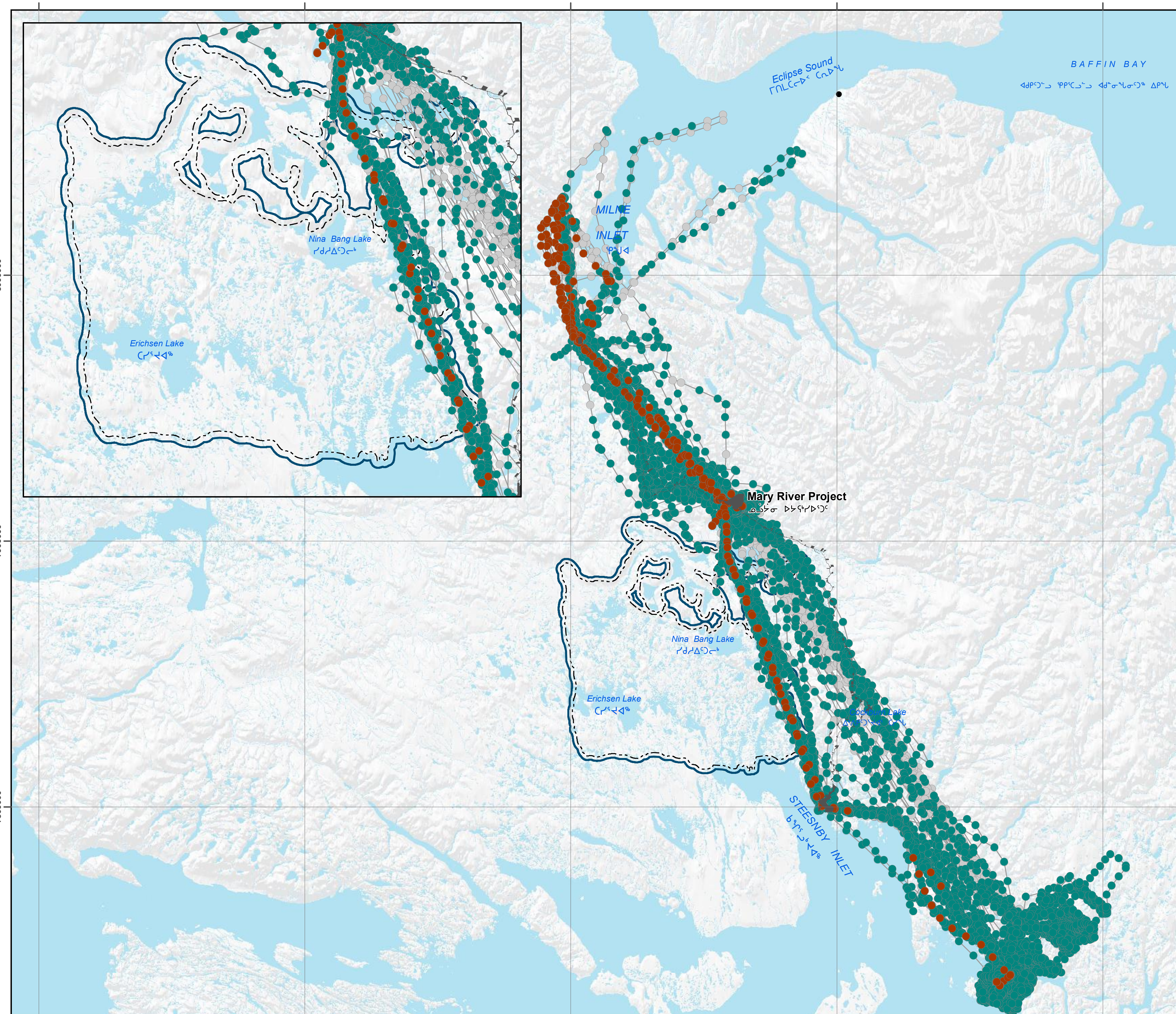
Overview Map of Helicopter Flight Paths for June, 2018

EDI

Date: 10/31/2018

MAP 8

Path: S:\Data\Project_Data\Baffinland_Spatial\2018_SpatialData\Mapping\Reporting\MonitoringReport_20181022\Map8_June_HeliOverview.mxd



LEGEND

- Non-Compliant July Flights (GPS points) Inside the SGMA and Below 1,100 m (agl); Outside the SGMA and Below 650 m (agl)
- Compliant – Low Level Flight Required – July Flights (GPS points) Inside the SGMA and Below 1,100 m (agl); Outside the SGMA and Below 650 m (agl)
- Compliant July Flights (GPS points) Inside the SGMA and Above 1,100 m (agl); Outside the SGMA and Above 650 m (agl)
- Helicopter Flight Path
- Environment Canada Area of Interest (Geese)
- 1500 m Horizontal Buffer - Environment Canada Area of Interest (Geese)
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Snow goose management area (SGMA) provided by Environment Canada.

Helicopter flight data collected by Canadian Helicopters (October, 2018).

PDA provided by KP, July 2017.

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 30 40 50 Km

Baffinland

Overview Map of Helicopter Flight Paths for July, 2018

EDI

Date: 2019-01-15

MAP 9

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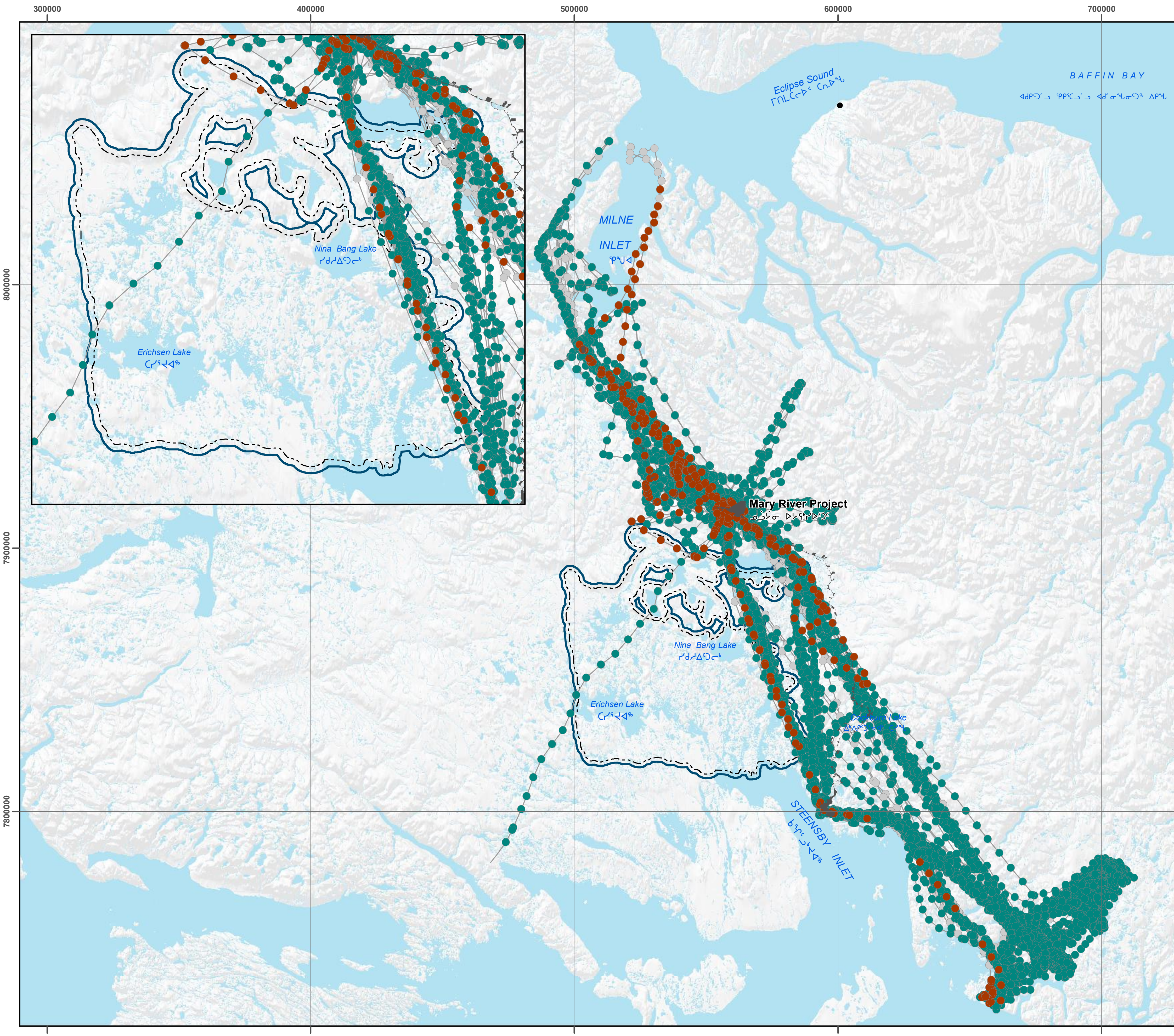

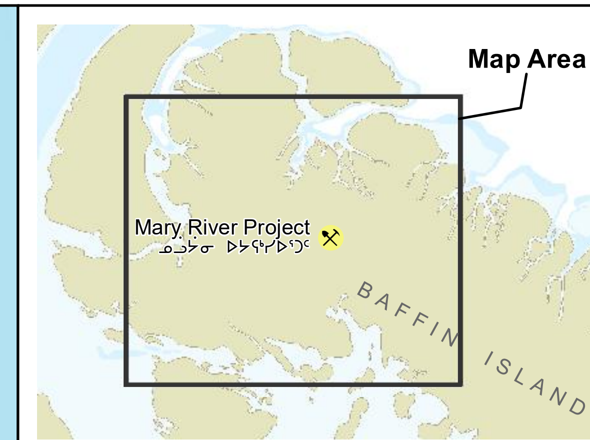

LEGEND

- Non-Compliant August Flights (GPS points) Inside the SGMA and Below 1,100 m (agl); Outside the SGMA and Below 650 m (agl)
- Compliant – Low Level Flight Required – August Flights (GPS points) Inside the SGMA and Below 1,100 m (agl); Outside the SGMA and Below 650 m (agl)
- Compliant August Flights (GPS points) Inside the SGMA and Above 1,100 m (agl); Outside the SGMA and Above 650 m (agl)
- Helicopter Flight Path
- Environment Canada Area of Interest (Geese)
- 1500 m Horizontal Buffer - Environment Canada Area of Interest (Geese)
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Helicopter flight data and tickets collected and provided by Canadian Helicopters (2018).

Potential Disturbance Area provided by Knight Piesold (July, 2017).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 30 40 50 Km

Baffinland

Overview Map of Helicopter Flight Paths for August, 2018

EDI

Date: 2019-01-15

MAP 10

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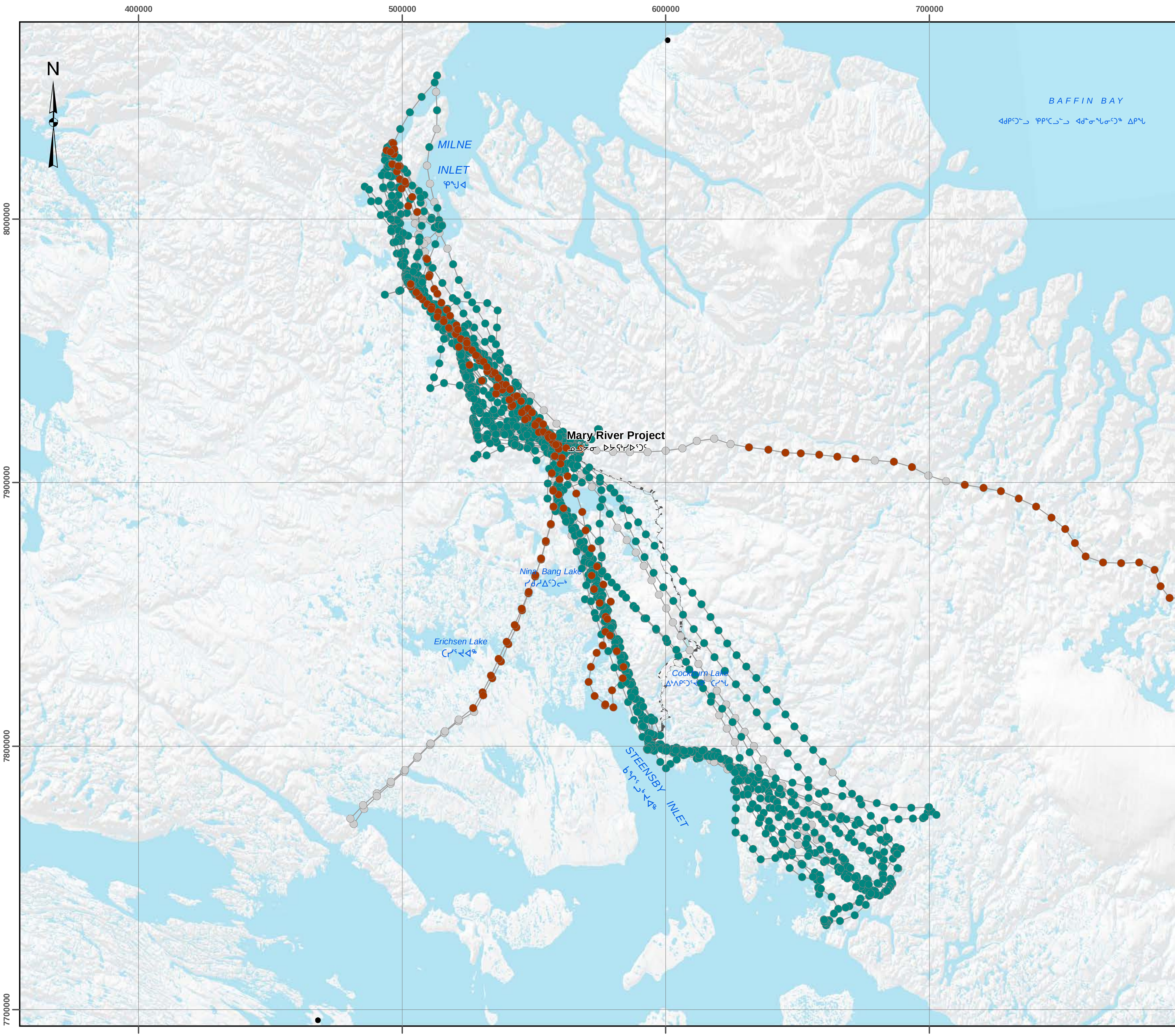

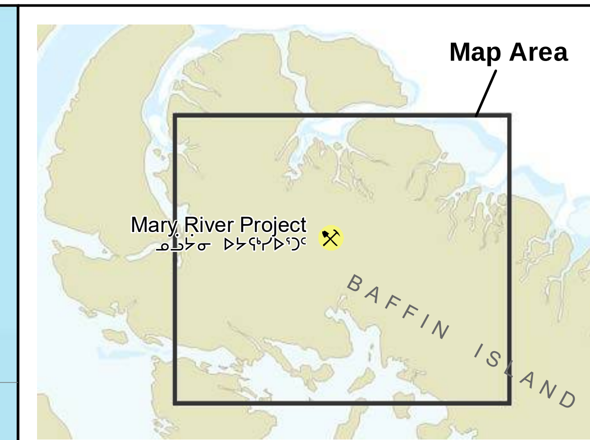

LEGEND

- Non-Compliant September Flights (GPS points) Below 650 m (agl)
- Compliant – Low Level Flight Required – September Flights (GPS points) Below 650 m (agl)
- Compliant September Flights (GPS points) Above 650 m (agl)
- Helicopter Flight Path
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Helicopter flight data and tickets collected and provided by Canadian Helicopters (2018).

Potential Disturbance Area provided by Knight Piesold (July, 2017).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 30 40 50 60 Km

Baffinland

Overview Map of Helicopter Flight Paths for September, 2018

EDI

Date: 10/31/2018

MAP 11

6.2 INTER-ANNUAL TRENDS

Helicopter flight height compliance inside the goose area during moulting period was 94%, which was like 2017 (95%) and considerably higher than 2015 (55%) and 2016 (10%) (Figure 44). Helicopter flight height compliance within and outside the goose area in all months was higher in 2018 (98%) than in 2017 (76%), 2016 (33%), and 2015 (40%).

2018 was the second year that additional analysis was performed, which considered rationale provided by pilots for many of the transits flown below the elevation requirements. For analytical purposes, flight height data points were designated "compliant" when elevation requirements were achieved, or where the pilot's discretionary rationale for deviating from flight heights was provided. Data points were designated "non-compliant" if they did not meet elevation requirements, and no explanation was given. The increase in compliance in 2017 and 2018 was likely due to this additional analysis as well as improved documentation of the rationale for low-level flights by pilots and Baffinland staff in 2018 (Figure 44).

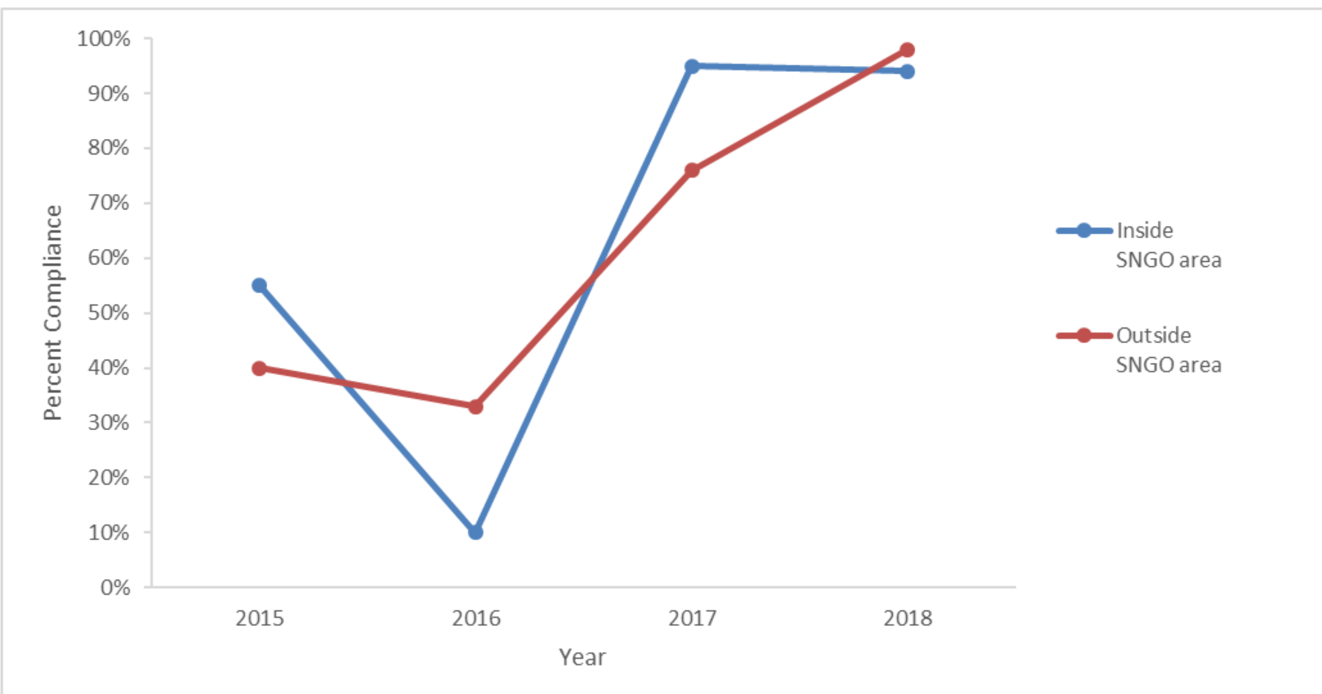

Figure 44 Percent compliance for flights inside the goose area during the moulting season and within and outside the goose area in all months from 2015–2018.

6.3 HELICOPTER OVERFLIGHT SUMMARY

- Helicopter flight heights continue to be used to monitor potential disturbance to birds and other wildlife inside and outside the snow goose area.
- In 2018, helicopter flight height compliance inside the goose area during the moulting period was 94%, and compliance within and outside the goose area in all months was 98%.
- 2018 was the second year that additional analysis was performed, which considered rationale provided by pilots for many of the transits flown below the elevation requirements. For analytical purposes, flight height data points were designated "compliant" when elevation requirements were achieved, or where the pilot's discretionary rationale for deviating from flight heights was provided. Data points were designated "non-compliant" if they did not meet elevation requirements, and no explanation was given.
- This additional analysis showed that when considering rationale provided by pilots for low-level flying, most low-level data points were compliant. For example, of all the compliant points within the snow goose area during the moulting season, only 8% were ≥ 1,100 magl, and the other 92% were < 1,100 magl with reasons given by pilots. Similarly, when looking at all compliant points within and outside the snow goose area in all months, only 6% were ≥ 650 magl, and the other 94% were < 650 magl with reasons given by pilots.
- The high percentage of low-level compliant flights in both areas is similar to what was observed in 2017, and will likely continue in future years as the majority of helicopter work conducted at Mary River either requires low-level flying for safety/operational reasons (e.g. slinging, surveys), or involves multiple short distance flights whereby helicopters are unable to reach the required elevations between take-off and landing sites (e.g. staking, sampling, drop offs/pickups).
- Most compliant transits that met the elevation requirements in 2018 tended to be long-distance flights, where pilots were airborne long enough to reach and maintain the required elevations
- Helicopter flight height analysis including rationale from pilot timesheets will continue in 2019.

7 WILDLIFE INTERACTIONS AND MORTALITIES

Although wildlife interactions and mortalities related to the human presence within the Project area are uncommon and measures are taken to avoid them, incidents did occur in 2018. When a wildlife interaction or mortality occurs, an incident report is written and an investigation is undertaken to better understand the circumstances. Based on the outcomes of the investigation, mitigation methods, when possible, are implemented to address the areas of concern to help prevent further interactions and mortalities.

7.1 WILDLIFE INTERACTIONS AND MORTALITIES IN 2018

In 2018, two non-fatal wildlife interactions and 12 wildlife mortality incidents were reported, all of which were individual losses. All the non-fatal wildlife interactions reported involved Arctic fox in areas with attractants, such as the landfill or garbage bins at the Port Site. Most of the mortalities that occurred in 2018 involved Arctic fox (a total of ten individuals). Eight of the fatalities occurred on roadways and were presumed to be the result of vehicle-wildlife collisions, and the other two mortalities were discovered near buildings at the Port Site, the cause of which remains unknown. An Arctic hare was also killed by an interaction with heavy equipment, and a migratory songbird (American pipit) was incidentally captured and found dead during the small mammal trapping program.

7.2 WILDLIFE INTERACTION AND MORTALITY PREVENTION MEASURES

Baffinland continues to mitigate wildlife interactions in the Project area by training, enforcing, and monitoring waste management practices and guidelines. All management, supervisors and new contract staff attend mandatory Environment Protection Plan (EPP) training, which is then passed on to all employees. Included in the EPP are wolf, polar bear, Arctic fox and caribou protection measures and waste management guidelines that are continually updated and implemented. Incineration and proper waste sorting are the most prominent deterrents used. Wildlife attractants such as food scraps and human waste are sorted and sealed in animal-proof containers and incinerated on site. Posted around each site are waste sorting guidelines that clearly define where food and other attractants should be placed. Other deterrents used include metal skirting to minimalize wildlife entry under buildings. Wire skirting is used under the main camps at both sites to ensure no wildlife such as foxes or hares den underneath. For equipment, honking your horn before starting the vehicle helps to scare off wildlife that might be hiding in the equipment. Wildlife has the right of way on all roadways, unless unsafe to do so. Snow banks along Tote Road are reduced where feasible by feathering back snow with equipment to ensure personnel along Tote Road have a view of wildlife crossing the road. Feeding of wildlife is strictly prohibited and noncompliance is dealt with accordingly.

7.3 INTER-ANNUAL TRENDS

In 2018, ten Arctic fox mortalities were reported, which is like previous years, except for 2015, where only three Arctic fox mortalities were reported. One Arctic hare mortality and one bird mortality was also reported in 2018. A total of thirteen bird mortalities (12 waterfowl, one songbird) have been reported since

2014, two in 2014, 10 in 2016, and one in 2018. No caribou mortalities have occurred thus far because of the Project (Figure 45). Most mortalities that have occurred on site from 2014 – 2018 have been attributed to wildlife-vehicle collisions. Other reported causes of mortality include: fatal injuries incurred from heavy machinery or Project infrastructure, and euthanasia by on-site staff due to aggressive behaviour towards employees.

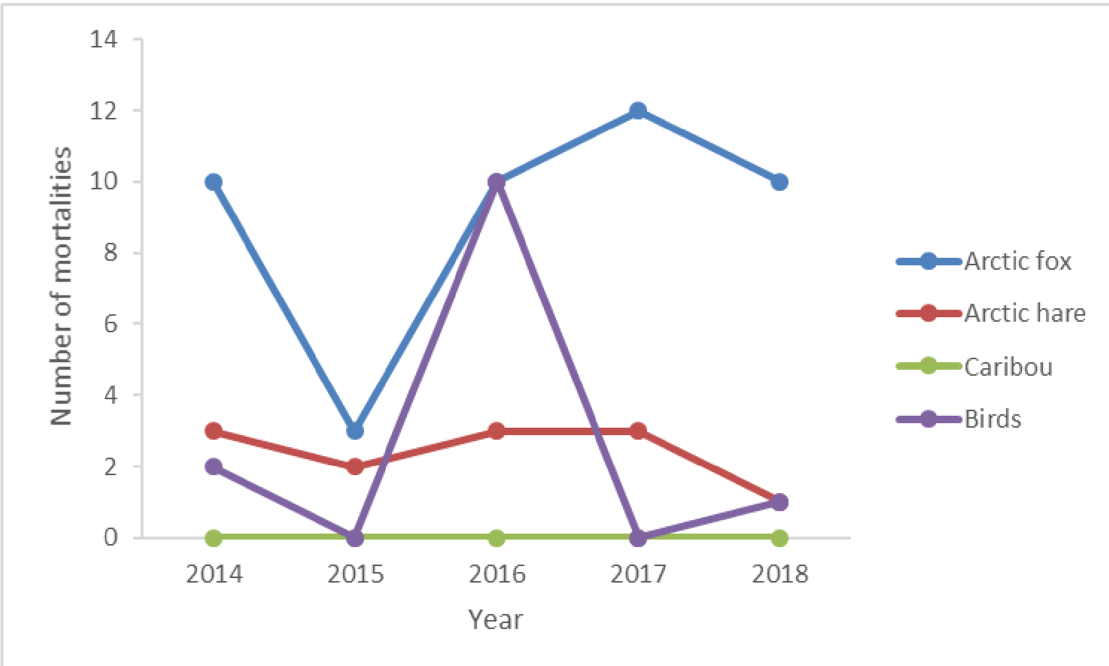

Figure 45 Wildlife mortality trends from 2014 –2018.

7.4 WILDLIFE INTERACTION AND MORTALITY SUMMARY

- In 2018, two non-fatal wildlife interactions and twelve wildlife mortality incidents were reported, all of which were individual losses.
- Ten of the mortalities that occurred in 2018 involved Arctic fox, eight of which were presumed to be the result of vehicle-wildlife collisions, and the cause of the other two remains unknown. One Arctic hare and one bird mortality were also reported.
- Baffinland continues to mitigate wildlife interactions in the Project area by training, enforcing, and monitoring waste management practices and guidelines.

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APPENDIX A. VEGETATION ABUNDANCE MONITORING SITES FOR EXCLOSURE (I.E., CLOSED) AND OPEN PLOTS IN THE RSA

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Table A-1 Vegetation Abundance Monitoring Sites for Exclosure (i.e., Closed) and Open Plots in the RSA

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Mine Site	1	T1D30A	29	Open	71.32020	-79.35944
Mine Site	1	T1D30X	29	Closed	71.32016	-79.35923
Mine Site	1	T1D100A	102	Open	71.31966	-79.36069
Mine Site	1	T1D100X	102	Closed	71.31964	-79.36049
Mine Site	1	T1D750A	751	Open	71.31495	-79.37126
Mine Site	1	T1D750X	751	Closed	71.31495	-79.37126
Mine Site	1	T1D1200A	1,191	Open	71.31239	-79.38171
Mine Site	1	T1D1200X	1,186	Closed	71.31243	-79.38161
Mine Site	2	T2D30A	19	Open	71.31922	-79.19151
Mine Site	2	T2D30X	16	Closed	71.31921	-79.19163
Mine Site	2	T2D100A	175	Open	71.31862	-79.18756
Mine Site	2	T2D100X	174	Closed	71.31871	-79.18748
Mine Site	2	T2D750A	765	Open	71.31549	-79.17373
Mine Site	2	T2D750X	765	Closed	71.31549	-79.17373
Mine Site	2	T2D1200A	1,178	Open	71.31269	-79.16479
Mine Site	2	T2D1200B	1,177	Open	71.31271	-79.16478
Mine Site	2	T2D1200X	1,179	Closed	71.31264	-79.16482
Mine Site	3	T3D30A	30	Open	71.34010	-79.31164
Mine Site	3	T3D30X	34	Closed	71.34013	-79.31172
Mine Site	3	T3D100A	87	Open	71.34042	-79.31307
Mine Site	3	T3D100B	98	Open	71.34051	-79.31317
Mine Site	3	T3D100X	103	Closed	71.34054	-79.31329
Mine Site	3	T3D750A	734	Open	71.34668	-79.31554
Mine Site	3	T3D750X	730	Closed	71.34664	-79.31550
Mine Site	3	T3D71200A	1,445	Open	71.35172	-79.32806
Mine Site	3	T3D1200X	1,445	Closed	71.35172	-79.32806
Tote Road	4	T4D30A	35	Open	71.34193	-79.54399
Tote Road	4	T4D30X	36	Closed	71.34193	-79.54398

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Tote Road	4	T4D100A	95	Open	71.31234	-79.54282
Tote Road	4	T4D100X	98	Closed	71.34231	-79.54267
Tote Road	4	T4D750A	830	Open	71.34631	-79.52631
Tote Road	4	T4D750B	831	Open	71.34626	-79.52620
Tote Road	4	T4D750X	832	Closed	71.34362	-79.52609
Tote Road	4	T4D1200A	1,268	Open	71.34653	-79.51250
Tote Road	4	T4D1200X	1,268	Closed	71.34653	-79.51250
Tote Road	5	T5D30A	21	Open	71.37588	-79.73111
Tote Road	5	T5D30X	22	Closed	71.37586	-79.73100
Tote Road	5	T5D100A*	86	Open	71.37511	-79.73049
Tote Road	5	T5D100X	89	Closed	71.37508	-79.73042
Tote Road	5	T5D750A	730	Open	71.36990	-79.73830
Tote Road	5	T5D750B	738	Open	71.36984	-79.73837
Tote Road	5	T5D750X	740	Closed	71.36983	-79.73842
Tote Road	5	T5D1200A*	1,106	Open	71.36624	-79.73808
Tote Road	5	T5D1200X	1,139	Closed	71.36585	-79.73741
Tote Road	6	T6D30A	42	Open	71.38194	-79.99419
Tote Road	6	T6D30B*	44	Open	71.38197	-79.99432
Tote Road	6	T6D30X	41	Closed	71.38196	-79.99448
Tote Road	6	T6D100A	91	Open	71.38248	-79.99201
Tote Road	6	T6D100X	91	Closed	71.38248	-79.99219
Tote Road	6	T6D750A*	694	Open	71.38803	-79.99321
Tote Road	6	T6D750X	694	Closed	71.38803	-79.99321
Tote Road	6	T6D1200A*	1,225	Open	71.39247	-79.98299
Tote Road	6	T6D1200X	1,226	Closed	71.39249	-79.98305
Milne Inlet	7	T7D30A*	26	Open	71.87114	-80.87792
Milne Inlet	7	T7D30X	26	Closed	71.87122	-80.87794
Milne Inlet	7	T7D100A	105	Open	71.87211	-80.87576

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Milne Inlet	7	T7D100X	99	Closed	71.87212	-80.87593
Milne Inlet	7	T7D750A	884	Open	71.86808	-80.85032
Milne Inlet	7	T7D750B	874	Open	71.86797	-80.85041
Milne Inlet	7	T7D750X	871	Open	71.86788	-80.85025
Milne Inlet	7	T7D1200A	1,136	Open	71.87198	-80.84419
Milne Inlet	7	T7D1200B	1,135	Open	71.87201	-80.84426
Milne Inlet	7	T7D1200X	1,133	Closed	71.87203	-80.84431
Milne Inlet	8	T8D30A	51	Open	71.88273	-80.87804
Milne Inlet	8	T8D30X	54	Closed	71.88277	-80.87793
Milne Inlet	8	T8D100A*	90	Open	71.88243	-80.87705
Milne Inlet	8	T8D100X	94	Closed	71.88245	-80.87691
Milne Inlet	8	T8D750A	818	Open	71.88108	-80.85626
Milne Inlet	8	T8D750B	822	Open	71.88110	-80.85614
Milne Inlet	8	T8D750X	826	Closed	71.88111	-80.85604
Milne Inlet	8	T8D1200A	1,098	Open	71.88471	-80.84666
Milne Inlet	8	T8D1200X	1,104	Closed	71.88476	-80.84648
Mine Site	9	T9D30A*	32	Open	71.29982	-79.26338
Mine Site	9	T9D30X	32	Closed	71.29981	-79.26321
Mine Site	9	T9D100A	135	Open	71.29912	-79.26827
Mine Site	9	T9D100X	134	Closed	71.29915	-79.26846
Mine Site	9	T9D750A	713	Open	71.29443	-79.27907
Mine Site	9	T9D750B	708	Open	71.29448	-79.27903
Mine Site	9	T9D750X	701	Closed	71.29453	-79.27890
Mine Site	9	T9D1200A	1,186	Open	71.29173	-79.29365
Mine Site	9	T9D1200X	1,182	Closed	71.29176	-79.29358
Mine Site	10	T10D30A	28	Open	71.34274	-79.29750
Mine Site	10	T10D30X	34	Closed	71.34280	-79.29755

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Mine Site	10	T10D100A	127	Open	71.34355	-79.29861
Mine Site	10	T10D100B	127	Open	71.34355	-79.29861
Mine Site	10	T10D100X	127	Closed	71.34355	-79.29861
Mine Site	10	T10D750A	650	Open	71.34911	-79.29802
Mine Site	10	T10D750X	650	Closed	71.34911	-79.29802
Mine Site	10	T10D1200A*	1,219	Open	71.35276	-79.31007
Mine Site	10	T10D1200X	1,219	Closed	71.35276	-79.31007
Mine Site	11	T11D30A	29	Open	71.31259	-79.19954
Mine Site	11	T11D30X	17	Closed	71.31273	-79.19974
Mine Site	11	T11D100A	233	Open	71.31095	-79.19546
Mine Site	11	T11D100X	233	Closed	71.31095	-79.19546
Mine Site	11	T11D750A*	804	Open	71.30648	-79.18466
Mine Site	11	T11D750B	805	Open	71.30640	-79.18483
Mine Site	11	T11D750X	802	Closed	71.30642	-79.18486
Mine Site	11	T11D1200A	1,219	Open	71.30536	-79.17309
Mine Site	11	T11D1200X	1,225	Closed	71.30538	-79.17287
Tote Road	12	T12D30A	55	Open	71.41457	-80.1019
Tote Road	12	T12D30X*	50	Closed	71.41467	-80.1021
Tote Road	12	T12D100A	113	Open	71.41430	-80.10019
Tote Road	12	T12D100X	113	Closed	71.4143	-80.10019
Tote Road	12	T12D750A	757	Open	71.41617	-80.08279
Tote Road	12	T12D750B	757	Open	71.41617	-80.08279
Tote Road	12	T12D750X	757	Closed	71.41617	-80.08279
Tote Road	12	T12D1200A*	1,141	Open	71.41851	-80.07372
Tote Road	12	T12D1200X	1,140	Closed	71.41859	-80.07383
Tote Road	13	T13D30A	35	Open	71.42143	-80.10964
Tote Road	13	T13D30B	35	Open	71.42143	-80.10964

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Tote Road	13	T13D30X	35	Closed	71.42143	-80.10964
Tote Road	13	T13D100A	87	Open	71.42149	-80.10794
Tote Road	13	T13D100X	87	Closed	71.42149	-80.10794
Tote Road	13	T13D750A	669	Open	71.42509	-80.09329
Tote Road	13	T13D750X	674	Closed	71.42512	-80.09317
Tote Road	13	T13D1200A	1,166	Open	71.42884	-80.08349
Tote Road	13	T13D1200X	1,165	Closed	71.42895	-80.08375
Milne Inlet	14	T14D30A	43	Open	71.87797	-80.87826
Milne Inlet	14	T14D30X	37	Closed	71.87815	-80.87845
Milne Inlet	14	T14D100A	129	Open	71.87736	-80.87571
Milne Inlet	14	T14D100X	118	Closed	71.87738	-80.87601
Milne Inlet	14	T14D750A	756	Open	71.87649	-80.85755
Milne Inlet	14	T14D750X	749	Closed	71.87649	-80.85775
Milne Inlet	14	T14D1200A	1,178	Open	71.87772	-80.84550
Milne Inlet	14	T14D1200B	1,173	Open	71.87770	-80.84564
Milne Inlet	14	T14D1200X	1,170	Closed	71.87766	-80.84573
Milne Inlet	15	T15D30A	48	Open	71.87430	-80.87769
Milne Inlet	15	T15D30X	50	Closed	71.87434	-80.87763
Milne Inlet	15	T15D100A	104	Open	71.87393	-80.87603
Milne Inlet	15	T15D100X	100	Closed	71.87391	-80.87615
Milne Inlet	15	T15D750A*	812	Open	71.87411	-80.85563
Milne Inlet	15	T15D750X	806	Closed	71.87427	-80.85583
Milne Inlet	15	T15D1200A	1,130	Open	71.87504	-80.84659
Milne Inlet	15	T15D1200X	1,126	Closed	71.87500	-80.84671
Total	**--**	**133 plots**	--	--	--	--
Control	1	REF1A	19,450	Open	71.16658	-79.71055
Control	1	REF1B*	19,448	Open	71.16658	-79.71037

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Control	1	REF1X	19,450	Closed	71.16655	-79.71028
Control	2	REF2A	20,409	Open	71.51695	-78.91855
Control	2	REF2B	20,410	Open	71.51694	-78.91845
Control	2	REF2X	20,407	Closed	71.51690	-78.91839
Control	3	REF3A*	20,595	Open	71.85313	-79.99586
Control	3	REF3B*	20,593	Open	71.85307	-79.99581
Control	3	REF3X	20,594	Closed	71.85302	-79.99567
Control	4	REF4A*	21,178	Open	71.88674	-80.05467
Control	4	REF4B	21,185	Open	71.88678	-80.05450
Control	4	REF4X	21,190	Closed	71.88680	-80.05435
Control	5	REF5A*	33,185	Open	71.65634	-79.34103
Control	5	REF5B	33,184	Open	71.65635	-79.34108
Control	5	REF5X	33,184	Closed	71.65638	-79.34125
Control	6	REF6A	16,435	Open	71.29160	-80.39122
Control	6	REF6B	16,429	Open	71.29161	-80.39097
Control	6	REF6X	16,432	Closed	71.29155	-80.39089
Total	**--**	**18 plots**	--	--	--	--
Total (66 sites)	**--**	**151 plots**	--	--	--	--

* Plots remeasured as part of the evaluation of the vegetation abundance monitoring methods

APPENDIX B. BIRD SPECIES OBSERVED WITHIN THE MARY RIVER PROJECT TERRESTRIAL REGIONAL STUDY AREA, 2006–2018

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Table B-1 Bird species observed within the Mary River Project Terrestrial Regional Study Area, 2006 — 2018.

Species	Latin name	2006	2007	2008	2012	2013	2014	2015	2016	2017	2018
Snow Goose	*Chen caerulescens*	B	B	B	S	S	B	S	S	B	B
Brant	*Branta bernicla*	S	-	-	-	-	-	-	-	-	
Cackling Goose	*Branta hutchinsii*	-	-	-	-	B	S	S	-	B	B
Canada Goose	*Branta canadensis*	-	-	-	-	B	S	S	S	B	B
Canada/Cackling Goose	*Branta spp.*	B	B	B	B	-	-	-	-	-	B
Tundra Swan	*Cygnus columbianus*	-	-	B	S	-	-	-	-	S	S
King Eider	*Somateria spectabilis*	B	B	B	S	S	-	S	-	S	S
Common Eider	*Somateria mollissima*	S	S	S	S	S	-	-	-	-	S
Long-tailed Duck	*Clangula hyemalis*	B	B	B	S	B	S	S	S	B	B
Red-breasted Merganser	*Mergus serrator*	B	B	B	S	S	-	S	-	S	S
Rock Ptarmigan	*Lagopus muta*	-	-	-	S	S	-	S	-	S	-
Willow Ptarmigan	*Lagopus lagopus*	-	-	-	-	-	-	-	-	S	-
Unspecified Ptarmigan	*Lagopus spp.*	-	-	S	-	-	S	-	S	-	S
Red-throated Loon	*Gavia stellata*	B	B	B	S	B	B	S	S	B	B
Pacific Loon	*Gavia pacifica*	B	B	B	S	S	S	-	-	-	-
Common Loon	*Gavia immer*	B	B	B	S	S	S	S	-	-	S
Yellow-billed Loon	*Gavia adamsii*	B	B	B	S	S	B	S	S	S	S
Northern Fulmar	*Fulmarus glacialis*	S	-	-	-	-	-	-	-	-	-
Rough-legged Hawk	*Buteo lagopus*	B	B	B	B	B	B	B	B	B	B
Gyrfalcon	*Falco rusticolus*	B	B	B	B	B	B	B	B	B	B
Peregrine Falcon	*Falco peregrinus tundris*	B	B	B	B	B	B	B	B	B	B
Sandhill Crane	*Grus canadensis*	B	B	B	S	B	B	S	S	S	S
American Golden-Plover	*Pluvialis dominica*	S	S	S	B	S	S	S	-	S	S
Semipalmated Plover	*Charadrius semipalmatus*	-	-	-	B	B	B	S	-	-	S
Common Ringed Plover	*Charadrius hiaticula*	S	-	-	-	S	B	S	-	-	-
Dunlin	*Calidris alpina*	-	-	-	S	-	-	-	-	-	-
White-rumped Sandpiper	*Calidris fuscicollis*	-	-	-	-	B	-	-	-	-	-
Baird's Sandpiper	*Calidris bairdii*	S	S	S	B	B	B	S	S	-	-
Pectoral Sandpiper	*Calidris melanotos*	-	-	-	S	-	-	-	-	-	-
Red Phalarope	*Phalaropus fulicarius*	-	-	-	S	S	-	-	-	-	-

Table B-1 Bird species observed within the Mary River Project Terrestrial Regional Study Area, 2006 — 2018.

Species	Latin name	2006	2007	2008	2012	2013	2014	2015	2016	2017	2018
Unspecified Phalarope	*Phalaropus spp.*	-	-	S	-	-	-	-	-	-	-
Herring Gull	*Larus argentatus*	-	-	-	B	-	-	-	S	-	
Glaucous Gull	*Larus hyperboreus*	-	B	B	B	B	B	S	S	B	B
Thayer's Gull	*Larus thayeri*	-	-	-	-	B	-	S	-	-	U
Arctic Tern	*Sterna paradisaea*	-	S	S	-	-	-	-	-	-	-
Long-tailed Jaeger	*Stercorarius longicaudus*	-	-	-	S	-	-	S	-	-	-
Unspecified Jaeger	*Stercorarius spp.*	-	-	B	-	-	-	-	-	-	-
Snowy Owl	*Bubo scandiacus*	B	B	B	S	S	B	S	S	-	-
Short-eared Owl	*Asio flammeus*	-	-	S	-	-	-	-	-	-	-
Common Raven	*Corvus corax*	S	S	B	B	S	B	S	S	B	B
Horned Lark	*Eremophila alpestris*	S	S	S	B	S	S	S	S	S	S
Northern Wheatear	*Oenanthe oenanthe*	-	-	-	-	S	U	S	-	S	S
American Pipit	*Anthus rubescens*	S	S	S	B	B	-	S	-	B	B
Lapland Longspur	*Calcarius lapponicus*	S	S	S	B	B	S	S	S	B	S
Snow Bunting	*Plectrophenax nivalis*	S	S	S	B	B	S	S	S	B	B
Common Redpoll	*Carduelis flammea*	-	-	-	S	-	-	-	-	-	-
Hoary Redpoll	*Carduelis hornemanni*	-	-	-	S	-	-	-	-	-	-

Symbology: B = Confirmed Breeding; S = Confirmed Present; U = unconfirmed observation

*No formal bird surveys were conducted in 2017, and therefore all observations are incidental; from when qualified biologists were on site.

Baffinland

Name: Paul Smith, JF Dufour

Agency / Organization: ECCC (Wildlife)

Date of Comment Submission: 17-Dec-2018

#	Document Name	Section Reference	Comment	Baffinland Response
1	2018 Annual Monitoring Report - Draft	Pg. iv, Summary – Birds	"The deployment of passive sound recording devices to detect red knot vocalizations was also scheduled for 2018 but was deferred to 2019/2020." ECCC would like to initiate logistical discussions with BIMC in early January to not miss the opportunity to deploy the devices this field season.	BIM on site staff were notified (via email) that logistical discussions should be initiated soon to plan for the deployment of the devices during the 2019 field season.
2		Pg. 20, Fig. 3 and 4	Please explain the use of asymmetrical error bars in these figures. Are these possible calculation or plotting errors?	The error bars are asymmetrical because the data is log transformed for analysis but then graphed on a linear scale. The figure captions in the final draft have been amended to include this information, and it is also described in the methods.
3		Fig. 21 and 22	Figures show more moss and less shrub on reference sites vs. roadside sites (albeit with some overlap in confidence intervals). Is there a potential bias? It's possible that the reference sites are more moist than the roadside sites, even within the sedge meadow habitat type, because roads follow the driest areas.	In 2019, we will measure soil moisture at vegetation abundance monitoring sites. This information will be used to check if there is an effect of soil moisture on plant cover and composition. In 2019, we may add up to 6 more reference sites to double the number of sites. New reference sites will be in areas that have comparable soil moisture to the other distance classes, to

Baffinland

#	Document Name	Section Reference	Comment	Baffinland Response
			Have soil moisture measurements been taken at sites? If not, maybe this should be considered.	attempt to control for the potential effects of soil moisture on plant cover and composition.
4		4.2 Snow Track Surveys	Although snow track surveys are a project condition, would it not be possible to achieve better indices of mammal abundance through "daily species logs" or driver sightings, while correcting for daylight hours, visibility and search effort?	BIM recognizes the value of driver sightings and will consider ways of standardizing incidental observations to contribute to continual site monitoring of wildlife encounters.
5		5.2.2	What does "buffered accordingly" mean, with respect to the mobile young of Snow Bunting located during the pre-clearing nest searches?	Both songbird nests (SNBU and AMPI) that were found during nest searches in 2018 were given 100 m buffers, as per ECCC's recommended setback distances for roads/construction/industrial activity. Section 5.2 of the report has been amended to reflect this.
6		Pg. 96, 5.3.6.4	Snap-trapping: "One individual from a non-target species was captured". Presumably this was a bird, and should be reported. There is recent evidence (paper by Gilles Gauthier) to suggest that observational indices are adequate for lemmings in intensively studied areas. This might not be applicable to Mary River, but is worth considering as a more ethical alternative to snap trapping.	The individual from a non-target species was an American Pipit. This has now been included in the camp mortality log. Other small mammal monitoring methods were considered (e.g., live trapping, indices) but snap-trapping was selected as the most suitable for the following reasons: 1. Based on our experience working in Nunavut, it is our understanding that Inuit believe that live capture of animals is disrespectful to the animals (i.e., not-ethical).

#	Document Name	Section Reference	Comment	Baffinland Response
				2. Live trapping was previously trialed at the site. This method proved unsuccessful because of the unreliability of securing timely transport to the sampling site as a result of inclement weather (i.e., heavy rain, low cloud ceilings, closed road) which often resulted in heavy trap mortality. 3. Abundance indices require intensive field studies (i.e., cliff-nesting raptor studies at Mary River are low intensity). To meet statistical analysis requirements, abundance indices methods require many hours of observations and do not perform well at low small mammal population densities (Fauteux et al. 2018). Project objective and methods were evaluated and approved by the University of Alberta Animal Care Committee.
7		Pg. 98, Table 20 and 21: Helicopter Flight height	The high compliance here is largely a function of pilots providing justification for flying low. The project conditions also require horizontal avoidance (as noted on Page 98 of the report). The percentage compliance estimates reported only consider height, not horizontal distance. Is there a reason why horizontal avoidance could not be achieved?	The SNGO area boundary is buffered by the required 1500 m horizontal avoidance distance, and pilots are advised to stay outside this boundary. The report (text and map legends) has been amended to clarify this, however there is currently no analysis of compliance with horizontal avoidance. Types of surveys done by helicopter include: raptor monitoring surveys, caribou

#	Document Name	Section Reference	Comment	Baffinland Response
			"Surveys" are listed as the most common reasons for flying low. What types of surveys are included in this category? In addition to avoiding the key site for snow geese, the conditions require avoidance of observed concentrations of migratory birds. In the Phase 2 EIS bird baseline report, a colony of ~5,000 snow geese was observed at Steensby Inlet during marine surveys. The colony should be mapped to assess if there is an interaction with helicopter flights, and if so, compliance should also be assessed.	monitoring surveys (some stations), water sampling programs (some sites; multiple programs), dust monitoring (some sites), vegetation monitoring (some sites) and geophysics surveys. All monitoring and sampling programs are required for compliance with Project conditions. The SNGO colony near Steensby Inlet referred to in the Phase 2 EIS baseline report was documented to be outside the TRSA, on the southwestern shore of Steensby Inlet. At present, helicopter flight paths are mostly within the TRSA and exclusively follow the eastern side of Steensby Inlet (see Maps 7-11 in Section 6.1.2 in the 2018 annual monitoring report). Since helicopter flight paths do not appear to interact with this colony, mapping is not required.

References

Fauteux, D., Gauthier, G., Mazerolle, M.J., Coallier, N., Bêty, J., and Berteaux, D. 2018. Evaluation of invasive and non-invasive methods to monitor rodent abundance in the Arctic. Ecosphere. 9(2):e02124. DOI: 10.1002/ecs2.2124.

Baffinland

Name: Bradley Pirie, John Ringrose

Agency / Organization: Government of Nunavut

Date of Comment Submission:

#	Document Name	Section Reference	Comment	Baffinland Response
1	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Section 2.1 Map 1 Section 2.2 Dust Fall Results and Discussion Section 2.2 Table 5	The GN request that the Proponent conduct monitoring of dust fall collectors DF-M-06 to DF-M-09 year-round. As the 2018 monitoring season has past the GN requests that an explanation justifying the lack of year-round sampling at all dust fall collectors be included in the report; along with the rational for why dust fall collectors that were not monitored year-round were only sampled in the 3 months with the lowest recorded dust fall across all monitoring stations.	BIM does not agree with this request for the following two reasons: 1. There is no precedent for year-round sampling. BIM is the only project that currently conducts any winter sampling. Due to the inherent risks associated with visiting the sites in the dark winter months the data collection is currently restricted to the sites where year-round data is considered most valuable -- those nearest project development areas. 2. We believe this question is in response to the observation that in 2018 winter dust fall was higher than summer. The annual terrestrial monitoring final report has been amended with information that includes an inter-annual comparison of seasonal data that shows little to no change in winter dust fall, but rather a marked decrease in summer dust fall (likely due to wetter weather conditions

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#	Document Name	Section Reference	Comment	Baffinland Response
				combined with dust suppression efforts. Winter dust fall always has been and remains low in magnitude (< 2 mg/dm²/day) at all sites where it is measured. Sites 1 km distant would have dust fall of a lower magnitude than this.
2	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Section 4.3.1 Section 4.3.2 Table 8 and Figure 32	The GN requests the Proponent update its annual terrestrial monitoring report to either include snow bank survey data for the month of March, or an explanation for why this data was not obtained or included.	Monthly surveys are not required. However, in 2018 BIM agreed to conduct snow bank surveys more than once annually (in response to reviewer comments). Report amended to explain that a March survey was not conducted due to operational constraints.
3	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Section 3.1.1.2 page 42	The GN requests that the Proponent update its terrestrial monitoring report with more current and detailed literature justifying the use of the point quadrant method for Mary River vegetation monitoring.	The point quadrat method for monitoring vegetation abundance is considered one of the most objective and repeatable methods for monitoring vegetation. This statement is supported by several resources across multiple decades from 1933–2013. See paragraph in Section 3.1.1.1 of the 2018 AMR for more details.
4	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Section 3 Figure 17 Figure 20 Figure 21 Figure 22 Figure 29	The GN requests clarification of why reference sites have the greatest variability (largest error bars) compared to all other distance classes. Ideally other distance classes would be compared to the reference sites (could also be called control) to determine the degree of project related effects per distance class. This will not be possible with the variability between the reference class.	The reference distance class has the greatest variability because there are fewer reference sample sites than for other distance classes. In 2019, we may add up to 6 more reference sites to double the number of sites. This may improve the precision of the vegetation cover estimates for reference sites. In 2019, we will measure soil moisture at vegetation abundance

#	Document Name	Section Reference	Comment	Baffinland Response
			In addition, the higher % moss and deciduous shrub cover for reference sites are generally indicative of sites with higher moisture. There is no mention of differences in soil moisture between classes or sites which is likely the cause for greater variability in reference sites. The GN requests that the suspected reason for the variability be identified and how this variability will be reduced and tested during 2019 monitoring.	monitoring sites. This information will be used to check if there is an effect of soil moisture on plant cover and composition.
5	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Section 6	The GN requests the proponent update its annual terrestrial report to include further analysis of helicopter transits that are "non-compliant" because of flight height but are being deemed "compliant" because of other reasoning. A detailed breakdown of the types (i.e. slinging, surveys, passenger, etc.) and quantity of flights that are being changed from "non-compliant" to "compliant" will help the proponent mitigate unnecessary project related effects. This is concerning as more flights are being deemed compliant when they don't meet the height requirement (>650 magl) but a 92% increase in the number of helicopter transits occurred from 2017 (1,249) to 2018 (2,588).	A percentage break down of compliant points that did not meet the elevation requirements vs. ones that did was provided in Section 6.1.2, including a brief summary of the most common reasons for low level flights in 2018 (surveys, slinging and drop offs/pickups). All helicopter use is considered mandatory for monitoring and/or operational purposes.

#	Document Name	Section Reference	Comment	Baffinland Response
6	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	4.2 Snow Track Survey	The GN requests clarification of how effort and sightability of tracks affected snow tracking in 2018 and confidence in the results. As per discussions at the TEWG meeting the survey was completed with a driver and observer with the observer focusing on their side of the road only. The report mentions that after the first half of the survey conditions declined due to fading light and wind. Is this comparable to surveys in previous years where only half the survey is completed with good survey conditions or is this not comparable to previous years? It is unclear if surveying was completed up the road and back which was the impression given at the TEWG or if the current methodologies only encompass one side of the road? The GN request clarification of the methods and acceptable level variation from those methods which will still be comparable to past surveys.	The 2018 snow track survey was conducted similarly to previous years, whereby the entire Tote Road was driven in one direction and observations were made on both sides of the road by two surveyors (driver and observer). Two surveyors have conducted the survey every year since 2014 except for 2017 when there were four surveyors. The declining survey conditions during the latter part of the 2018 survey is comparable to previous years, as survey conditions are often variable along the Tote Road. Conditions have never been to the point that surveyors felt that observability was substantially reduced.
7	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	5.3.6.4 Small mammal monitoring	This section identifies that there was a non-target species captured during this survey. What was the non-target species and what was the result (euthanized or released unharmed)?	The individual from a non-target species was an American Pipit (a migratory songbird). The songbird was found dead in the trap and incinerated with camp waste. This has now been included in the camp mortality log.

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#	Document Name	Section Reference	Comment	Baffinland Response
8	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	4.4 Height of Land Surveys	The GN requests clarifications as to why the only June surveys were completed and "Late winter surveys were not conducted in 2018"? The GN requests that the proponent include in the report which sites were accessed with a helicopter for HOL surveys.	Late winter HoL surveys were not conducted due to operational constraints. However, survey effort in 2018 was still comparable to previous years. Report amended to include list of HoL sites accessed by helicopter.
9	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	4.5 Incidental Observations Table 10	Table 10 identifies 11 caribou that were observed incidentally outside of the PDA but only general location data is included. Are these caribou being observed within areas that will ultimately become the PDA when construction of the south railway or Steensby port takes place?	The PDA refers to the Approved Project, and thus already includes the south railway and Steensby Port.
10	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	4.7 Inter-annual Trends	Section 4.7 states "*Lack of caribou observations on site follow the trends of low numbers recorded in regional observations and have been confirmed through collaboration with the Government of Nunavut who conducts caribou aerial surveys…*" The GN has continually identified that the HOL surveys do not have the power to detect if the lack of caribou observations from HOL surveys are because of low regional abundance or avoidance/changes in distribution related to project effects. Therefore this sentence is misleading as it suggests the GN agrees that the reason caribou are not being observed is because of low caribou abundance. The GN requests that this sentence be removed.	Report amended.

#	Document Name	Section Reference	Comment	Baffinland Response
			If this sentence is trying to explain that the 2014 island wide abundance survey identified low abundance then it should reflect this alone and not relate this to on-site observations because current methods cannot differentiate between these.	

Baffinland

Name: Jeff W. Higdon, D. Bruce Stewart, Rick Hoos

Agency / Organization: Qikiqtani Inuit Association

Date of Comment Submission: 17 December 2018

#	Document Name	Section Reference	Comment	Baffinland Response
1	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Summary (p. i) and Overview (p. 1)	Typo - Environment Canada and Climate Change (ECCC) should be Environment and Climate Change Canada (also see page xvi, Acronyms, where "EC" is used).	Amended.
2	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Summary (p. i)	Carnivore studies will be re-initiated once changes occur in wolf abundance and after further discussion with the GN and the TEWG. Are there any reports from local harvesters on recent changes in carnivore abundance?	During Baffin Island HTO consultations in January, 2019 for Baffinland's Phase 2 Development proposal, there was no indication that the HTO believe there has been an increase in the wolf population or densities on Baffin Island (Government of Nunavut 2019).
3	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Summary (p. ii) and s. 2.1.1 (p. 3)	The report notes that rainfall monitoring at the mine site was inconclusive due to malfunctioning equipment. Has the malfunctioning rainfall monitoring equipment been fixed? Also see below (#25) re: raptor monitoring.	The malfunctioning weather monitoring equipment has been fixed. The report has been amended to describe the details of the malfunction (Section 2.2.1.1)

#	Document Name	Section Reference	Comment	Baffinland Response
4	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Summary (p. iv) and s. 5.3.6.4 (p. 96)	No small mammals were captured during raptor monitoring studies, suggesting that lemmings are at a low point in their population cycle. Are there corresponding Inuit observations re: small mammal abundance cycles and current abundance patterns?	Inuit Qaujimajatuqangit was not collected as part of the small mammal study. Students, technicians, and biologists working on the cliff-nesting raptor study and other monitoring studies have collected field and local knowledge anecdotal information on small mammal population cycles since 2006.
5	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Summary (p. iv) and s. 5.2.6.4 (p. 95)	There is some evidence (p=0.05) that distance to disturbance influenced reproductive success at Peregrine Falcon nesting sites near mine infrastructure in 2018. How does this compare to past years? Can a combined analysis across years be conducted?	No effect was detected in previous years. The results are based on a multi-variate modelling analysis across years.
6	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	Summary (p. iv) and s. 5.3.5.7 (p. 88)	Is small mammal monitoring planned to continue in 2019?	Small mammal monitoring is planned for 2019.
7	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.1 (p. 9)	"In 2018, the onset of snowmelt was around the second week in June when temperatures were consistently above 0ºC. Following the onset of snowmelt, air temperatures rise and the amount of daily sunlight increases, triggering plant growth and green-up. On-site staff reported an abundance of flowering purple saxifrage (*Saxifraga oppositifolia*) across the landscape in late June and early July 2018."	The 2017-2018 NIRB report states in Appendix I under PC Condition No. 57 that “no monitoring is being done to assess timing of snowmelt and green-up; Baffinland is not clear as to why this information is necessary or how to qualify the timing.” Currently, the onset of snowmelt and green-up are inferred by the data collected from Baffinland’s on-site meteorological stations (i.e., air temperature). No other parameters are measured

#	Document Name	Section Reference	Comment	Baffinland Response
			Are direct data (i.e., actual dates) being collected on onset of snowmelt or greenup?	with the intent of collecting data for the purpose of timing snowmelt and green-up.
8	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.1.2 (pp. 11-12)	Daily averages are provided for truck traffic in 2017 and 2018. At the TEWG it was clarified that transits represent a one-way trip, which could be specifically noted in the report text. It would also be beneficial to provide the total number of transits as well as the means for each calendar year.	Report amended to define ‘transit’ as a one-way trip. Also, the total number of transits for each year are now included in the final version of the report.
9	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.1.3 (p. 13)	The dust suppressant EK-35 is being used annually to reduce dust generation from the airport. What quantity is applied and is the presence of 1,2-dichloroethane being tested for in the aquatic environment? This was asked at the TEWG and Baffinland noted that they would follow up with information.	The use of EK35 as a dust suppressant is approved by the Government of Nunavut; this product is 60% biodegradable and the material safety data sheet (SDS) states that the product, when properly applied is not known to pose ecological concern. In 2018, Baffinland conducted toxicity testing down gradient of the airstrip and Project which exhibited non-lethal results for acute toxicity. Baffinland tested water sourced from Camp lake for 1,2-dichloroethane in 2018, and the sample result was below the detection limit 0.50 ug/L, supporting that potential runoff of the EK 35 polymer is resulting in negligible changes to compound concentrations in potential receiving water bodies. Baffinland is planning to trial dust stop polymer this year. Baffinland is open to further discussion with QIA to incorporate sampling for this

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#	Document Name	Section Reference	Comment	Baffinland Response
				compound at strategic locations as agreed upon by both parties.
10	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.1.3 (p. 13)	"The Mine Haul Road had strategic locations of the road resurfaced and recontoured with competent aggregate which reduces interaction with older less ideal road surfacing materials; this work raised the roads up to 10 m in elevation to decrease slumping and subsequent erosion." What, if any, considerations re: caribou crossing ability are made when roads are recontoured?	Caribou crossing ability has never been considered on the Mine Haul road (i.e., the road from the deposit to the Mine Site Complex). Baseline surveys did not show any areas of noted movement, and the traditional knowledge, while acknowledging that the deposit could be used by caribou, was not noted as an area of movement.
11	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.1.3 (p. 13)	Re: water and CaCl use in the Project Area, these products are presumably used past 3 Sept. and the final report will update? How does water and CaCl usage compare with previous years?	Products are not used past September 3, this report section is complete.
12	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.1.3 (pp. 13-14)	Large quantities of CaCl are being applied to the Tote Road to suppress dust (page 14, pgph 2). Are these applications altering the chemistry of the receiving streams? BIMC is encouraged to consider the use of other high tech, more environmentally friendly and effective dust suppressants such as RoadWarrior, Newtrol, Envirotac as a cost-effective replacement for CaCl.	The use of CaCl as a dust suppressant is approved by the Government of Nunavut. Baffinland's freshet monitoring and water license monitoring programs analyze water quality samples for conductivity and ions, however, there are no limits on surface water runoff for these parameters under Baffinland's Type A water Licence. Baffinland is planning a trial of dust stop polymer this year to evaluate alternatives to CaCl application. While conductivity values have exhibited variation within the Project Development Area, Baffinland's AEMP has seen

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				little to no change in biotic ecosystem health resultant from the mine.
13	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.1.3 (pp. 13-14)	Dust suppression efforts appear to occur most frequently in the vicinity of the southern monitoring transect across the Tote Road (see Map 3, p. 17), and suppression is being credited in part for reducing dust fall. Given that other areas of the Tote Road receive less frequent dust suppressant applications how applicable are these monitoring results to the Tote Road as a whole?	Dust suppression is conducted by Mine Operations based on where they feel it is most useful. The AMR can only report on what has been completed and the reported dust fall as measured. At this time we can draw no statistical correlation between dust fall magnitude and dust suppression. Report has been amended to state this.
14	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.2 (p. 18)	The highest recorded dust fall at the Mine Site was at the sample site located near the airstrip (see Map 1, p. 7). Would multiple applications of EK-35 help reduce dust from the airstrip? And if so, what would be the potential impacts on aquatic receiving environments? (Also see comment #9)	Multiple applications of EK35 may further reduce dust from the airstrip. Baffinland will continue to monitor potential impacts in aquatic ecosystems as per the Aquatic Effects Monitoring Plan, and plans to trial dust stop polymer this year to help reduce dust fall levels sourcing from the Tote Road. EK-35 will continue to be applied on the airstrip in 2019. The use of EK35 as a dust suppressant is approved by the Government of Nunavut; this product is 60% biodegradable and the material safety data sheet (SDS) states that the product, when properly applied is not known to pose ecological concern. In 2018, Baffinland conducted toxicity testing down gradient of the airstrip and Project which exhibited non-lethal results for acute toxicity.

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15	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.2 (p. 20), also 3.1.2.2 (p. 55) and s. 4.7 (p. 74)	Several link errors ("Reference source not found"), presumably will be updated for final report?	Amended
16	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.2.3 (p. 24)	The generally higher rates of winter dust fall suggest that spring runoff may transport a particularly strong pulse of particulates from the watershed into the freshwater receiving environments. The magnitude of this transport and its effects on sediment deposition and accumulation should be monitored at several key stream locations.	Baffinland conducts freshet monitoring programs at the Mary River Mine Site, and along the Milne Inlet Tote Road to characterize the water quality of several tributaries, drainages, and crossings annually. Additionally, water quality monitoring under the Surveillance Network Program is conducted each year during periods of flow as outlined in Baffinland's Type 'A' Water License. Under the terms and conditions of the Type A water license, Baffinland implements an Aquatic Effects Monitoring Plan and a Core Receiving Environment Monitoring Program that monitors sediment/dust deposition into lakes. Water quality results can be found in the *Freshet 2018 Monitoring Report* as well as the *2018 QIA and NWB Annual Report for Operations*. In 2018, sedimentation rates in Sheardown Lake which receives significant Project surface water runoff were observed to be well below DFO fish health and egg smothering guidelines. The sedimentation rate also decreased in comparison to the 2017 data.

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17	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.3 (pp. 30-31)	Figure 13 (p. 31) depicts interannual trends in dust fall. It could be improved by using the same Y-axis scale for all graphs so they are all directly comparable and it is immediately obvious to readers where and when the highest dust fall has been occurring. Given that the 2018 data points only include data up to September, the apparent patterns of decline may change an these changes should be reflected in the final document.	BIM agrees that this would be ideal, however, the difference between the road sites and the mine and port is so great that if all were given the same y-axis scale it would be difficult to review data from the mine and port sites, which have recorded dust fall that is much lower than historically measured along the Tote Road.
18	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 2.3 (pp. 30-31)	Year over year trends are presented for all the year-round monitoring stations. It would be useful to see a comparison of trends for summer deposition as well.	Report has been amended to include this information.
19	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 3.1.2.1 (p. 48)	As discussed during the TEWG meeting, the comment that "[h]igh ground litter cover has the potential to obscure lichen during measurements" could be better worded to reflect the fact that this litter cover might impact lichen's ability to grow, not influence measurements of lichen cover.	Ground litter is dead, unattached material; therefore, the presence and potential of ground litter to partially cover lichen is a natural phenomenon dependent upon season and micro scale ecology. Studies to assess the potential for ground litter to hinder lichen growth is beyond the scope of Project effects monitoring. Although lichens require sunlight for photosynthesis to grow, they are adapted to shaded environments with lower light intensity.

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20	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 3.1.2.2 (p. 58)	See Table 7, what happened at site TARACER4_2016 for Horned Dandelion to have been present there in 2016 but not in 2017 or 2018? It was the second-largest known occurrence (150 plants).	Approved construction activities within the Project footprint including road widening and clearing for a pull-out resulted in the removal of known Horned Dandelion occurrences in the Project area. See the 2017 AMR for further information (EDI Environmental Dynamics Inc. 2018).
21	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 3.3 (p. 59)	The statement in Paragraph 1 "Standing dead litter and ground litter were higher in 2014 than in subsequent years and the opposite was true for moss and lichen cover." appears to be contradicted in paragraph 2 "…ground litter was low in 2014 and higher in 2016, 2017, and 2018;…". Needs clarification.	The report has been amended to include corrections to Paragraph 1 which states that, "Standing dead litter and ground litter were low in 2014 and higher in subsequent years and the opposite was true for moss and lichen cover.**"**
22	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 4 (p. 61)	The draft report states that the GN released a summary report on caribou composition surveys conducted throughout Baffin Island from 2015 to 2018 in August 2018. Is this report publicly available for the TEWG members? It does not appear to be posted on the Publications page of the GNDOE website. (Note: comment directed at both GN and BIMC)	GN to comment on the availability of this report.
23	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 4.4.2.1 (p. 72)	In the Inuit Qaujimajatuqangit section the draft report says "MHTO Qaujimajatuqangit" - presumably a typo.	Amended report to say "Inuit Qaujimajatuqangit"

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24	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 5.3.6.4 (pp. 96-97)	During small mammal trapping, one individual from a non-target species was captured (p. 96), and p. 97 states that no small mammals were captured, suggesting a bird was caught. What was the species of the non-target capture?	The individual from a non-target species was an American Pipit (a migratory songbird). This has now been included in the camp mortality log.
25	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 5.3.7 (p. 96)	It is anticipated that weather-related environmental variables will be included in on-going modelling of the raptor monitoring data. What are available for weather data? Are additional weather stations, or upgrades to existing stations, needed?	The following variables are available for weather data: air temperature, solar radiation, wind direction and speed, and total precipitation. No additional weather stations or upgrades to weather stations are needed.
26	2018 Mary River Project Terrestrial Environment Annual Monitoring Report — DRAFT	s. 7.1 (p. 110)	Two Arctic fox mortalities were discovered near buildings at the Port Site, with unknown cause of death. Were these animals submitted for rabies testing?	None of the fox carcasses were tested for rabies in 2018.

References

EDI Environmental Dynamics Inc. 2018. 2017 Terrestrial Environment Annual Monitoring Report. 114 pp. Prepared for Baffinland Iron Mines Corporation.

Government of Nunavut. 2019. Response to WWF Information Requests for Baffinland's "Phase 2 Development" Project Proposal (NIRB File No. 08MN053).