MARY RIVER PROJECT

Terrestrial Environment
2022 Annual Monitoring Report

Prepared For
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Down to Earth Biology

Cover photo: EDI Environmental Dynamics Inc. and Inuit assistants from Arctic Bay conducting Height of Land Surveys above Mary River, near the Deposit.

ᓇᐃᓈᖅᓯᒪᔪᑦ

ᓄᓘᔾᔪᓐᓂ ᐱᓕᕆᐊᖅ (ᐱᓕᕆᐊᖅ) ᓵᕕᒃᓴᓂᒃ ᐅᔭᕋᓐᓂᐊᕕᒃ ᐃᓂᖃᖅᑐᑦ ᕿᑭᑖᓘᑉ ᓄᓇᑯᑎᖓᓂ ᕿᑭᑖᓘᑉ ᐅᐊᓐᓇᖓᓂ ᕿᑭᖅᑕᒥ, ᓄᓇᕗᒻᒥ. ᐱᓕᕆᐊᖅ ᐱᖃᓯᐅᔾᔨᔪᖅ ᓴᓇᔭᐅᓂᖓᓂᒃ, ᐊᐅᓚᑕᐅᓂᖓᓂ, ᒪᑐᓂᒃᓯᖓᓂᒃ, ᐊᒻᒪᓗ ᓄᓇᖓᑕ ᐅᑎᖅᑎᑕᐅᓂᖓᓂᒃ ᑖᒃᑯᓇᓂ 22.2 ᒥᓕᐊᓐ ᑕᓐᓯ ᐊᕐᕌᒍᑕᒫᒧᑦ (ᒥᓕᐊᓐ ᑕᓐᓯ ᐊᕐᕌᒍᑕᒫᒧᑦ) ᐃᑎᖅᓴᓕᐅᕐᕙᑎᒃ ᐅᔭᕋᓐᓂᐊᖅᑐᑦ ᐊᐅᓚᓂᖃᕐᓂᐊᖅᑐᑦ 21-ᓄᑦ ᐊᕐᕌᒍᓄᑦ.

2022-ᒥ, ᐹᕙᓐᓛᓐᑯᑦ ᐅᓯᑲᖅᑕᓚᐅᖅᑐᑦ 5.7 ᒥᓕᐊᓐ ᑕᓐᓯᐸᓘᓐᓂᒃ (ᒥᓕᐊᓐ ᑕᓐᓯᑦ) ᓵᕕᒃᓴᓂᒃ ᐅᔭᕋᓐᓂᐊᕐᕕᖕᒥ ᕿᓐᖑᐊᓂ ᑐᓚᒃᑕᕐᕕᖕᒥ ᑲᑎᖅᓱᖅᑕᐅᔪᓄᑦ ᐊᒻᒪᓗ ᐊᐅᓪᓚᖅᑎᑦᑎᓪᓗᑎᒃ 4.7 ᒥᓕᐊᓐ ᑕᓐᓯ ᓵᕕᒃᓴᓂ ᕿᓐᖑᐊᓂ ᑐᓚᒃᑕᕐᕕᒃᑯᑦ. ᓴᓇᔭᐅᓂᖓ 2022-ᒥ ᑭᓪᓕᖃᓚᐅᖅᑐᑦ ᐱᕙᓪᓕᐊᑎᑕᐅᖕᒋᓐᓇᕐᓂᖕᒋᑦ ᐊᒻᒪᓗ ᓴᓇᔭᐅᕙᓪᓕᐊᓂᖕᒋᑦ ᐱᕐᑯᑎᕐᔪᐊᑦ ᐱᕐᑯᑎᒃᑯᕖᓪᓗ ᐅᔭᕋᓐᓂᐊᕐᕕᖕᒥ ᐊᒻᒪᓗ ᕿᓐᖑᐊᓂ ᑐᓚᒃᑕᕐᕕᖕᒥ ᐃᑲᔪᖅᑐᕐᓂᐊᖅᑐᓂᒃ ᐊᐅᓚᓂᕐᓄᑦ ᐃᓚᒃᑲᓐᓂᖕᒋᑦ ᐱᕐᑯᑎᑦ ᐱᕐᑯᑎᓪᓗ ᐊᑐᖅᑕᐅᓚᐅᖅᑐᑦ. ᐃᓱᓕᓕᖅᑎᓪᓗᒍ 2022, ᑲᑎᓗᒃᑖᖅᓱᒋᑦ ᐱᓕᕆᐊᒥ ᓄᓇᖓᓂᒃ ᐊᑐᖅᑐᑦ 605 Hᐃᒃᑑᔅᖑᓚᐅᖅᑐᑦ.

ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦᑕ ᐅᔭᕋᓐᓂᐊᕈᓇᐅᑎᐅᑉ ᓈᓴᐅᑖ 005 ᐱᖃᓯᐅᔾᔨᔪᖅ ᐊᒥᓱᓚᓐᓂᒃ ᒪᓕᒋᐊᓕᓐᓂᒃ ᐱᑕᖃᐊᖃᖅᑎᑦᑎᔪᑦ ᐹᕙᓐᓛᓐ ᓵᕕᒃᓴᓂᒃ ᐅᔭᕋᓐᓂᐊᖅᐲᑦ ᑯᐊᐳᕋᓴᓐ (ᐹᕙᓐᓛᓐ) ᐱᓕᕆᖃᑦᑕᕐᓱᑎᒃ ᐊᒃᑐᐃᓂᕐᒧᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕈᑎᓂᒃ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ. ᐱᓕᕆᐊᑦ ᐱᓕᕆᐊᖑᓚᐅᖅᑐᑦ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᕐᒧᑦ ᖃᐅᔨᒪᔾᔨᑎᖃᓚᐅᖅᑐᑦ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓂᒃ ᐊᒃᑐᐃᓗᐊᖅᑕᐃᓕᔾᔨᑎᓂᒃ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᓂᒃ (ᐹᕙᓐᓛᓐ ᓵᕕᒃᓴᓂᒃ ᐅᔭᕋᓐᓂᐊᖅᐲᑦ ᑯᐊᐳᕋᓴᓐ 2016ᐃ). ᑲᒪᕆᔭᐅᓚᐅᖅᑐᑦ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᐱᓕᕆᖅᑎᕆᓂᒃ, ᐱᖃᓯᐅᔾᔨᓯᒪᔪᑦ ᐃᓚᒋᔭᐅᔪᓂᒃ ᐹᕙᓐᓛᓐᑯᓐᓂᑦ, ᕿᑭᖅᑕᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᖕᒋᓐᓂᒃ, ᓄᓇᕗᑉ ᒐᕙᒪᒃᑯᓐᓂ, ᐊᕙᑎᓕᕆᓂᕐᒥᑦ ᐊᒻᒪ ᓯᓚᒥᒃ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᕐᒧᑦ ᑲᓇᑕᒥᒃᑯᑦ, ᐊᒻᒪᓗ ᒥᑦᑎᒪᑕᓕᖕᒥ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ ᑎᒥᖁᑖᓂᒃ. ᑎᓴᒪᒃᑲᓀᑦ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ ᑎᒥᖁᑎᖕᒋᑦ (ᐃᑲᔫᖅᐲᑦ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ, ᓇᖕᒪᐅᑕᖅ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ, ᓴᓂᕋᔭᖕᒥ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ) ᐃᓚᓕᐅᔾᔭᐅᓚᐅᖅᑐᑦ ᕖᕝᕗᐊᕆ 2023-ᒥ ᐊᒻᒪᓗ ᐃᓚᐅᔪᓐᓇᖅᓯᓪᓗᑎᒃ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᐃᓕᕆᖅᑎᕆᑦ ᐃᓚᖏᔭᐅᔪᑦ ᖃᓄᐃᓕᖓᓂᖕᒋᓐᓄᑦ ᓂᕈᐊᖅᓯᒪᒍᑎᒃ ᐃᓚᐅᔪᒪᓗᑎᒃ. ᓄᓇᐅᑉ ᐊᕙᑎᖓᓂᒃ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖅ ᐱᒋᐊᓚᐅᖅᓯᒪᔪᖅ 2012-ᒥ ᐊᒻᒪᓗ ᑲᔪᓯᒪᓪᓗᓂ 2022-ᒧ ᐋᖅᑭᒋᐊᖅᓯᓂᖅᑕᖅᖢᓂ ᐱᓕᕆᐊᓄᑦ ᑐᙵᕕᒋᓪᓗᒋᑦ ᖃᐅᔨᔭᐅᔪᑦ ᐊᒻᒪᓗ ᑐᓴᖅᑎᑦᑎᔾᔪᑕᐅᓯᒪᔪᑦ ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᐱᓕᕆᖅᑎᕆᓂᑦ. ᑖᓐᓇ ᐅᓂᒃᑳᖅ ᓇᐃᓪᓕᑎᕆᓯᒪᔪᖅ ᖃᐅᔨᓴᕈᑎᕕᓂᕐᓂᒃ ᑲᑎᑕᐅᓯᒪᔪᓂᒃ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᑦ ᐱᓕᕆᐊᖑᓯᒪᔪᑦ 2022-ᒥ ᐱᓕᕆᐊᒧᑦ, ᐱᖃᓯᐅᑎᓪᓗᒋᑦ ᐅᑯᐊ ᐃᓗᓕᖕᒋᑦ (ᓇᐃᓈᖅᓯᒪᔪᑦ ᐊᑐᐃᓐᓇᐅᔪᑦ ᑎᑎᕋᖅᓯᒪᔪᖅ 0-ᒥ):

- ᓯᓚᒥᒃ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᖅ
- ᖁᓕᒥᒎᒃᑯᑦ ᖁᓚᐅᓐᓂᕐᓂᒃ ᕿᒥᕐᕈᓂ
- ᐳᔪᕋᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓᓄᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᖅ
- ᐳᔪᕋᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓᑕ ᐊᓂᖕᒋᖓ ᐊᔾᔨᙳᐊᑎᒎᑦ ᕿᒥᕐᕈᓂ
- ᓂᐱᓂᒃ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᖅ
- ᐱᕈᖅᑐᓂᒃ ᐊᒻᒪᓗ ᐃᔾᔨᒦᑦᑐᓂᒃ ᓴᕕᕋᔭᒃᓴᓂᒃ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓐᒋᓐᓇᕐᓂᖅ

- ᐊᐳᒻᒥ ᑐᒥᓂᒃ ᖃᐅᔨᓴᕐᓃᑦ
- ᐊᐳᔅᓭᓐᓂᐅᔪᓂᒃ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᖏᓐᓇᕐᓂᖅ
- ᓇᓯᑦᑕᖅᑐᖃᑦᑕᕐᓂᒃᑯᑦ ᑐᒃᑐᓂᒃ ᖃᐅᔨᓴᕐᓃᑦ
- ᐅᖓᓯᒃᑐᒦᕈᑎᒃ ᐊᔅᓯᓕᐅᑎᓃᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᖏᓐᓇᕐᓃᑦ
- ᐊᖑᓇᓱᒃᑎᓂᒃ ᐊᒻᒪᓗ ᐳᓛᖅᑏᑦ ᑎᑎᕋᖅᑕᐅᓯᒪᓂᖏᑦ ᓇᐃᓪᓕᑎᖅᓯᒪᔪᑦ
- ᑎᑭᐸᒃᑐᑦ ᑎᖕᒥᐊᑦ ᐃᕙᕝᕕᖏᓐᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ; ᐊᒻᒪᓗ
- ᓂᕐᔪᑎᑦ ᖃᓄᐃᓕᐅᖃᑦᑕᐅᑎᓃᑦ ᑐᕐᑯᕙᓪᓕᐊᔪᓪᓗ.

ᐃᓄᐃᑦ ᐃᓚᐅᓂᖏᑦ - 2022-ᒥ, ᓄᓇᕗᒻᒥ ᐊᒻᒪᓗ ᐅᔾᔨᖓᓂᐊᕐᕕᖕᒥ ᑭᒡᓕᖃᖅᑎᑕᐅᒧᑦ ᐊᒃᑐᐊᒧᑦ ᓄᕙᒡᔪᐊᕐᓇᖅ ᓄᓇᕐᔪᐊᒥ ᖃᓂᒪᓇᖅ ᐊᑐᕈᓐᓃᖅᑎᑕᐅᓚᐅᖅᑐᑦ. ᑎᓯᒪᑦ ᐃᓄᐃᑦ ᓄᓇᓕᖕᓂᕐᒥ ᐃᑲᔪᖅᑏᑦ ᐃᑲᔪᓚᐅᖅᑐᑦ ᓇᓯᑦᑕᖅᑐᖃᑦᑕᕐᓂᒃᑯᑦ ᑐᒃᑐᓂᒃ ᖃᐅᔨᓴᕐᓂᕐᓂᒃ ᐊᒻᒪᓗ/ᐅᕙᓘᓐᓃᑦ ᐃᔾᔪᕐᒥᒃ, ᐱᕈᖅᑐᓂᒃ, ᐅᕙᓘᓐᓃᑦ ᓂᐱᓂᒃ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᖏᓐᓇᕐᓂᕐᒥᒃ 415 ᐃᑲᕐᖁᓂᒃ 2022 ᓯᓚᒥ ᐱᓕᕆᓇᐅᑎᓪᓗᒍ.

ᓯᓚ - ᓯᓚᐅᑉ ᖃᓄᐃᓕᖓᓂᖓ 2022-ᒥ ᓇᐃᓪᓕᑎᖅᑕᐅᓚᐅᖅᑐᑦ ᐊᒻᒪᓗ ᕿᒥᕐᕈᔭᐅᓪᓗᑎᒃ ᖃᓄᐃᓐᓂᖅᓴᐅᖕᒪᖕᖓᑕ ᖃᓄᐃᓕᖓᓂᐅᓚᔪᑐᓄᑦ ᑭᖑᓂᖕᖏᑦᑎᓐᓂ ᐊᕐᕌᒍᓄᑦ. ᐅᔾᔨᕐᓇᖅᑐᑦ ᖃᓄᐃᓕᖓᓕᕐᓃᑦ ᐱᖃᓯᐅᔾᔨᔪᑦ ᐅᖁᓂᖅᓴᐅᖃᑦᑕᓕᕐᓂᖓᓄᑦ ᐊᐅᔭᒃᑯᑦ 2022-ᒥ ᖃᓄᐃᓐᓂᖅᓴᐅᓂᖏᑦ ᕿᒥᕐᕈᓪᓗᒋᑦ ᐱᒋᐊᕈᑕᐅᔪᓄᑦ ᖃᐅᔨᓴᕈᑎᓄᑦ, ᐊᓄᕌᖅᑲᑦᑕᕐᓂᖓ ᐊᒻᒪᓗ ᒪᕐᑯᖅᑲᑦᑕᕐᓂᖓᑕ ᒪᓖᓐᓇᑐᐃᓐᓇᖅᑎᓪᓗᒍ ᐱᒋᐊᕈᑕᐅᔪᓄᑦ ᖃᐅᔨᓴᕈᑎᓄᑦ.

ᖁᓕᒥᒨᒃᑯᑦ ᖁᓚᐅᑦᑎᓃᑦ – ᖁᓕᒥᒨᑉ ᖃᖓᑕᓂᖓᑕ ᖁᓚᐅᓐᓂᖓᓂᒃ ᕿᒥᕐᕈᓂᕐᒧᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᖏᓐᓇᕐᓂᖅ ᐸᒡᕕᓴᐃᑐᐃᓐᓇᕆᐊᖃᕐᓂᖓᓄᑦ ᑎᖕᒥᐊᓂᒃ ᐊᒻᒪᓗ ᐊᓯᖏᓐᓂᒃ ᐆᒪᔪᓂᒃ ᓄᓇᓂ ᐊᕝᕕᒃᑐᖅᓯᒪᔪᓂ ᖃᐅᔨᓴᕐᕕᐅᔪᒥ ᐊᒻᒪᓗ ᑎᒃᑯᐊᖅᑕᐅᓯᒪᔪᓂ ᑲᖑᖃᕐᕕᐅᔪᒥ. 2022-ᒥ, ᖁᓚᐅᑦᑎᓂᕐᓂᒃ ᕿᒥᕐᕈᓂᖅ ᐊᕐᕕᓂᓕᒋᓕᖅᑕᖓᓂ ᐊᕐᕌᒍᓂ ᑭᖑᓕᕉᓂ ᕿᒥᕐᕈᓂᒃᑲᓐᓃᑦ (ᓲᕐᓗ ᐃᓱᒪᒋᔭᐅᓪᓗᑎᒃ ᐊᕐᑯᑏᑦ ᐃᓱᒪᒋᔭᖏᑦ) ᐱᓕᕆᐊᖑᓚᐅᖅᑐᑦ. ᐅᔾᔨᕐᓇᖅᑐᒃᑯᑦ, ᐊᕕᒃᑐᖅᑕᐅᓂᖏᑦ ᖃᖓᑕᓃᑦ "ᒪᓕᒃᑐᑦ ᐃᓱᒪᒋᔭᐅᔪᓂᒃ" ᓴᖅᐲᓚᐅᖅᑐᑦ 53.5% ᑲᑎᙵᒋᑦ ᖃᖓᑕᓂᙳᒃᑖᑦ ᐃᑲᕐᖁᖏᑦ ᕿᒥᕐᕈᔭᐅᔪᑦ ᕿᒥᕐᕈᓂᕐᓂ. ᕿᒥᕐᕈᒋᐊᓪᓚᒃᑲᓂᖅᑎᓪᓗᖏᑦ ᐊᕐᑯᑏᑦ ᐃᓱᒪᒋᔭᖏᓐᓄᑦ ᐊᑦᑎᓈᖅᑐᓄᑦ ᖃᖓᑕᓂᕐᓄᑦ (ᓲᕐᓗ ᓂᕕᖓᑎᑦᑎᓃᑦ, ᐊᐃᒃᓴᕐᓃᑦ/ᐊᓪᔭᖅᓯᓃᑦ, ᓯᓚ), ᐊᑕᖏᐸᓗᒃᑯᒋᑦ ᐊᑦᑎᓈᖅᑐᑦ ᖃᖓᑕᓃᑦ ᖃᖓᑕᔭᐅᓚᐅᖅᑐᑦ ᑕᐅᕘᓇ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᔪᑎᒍᑦ ᖃᖓᑕᓲᑦ ᐊᖅᑯᑖᒍᑦ, 61.6% ᖃᖓᑕᔭᐅᓪᓗᑎᒃ ᐱᕙᓪᓕᐊᕝᕕᐅᑐᐃᓐᓇᕆᐊᓕᒃᑯᑦ. ᑕᒪᐃᓐᓄᑦ ᒪᓕᖕᓂᑦ 2022-ᒥ (42.22%) ᑕᑯᓪᓗᒋᑦ ᖃᓄᐃᓐᓂᖅᓴᐅᓂᖏᑦ 2021-ᒧᑦ (33.92%), ᖁᕝᕙᓯᓛᑦ ᐳᓴᓐᑎᑦ ᒪᓕᖕᓂᕐᒧᑦ ᖃᖓᑕᓃᑦ ᐃᑲᕐᖁᖏᑦ ᑕᐃᑲᙵᓂᑦ 2016.

ᓄᓇᓯᐅᑏᑦ ᐅᓯᒃᖃᖅᑏᑦ ᐊᖅᑯᑎᖓ – ᓈᓴᐅᑕᐅᓚᔪᒃᑐᑦ ᖃᐅᑕᒫᑦ ᑲᑎᒋᑦ ᓄᓇᓯᐅᑏᑦ ᐅᑎᖅᑕᖅᑐᑦ (ᐅᓯᒃᖃᖅᑐᑦ ᐊᓯᖏᓪᓗ) ᓄᓇᐅᓯᑏᑦ ᐅᓯᒃᖃᖅᑐᑦ ᐊᖅᑯᑖᖑᑦ 2022-ᒥ 269.7-ᖑᓚᐅᖅᑐᑦ ᓄᓇᓯᐅᑏᑦ ᐅᑎᖅᑕᖅᑐᑦ ᐅᓪᓗᑕᒫᑦ. ᓇᓴᐅᑎᓪᓗᐊᑕᖅ ᐅᓯᒃᖃᖅᑕᐅᓲᖅ ᐅᓪᓗᐃᓐᓇᖅ ᓄᓇᓯᐅᑏᑦ ᐅᓯᒃᖃᖅᑏᑦ ᐊᖅᑯᑎᖓ, ᔭᓄᐊᕆ 1ᒥᑦ ᑎᓯᐱᕆ 31, 2022ᒧᑦ, 243.6ᖑᓚᐅᖅᑐ, ᖁᑦᑎᖕᓂᖅᓴᐅᕌᖅᔭᒃᑯᓂ ᑭᖑᓪᓕᖅᐹᒥ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐃᓂᐊᖅᑐ ᐅᓂᒃᑳᖏᑦ (FEIS) ᐃᓚᒋᐊᕈᑎᑦ ᓇᓚᐅᑦᑖᖅᑕᐅᓯᒪᔪᑦ. ᐊᓯᖏᑦ ᓄᓇᓯᐅᑎᑦ ᐊᖅᑯᑎᖏᑦ (ᓱᖅᑯ ᐅᓯᔭᐅᓂᖏᑦ ᐃᖅᑲᓇᐃᔭᖅᑏᑦ ᐊᒻᒪᓗ ᓱᓇᒃᑯᑖᑦ) ᐊᕐᕌᒍᑕᒪᖅᓯᐅᑎᑦ 26.7 ᓄᓇᓯᐅᑎᑦ ᓄᒃᑖᕈᑎᑦ ᐅᓪᓗᖅ ᐊᑕᐅᓯᖅ.

ᓂᐲᑦ - ᓂᐱᓂᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐱᓕᕆᐊᖑᓕᓚᐅᑦᑐᑦ 2022 ᐊᐅᔭᖓᓂ ᖃᐅᔨᓇᓱᒃᖢᑎ ᓂᐲᑦ ᓯᓚᑕᓂ ᐊᒻᒪᓗ ᓂᐲᑦ ᐱᓕᕆᕝᕕᖕᒥᑐ, ᖃᐅᔨᓴᕈᑎᒋᔭᕗᑦ ᕿᒥᕐᕈᓂᕐᒥᒃ ᐅᓂᒃᑲᐅᓯᐅᔪᓄᑦ ᑭᖑᓪᓕᖅᐹᒥ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐃᓂᐊᖅᑐᓂ ᐅᓂᒃᑳᖏᑦ (FEIS) ᐊᒻᒪᓗ ᒪᓕᒋᐊᓖᑦ ᐊᑐᕐᑯᔭᐅᓯᒪᔪᑦ DO38. ᐅᔭᕋᓐᓂᐊᕐᕕᖕᒥ ᐊᒻᒪᓗ ᕿᙵᐊᓂ, 1.5 ᑮᓚᒥᑐ ᓂᐱᐅᔪᑦ ᐱᓕᕆᐊᑉ ᐱᕚᓪᓕᐊᕝᕕᖓ ᐊᑦᑎᓐᓂᖅᓴᐅᓚᐅᖅᑐ ᒥᒃᓴᐅᓴᖅᑕᐅᓯᒪᔪᒥ ᑭᖑᓪᓕᖅᐹᒥ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐃᓂᐊᖅᑐᓂ ᐅᓂᒃᑳᖏᑦ (FEIS) (40 DBA). ᐊᖅᑯᑎᑰᑕᖓ (1,5 ᑭᓚᒥᑖ, 3 ᑭᓚᒥᑖ, ᐊᒻᒪᓗ 6 ᑮᓚᒥᑕ ᐅᖓᓯᓂᓕ), ᓂᐲᑦ ᕐᑯᑦᑎᖕᓂᓴᐅᖏᓐᓇᓚᐅᖅᑐ ᑭᖑᓪᓕᖅᐹᒥ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐃᓂᐊᖅᑐᓂ ᐅᓂᒃᑳᖏᑦ (FEIS). ᑕᓐᓇ ᑕᐃᒪᐃᑦᔪᑎᖃᓗᐊᖅᑐ ᓄᓇᓯᐅᑎᑦ ᐃᖏᕐᕋᓂᓇᔭᖏᓐᓄ ᐃᓱᒪᒋᔭᐅᓯᒪᓪᓗᓂ. ᑕᒪᐃᓐᓄᑦ, ᐃᒪᓐᓇᐅᔫᓐᓇᖅᑐᒃᓴᐅᕗ ᑕᒪᐃᓐᓂᑲᓴ, ᑕᒃᑯᐊ ᓂᐲᑦ ᐊᒃᑐᐃᓯᒪᔪᑦ ᐱᓕᕆᐊᒧᑦ ᒪᓕᑦᑎᐊᖅᓗᒋᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᓕᓐᓄ ᓴᖅᑭᑎᑕᐅᓯᒪᔪᓄᑦ ᑭᖑᓪᓕᖅᐹᒥ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐃᓂᐊᖅᑐᓂ ᐅᓂᒃᑳᖏᑦ (FEIS).

ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓕᐊᓂᖓ – 2022ᒥ ᐳᔪᖅ ᓯᐊᒻᒪᒃᓯᒪᓂᖓ ᖃᐅᔨᓴᕐᓂ ᐱᓕᕆᐊᖅ ᐊᑐᓚᐅᖅᑐ 53ᓂ ᓯᐊᒻᒪᒃᓯᒪᔪᓂ ᑲᑎᖅᓯᐃᓚᐅᖅᑐ ᐱᓕᕆᓂᖃᖅᑎᓪᓗᒋᑦ. 26ᖑᔪᑦ ᑲᑎᑕᐅᖃᑦᑕᖅᑐ ᑕᖅᑭᑕᒪ, ᐊᓯᖏᑦ ᖃᐅᔨᓴᖅᑕᐅᓗᑎᒃ ᐊᐅᔭᒃᑯᑐᐊᖅ. ᐊᕐᕋᒍᑕᒪᖅ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᐊᖏᔪᓂᖓ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᓂ 2022 ᐊᖏᒃᓕᒋᐊᖅᓯᒪᔪᖅ ᐊᕐᕋᒍᓚᐅᖅᑐᓂ. 2022ᖑᑎᓪᓗᒍ, ᐊᖏᓛᖑᓚᐅᖅᑐ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᐅᔭᕋᓐᓂᐊᕐᕕᖕᒥ ᒥᑦᑕᕐᕕᐊᓂ ᐊᒻᒪᓗ ᐊᖅᑯᑎᑯᑕᖅ. ᐊᖏᔫᓂᖓ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᕿᙵᐊᓂ ᓱᕐᕋᒃᐸᓪᓕᐊᖏᑦᑐᖅ, ᐅᕝᕙᓗᓐᓂ ᐃᓚᖓᓂ ᒥᒃᓵᕙᓪᓕᖅᓱᓂ, ᐱᒋᐊᓚᐅᖅᑐ 2018ᖑᑎᓪᓗᒍ. ᐃᓚᐅᓪᓗᓂ ᐊᖅᑯᑎᑰᑕ, ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ 2022ᖑᑎᓕᒍ ᓱᕐᑯᓯᐊᓚᐅᖏᑦᑐᖅ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐃᑳᕐᕕᖓ ᒥᒃᓴᐅᓯᖅᓱᒍ ᐊᕐᕌᒍᓚᐅᖅᑐ. ᑭᓯᐊᓂ ᐊᖏᒃᓕᒋᐊᓚᐅᖅᑐ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᐅᖃᐅᓯᐅᓚᐅᖅᑐ ᓂᕆᐊᓂ ᐃᑳᕐᕕᖓ. ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᓇᓗᓇᐃᖅᑕᐅᓚᐅᕐᒥᔪᖅ ᖃᖓᑦᑕᖅᑎᑕᐅᓯᒪᔪᒃᑯ ᐊᔾᔨᓕᐅᕈᑎᒃᑯ. ᑕᒪᓐᓇ ᖃᐅᔨᓴᕐᓂᑲᔭᐅᔪᖅ ᓇᓗᓇᐃᖅᓯᔪᒪᓂᕐᒧᑦ ᐃᓄᐃᑦ ᓄᓇᖓᓂ ᐊᑐᖃᑦᑕᕐᓂᖏᓐᓂ ᐅᓂᒃᑲᓂᑦ ᑕᑯᓯᒪᔪᑦ ᐳᔪᕐᓂᖅ ᓯᐊᒻᒪᒃᓯᒪᔪᓂᑦ ᐅᖓᑖᓄ ᓂᕆᐅᒋᔭᐅᓚᐅᖅᑐᒧᑦ ᐳᔪᕐᒧᑦ ᐊᖅᑭᒃᑕᐅᓯᒪᔪᒧᑦ, ᐊᒻᒪᓗ ᑕᑯᒃᓴᐅᔪᒥᑦ ᑭᒡᒐᖅᑐᐃᓂᖅ ᐊᖏᓂᖓᓄᑦ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᐃᓚᖏᓐᓂ ᐊᑦᑎᖕᓂᖅᓴᒥ ᖃᐅᔨᓯᒪᔪᑦ ᐳᔪᖅ ᑲᑎᖅᓱᖅᑕᐅᓯᒪᔪᖅ. ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓕᐊᖃᑦᑕᕐᓂᖓ ᓄᓇᒧᑦ ᐊᔾᔨᕐᓚᑦᑎᐊᓇᔭᖓ 2014ᒥᑦ 2022ᒧᑦ ᐃᓚᖏᓐᓂ, ᐊᖏᓛᑦᑎᐊᖑᓪᓗᓂ ᑲᑎᑎᖅᓯᒪᔪᖅ ᐱᓕᕆᐊᖅ ᐊᒻᒪᓗ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᐅᐊᖕᓇᖅᐸᓯᕐᒥ ᕿᙵᐊᓂ, ᐱᖓᖕᓇᖅ ᐊᒻᒪᓗ ᓂᕆᖅ ᐅᔭᕋᓐᓂᐊᕐᕕᖕᒥ, ᐊᒻᒪᓗ ᓂᕆᖅᐸᓯᐊᓂ ᓂᕆᐊᓂ ᐃᑳᖅᕕ (ᑮᓚᒥᑕ 87) ᓇᒧᖓᐳᓗᔭᖅᖢᓂ ᐊᒻᒪ/ᐅᕝᕙᓗᓐᓂ ᐊᓄᕌᖅᔪᐊᕐᓂᕐᒧᑦ. ᐹᕝᕙᓖᓐ ᐅᓄᖅᑐᓂ ᐊᑐᖃᑦᑕᖅᑐ ᐳᔪᖅᑕᖃᓗᐊᔾᔭᐃᒃᑯᑎᓂ, ᐃᓚᐅᓪᓗᓂ ᖃᐅᓯᖅᑎᕆᓗᒍ ᐊᖅᑯᑦ ᐃᒪᕐᒧᑦ ᑕᖃᐅᖅᑎᕆᓗᒍᓐᓂ, ᑲᔪᓯᓐᓇᖅᖢᒍ ᑕᓗᐊᖅᐸᒃᓗᒥ ᓯᖃᓕᑦᔪᐲᑦ, ᐊᒻᒪᓗ ᐱᐅᓯᒋᐊᖅᐸᓪᓕᐊᓂᖅ ᓄᒃᑎᖅᑎᓇᓂᖅ ᓴᕕᕋᔭᒃᓴᖅ ᑲᑎᖅᓱᖅᑕᐅᓯᒪᔪᒧᑦ. ᐳᔪᖃᓗᐊᔾᔭᐃᒃᑰᑎᑦ ᐊᑐᖅᑕᐅᓕᓚᐅᖅᑐ ᓄᓇᓯᐅᐱᑦ ᐅᓯᒃᖅᑕᐅᐱᑦ ᐊᖅᑯᑎᑯᑖᖓᒧᑦ 2022ᖑᑎᓕᒍ. ᑲᔪᓯᓐᓇᕐᓂᐊᖅᖢᓂ ᐳᔪᖃᓗᐊᔭᐃᒃᑯᑎᓂ ᐊᑐᕐᓗᑎᒃ, ᐳᔪᖃᓗᐊᔾᔭᐃᒃᑰᑎᑦ ᐃᓚᔭᐅᖃᑦᑕᓕᓚᐅᖅᑐ ᑲᔪᓯᓐᓇᓕᖅᖢᓂ 2022ᒥ. ᑕᓐᓇ ᐃᓚᔭᐅᖃᑦᑕᖅᑐ ᐳᔪᖃᓗᐊᔾᔭᐃᒃᑯᑎᑦ ᐃᓚᔭᐅᓲᑦ ᐊᑦᑕᕐᓇᖏᑦᑐ, ᐃᒪᕐᒥ ᐊᑐᖅᖢᓂ, ᐊᑯᓂᐅᓂᖅᓴᖅ ᐳᔪᖃᕐᓇᖏᑦᑐᖅ ᐊᑐᖅᑕᐅᓂᖅᓴᐅᔪᓕᖅᑐᖅ ᑲᑎᖅᓯᖅᓯᒪᔪᓂ ᕿᙵᐊᓂ.

ᐱᕈᖅᑐᐃᑦ - ᐱᕈᖅᑐᓂ ᖃᐅᔨᓴᕐᓂᖅ 2022ᖑᑎᓪᓗᒍ ᖃᐅᔨᓴᓪᓗᐊᑕᓚᐅᖅᑐᐃ ᓴᕕᕋᔾᔭᕐᓂ – ᐱᓗᐊᖅᑐᒥ ᓱᕈᕐᓇᖅᑐᑦ ᐃᓱᒪᓗᑕᐅᑐᐃᓐᓇᓕᐊᓖᑦ (CoPCs) – ᐃᔾᔪᕐᒥᑦᑐ ᐊᒻᒪᓗ ᐱᕈᖅᑐᓃᑦᑐᑦ (ᓱᕐᓗ ᓂᕐᓇ). ᐃᔾᔪᕐᒥ–ᓴᕕᕋᔾᔭᖅ ᓴᕕᕋᔾᔭᖃᓗᐊᓕᕐᒪᖓᑕ ᐱᓕᕆᐊᖅ ᓱᕐᑯᓯᓗᐊᖅᓯᒪᙱᑦᑐᖅ ᐊᒻᒪᓗ ᒥᒃᓵᕆᐊᖅᓯᒪᓗᓂ ᐱᓕᕆᕝᕙᐅᔪᓂ ᐊᒻᒪᓗ ᖃᐅᔨᓴᕈᑏᑦ ᐅᖓᓯᖕᓂᖓᓄ. ᐊᒥᓱᑦ ᓂᕐᓇᑦ–ᓴᕕᕋᔾᔭᑦ ᓴᕕᕋᔾᔭᖃᓗᐊᓕᕐᒪᖔ ᐱᓕᕆᐊ ᖃᓂᒋᔭᖓᓂ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᓯᒪᓗᑎ ᐅᖓᓯᒃᑐᒧᖅᐸᓪᓕᐊᒪᙱᑦᑐ ᓱᕐᑯᓯᓗᐊᖅᓯᒪᙱᑦᑐ ᑭᒃᓕᒋᔭᐅᔪᓂ ᐱᒪᓂᐅᕆᔭᐅᔪᓂ. ᑭᓯᐊᓂ, ᐅᓄᖅᓯᕆᐊᖅᑐ ᓱᕈᕐᓇᖅᑐᑦ ᐃᓱᒪᓗᑕᐅᑐᐃᓐᓇᓕᐊᓖᑦ ᐃᔾᔪᕐᓂᑦ (ᓱᕐᓗ ᖄᐳ, ᔮᖕᒃ) ᐊᒻᒪᓗ ᓂᕐᓇ (ᐋᓯᓂᒃ, ᑲᐅᑎᔾᓪ, ᖄᐳ, ᓚᑦ, ᓯᓕᓂᐊᒻ) ᑕᒃᑯᐊ ᓇᓂᔭᐅᓚᐅᖅᑐᒥ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥ, ᕿᙳᐊᓂᓗ, ᐊᒻᒪᓗ ᓄᓇᓯᐅᑎᒃᑯ ᐊᖅᑯᑎᑯᑖᒃ, ᐃᓚᖏᓐᓄᑦ ᐱᒪᓂᐅᕆᔭᐅᔪᖅ ᐅᕝᕙᓗᓐᓂ ᖃᐅᔨᓴᖅᑎᓂᑦ ᐱᒪᓂᐅᕆᔭᐅᔪᖅ. ᖃᐅᔨᓴᖅᑏᑦ ᓇᓗᓇᐃᖅᓯᔪᑦ ᐊᓯᔾᔨᑐᐃᓐᓇᓕᐊᓖᑦ ᐱᕈᖅᑐᓂ ᖃᓄᐃᓐᓂᖓᓄᑦ. ᐃᒪᐃᒪ ᐊᖏᒃᓕᒋᐊᖅᑐ ᐊᒻᒪᓗ ᖃᖏᐅᑎᔪᑦ ᓴᕕᕋᔾᔭᒥ ᐊᒻᒪᓗ ᖃᐅᔨᓴᓇᐊᓕᑦ ᐊᔾᔨᖏᖏᑦᑐ. ᐊᓯᖏᑦ ᓱᕈᕐᓇᖅᑐᑦ ᐃᓱᒪᓗᑕᐅᑐᐃᓐᓇᓕᐊᓖᑦ ᖃᓗᐊᖅᑐ ᐅᔭᕋᖕᓂᐊᖅᕕ ᐱᓕᕆᐊᖑᔪᒥᑦ. ᑕᒃᑯᐊ ᐊᖏᒃᓕᕙᓕᐊᖏᓇᕈᑎ ᐅᕝᕙᓗᓐᓂ ᑲᔪᓯᑦᑎᓐᓇᕋᔭᖅᐸᑦ (ᐊᕐᕋᒍ ᐊᓂᒍᖃᑦᑕᐅᔭᖅᑎᓪᓗᒋᑦ) ᐅᖓᑕᓄᖅᑐ ᐅᑎᖅᑎᕕᐅᔨᓇᒃᒪᖓ ᐊᑭᖏᓐᓂ, ᕿᒥᕐᕈᒃᑲᓂᕐᓇᐊᖃᕋᔭᖅᑐ ᐊᒻᒪᓗ ᖃᐅᔨᓴᑦᑎᐊᒃᑲᓂᕐᓗᑎᑦ ᐊᒃᑐᐃᔾᔪᑕᐅᔪᑦ. ᖃᐅᔨᓴᖅᑎᒻᒪᓇᑦ ᐳᔪᕐᒥ ᐃᓚᔭᐅᓯᒪᓂᖓᓂ ᓴᕕᕋᔾᔭᖅ ᓂᕐᓈᓂᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᑕᐅᓂᖅ ᓴᕕᕋᔾᔭᕐᓂᑦ ᐊᒻᒪᓗ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖓ ᑕᒪᒃᑯᓄᖓ ᐃᔾᔪᖅ–ᓴᕕᕋᔾᔭᓕᒃ ᐊᒻᒪᓗ ᓂᕐᓇᑦ–ᓴᕕᕋᔾᔭᓖᑦ ᐱᐊᓂᒃᑕᐅᓚᐅᖅᑐ ᐊᔾᔨᖏᖏᑦᑐᓂ ᖃᐅᔨᕙᓪᓕᐊᓂᖏᓄᑦ ᐳᔪᕐᒥ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖏᓄ ᖃᐅᔨᓴᕐᓂᖅ. ᖃᐅᔨᓴᖅᑎᒻᒪᓇ ᖃᐅᔨᓚᐅᖏᑦᑐ ᓂᕐᓇ ᓴᕕᕋᔾᔭᖃᓗᐊᓚᐅᖏᑦᑐ ᐅᕝᕙᓗᓐᓂ ᐊᒃᑐᐊᓂᖏᓄ ᓴᕕᕋᔾᔭᖅ ᐳᔪᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᓂᖅ ᓴᓂᐊᓂ ᐃᔾᔪᖅ–ᓴᕕᕋᔾᔭᖅ ᐊᒻᒪᓗ ᓂᕐᓇ–ᓴᕕᕋᔾᔭᖅ.

ᓂᖅᔪᑏᑦ - ᐊᐳᒻᒥ ᑐᒥᓂᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐱᓕᕆᐊᖑᓚᐅᖅᑐ ᖃᓄᖅ ᓂᖅᔪᑎ ᐱᓲᖑᒪᖔ ᓄᓇᓯᐅᑎᐅᑦ ᐊᖅᑯᑎᑯᑖᖓᓂ, ᑐᒃᑐᐃ ᐃᓱᒪᒋᔭᐅᓪᓗᐊᑕᖅᓯᑎ. ᑎᓴᒪᑦ ᖃᐅᔨᓴᕈᑏᑦ ᐱᐊᓂᒃᑕᐅᓚᐅᖅᑐ 2022ᒥᑦ. ᖃᐅᔨᓴᕐᓂᐅᖃᑦᑕᓚᐅᖅᑐᓂ, ᑐᒦᑦ ᖃᐅᔨᓴᖅᑕᐅᖃᑦᑕᓚᐅᖅᑐ ᐅᑯᐊᖑᒐᔪᓚᐅᖅᑐᑦ ᑎᓇᒐᓂᐊᖅ ᐊᒻᒪᓗ ᐊᖅᑭᒡ, ᐊᒻᒪᓗ ᑐᒃᑐᓂᑦ ᑐᒥᓯᓚᐅᕆᓪᓗᑎ 2022ᒥᑦ. 6ᐳᓴᑐᐃᓐᓇᐅᔪᑦ ᐅᔾᔨᓇᔭᐅᓯᒪᔪᑦ ᑐᒥᑦ ᑎᑎᖅᑕᐅᓯᒪᓗᑎᒃ ᓄᓇᓯᐅᑎᒃᑯ ᐊᖅᑯᑎᑰᑕᖓᓂ.

ᐊᐳᔾᔭᓇᖕᓂᐅᔪᓂᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᖏᓇᕐᓂᖅ ᐱᓕᕆᐊᖑᓚᐅᖅᑐᖅ 1ᒦᑕᓂᒃ ᖁᑦᑎᖕᓂᓕ, ᑕᓐᓇ ᓂᕐᔪᑎᓄᑦ ᐃᑳᖅᑕᐅᖃᑦᑕᖅᑐ ᐊᒻᒪᓗ ᐃᑲᔪᑎᓪᓗᓂ ᐊᖅᑯᑎᓄᑦ ᓴᖅᑭᔭᑦᑎᐊᕐᓂᖅᓴᐅᓪᓗᓂ ᑐᓗᖅᓯᖏᓐᓂᖅᓴᐅᔪᑦ. ᑕᒃᑯᐊ ᐊᐳᔾᔭᓇᖕᓂᐅᔪᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᖏᓇᕐᓂᖅ ᐱᓕᕆᐊᖑᓚᐅᖅᑐ 2022 ᐅᑭᐅᖓᓂ. ᓄᓇᐅᑉ ᐊᕙᑎᖏᓐᓄ ᑲᑎᒪᔨᐊᓖᑦ ᑐᒃᓯᕋᖅᓯᒪᓚᐅᖅᑐ, ᐅᒃᑐᕋᖅᓯᒪᔪᓂ ᓈᒥᓂᖓᓂᓗ 2020ᒥ ᐊᑐᕐᖓᖅᓗᑎ ᐅᓂᒃᑳᖅᑕᐅᓯᒪᔪᒥ ᑭᓚᒥᑕᕐᓂ ᑎᑎᖅᓯᒪᔪᓂ ᐅᒃᑐᕋᖅᓯᒪᔪᓂ. ᑲᑎᓪᓗᒃᑖᖅᓱᒋ, ᖁᑦᑎᒃᑐᐊᓗᓚᐅᖅᑐ 91ᐳᓴᒥ ᖁᑦᑎᖕᓂᖅᓴᐅᓗᓂ 2021ᖑᑎᓪᓗᒍ (90ᐳᓴᑦ).

ᓇᓯᑦᑕᖅᑐᖃᑦᑕᕐᓂᒃᑯᑦ ᑐᒃᑐᓂᒃ ᖃᐅᔨᓴᕐᓃᑦ ᖃᐅᔨᓴᕐᓂᐅᓚᐅᖅᑐ ᑐᒃᑐᐃ ᐱᑕᖃᖏᓐᓂᖏᑦ, ᓇᒥᓕᕐᓂᖏᑦ, ᓇᒧᖓᐅᕙᖕᓂᖏᑦ, ᐊᒻᒪᓗ ᐊᒃᑐᐃᖕᒪᖓᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥ ᐱᓕᕆᓂᖓᓄ, ᖃᐅᔨᓴᕈᑎᓄᑦ. ᓇᓯᑦᑕᖅᑐᖃᑦᑕᕐᓂᒃᑯᑦ ᑐᒃᑐᓂᒃ ᖃᐅᔨᓴᕐᓃᑦ (HOL) ᐱᐊᓂᒃᑕᐅᓚᐅᖅᑐ ᔫᓂ 3 ᐊᒻᒪᓗ ᔫᓂ 12, 2022ᒥᑦ. ᑕᒪᕐᒥᑦ ᐃᓂᒋᔭᐅᔪᑦ ᐅᐸᒃᑕᐅᓚᐅᖅᑐᑦ ᒪᕐᕈᐃᖅᓱᑎ. ᑲᑎᓪᓗᒃᑕᖅᓱᒍ 36 ᐃᑲᕐᕋᐃᑦ, ᑕᒃᑯᐊ ᖃᐅᔨᓴᕐᓂᑦ 45ᒥᓂᑦ ᐅᓪᓗᖅ ᐊᑕᐅᓯᖅ. ᑕᒃᑯᐊ ᖃᐅᔨᓴᕐᓂᓇᔭᖓᓂ, ᑐᒃᑐᓯᓚᐅᖏᑦᑐ. ᑕᐃᒪᖓᓂ ᖃᐅᔨᓴᐃᓐᓇᖅᓱᑎ 2013ᒥᓂ ᐊᒻᒪᓗ ᑐᒃᑐᐃᑦ ᐅᓄᖏᓐᓂᖅᓴᐅᓗᑎ.

ᑕᒃᑯᐊ ᖃᐅᔨᓴᕈᑏᑦ ᓄᓇᐃᓐᓇᕐᒥᑦᑐ ᐊᔾᔨᓕᐅᕈᑏᑦ, ᓇᒧᓇᐃᖅᓯᓯᒪᓪᓗᓂᓪᓗ ᑐᒃᑐᓯᓚᐅᖏᑦᑐᑦ ᐅᑐᐱᕆ 31, 2021ᒥ ᔫᓂ 05, 2022ᒧᑦ.

ᑎᖕᒥᐊᑦ - ᑎᑭᑉᐸᒃᑐᑦ ᑎᖕᒥᐊᑦ ᐃᕙᕝᕕᖏᓐᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ (AMBNS) ᐱᐊᓂᒃᑕᐅᓚᐅᖅᑐ ᐱᕈᖅᑐ ᓱᕐᑯᓯᖅᓯᒪᖏᑎᓪᓗᒋᑦ ᐅᕝᕙᓗᐃᓐᓃᑦ ᑎᖕᒥᐊᑦ ᐃᕐᓂᐊᖅᑎᓪᓗᒋᑦ (ᒪᐃ 17ᒥᑦ ᐊᐅᒡᒍᓯ 19ᒧᑦ) ᖃᐅᔨᓴᕈᑎᑦ ᐅᑯᓂᖓ ᐊᑐᓚᐅᖅᑐ ᐊᒃᓘᓈᒥᑦ ᐊᑐᖅᓘᑎ (ᕋᐅ 2015) ᖃᐅᔨᓴᖅᓘᑎᒃ ᐃᕙᕝᕕᖕᓂ ᐱᓕᕆᓯᒋᐊᖏᑎᓪᓗᒋᑦ ᖃᐅᔨᓴᕐᓂᖅᑕᖃᓚᐅᖅᑐ, ᐊᒻᒪᓗ ᐃᕙᕝᕕᒃᓯᐊᓚᐅᖏᑦᑐ.

ᐊᕐᕌᒍᒐᓴᐃᑦ ᐱᐊᓂᒃᓯᒪᓕᖅᑎᓪᓗᒋᑦ ᑎᖕᒥᐊᑦ ᓂᖅᑭᑐᖅᑏᑦ ᖃᐅᔨᓴᖅᑕᐅᑎᓪᓗᒋᑦ, ᐃᓅᒃᐸᓪᓕᐊᓂᖏᑦ ᐊᒻᒪᓗ ᐃᕐᓂᕙᓪᓕᐊᓂᖏᑦ ᖃᓄᐃᖏᑦᑎᐊᓚᐅᖅᑐ, ᐊᒻᒪᓗ ᑕᑯᓯᒪᖏᓪᓗᑎ ᓴᐳᑎᔭᕆᐊᖃᓕᕐᓂᖏᓐᓂ ᑎᖕᒥᐊᑦ ᓂᖅᑭᑐᖅᑎᐅᔪᑦ. ᑕᐃᒪᐃᒻᒪ, ᑎᖕᒥᐊᑦ ᓂᖅᑭᑐᖅᑏᑦ ᐃᓂᒋᔭᖏᑦ ᖃᓄᐃᓐᓂᖏᓪᓗ ᖃᐅᔨᓴᕐᓂᖓ ᓄᑕᐅᓚᐅᖅᑐ 2021ᒥᑦ ᐊᒻᒪᓗ 2022. ᓯᕗᓂᑦᑎᓐᓂᒃ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᑐᒃᓯᕋᐅᑎᖃᑕᖏᔪᓂ ᒫᓐᓇ.

ᓂᕐᔪᑎᓂᑦ ᖃᓄᐃᓕᐅᖃᑦᑕᐅᑎᓂᖅ - 15 ᓂᖅᔪᑎᑦ ᑐᕐᑯᔪᑦ ᐅᖃᐅᓯᐅᓚᐅᖅᑐ 2022ᖑᑎᓪᓗᒍ, ᐅᖁᕐᓂᖅᓴᐅᕋᖅᔫᓘᑎ 2021ᒥ (10), ᑕᒪᕐᒥ ᐊᑐᓂ ᐊᓯᐅᔨᓪᓗᑎᒃ. ᑐᕐᑯᔪᑦ 2022ᖑᑎᓪᓗᒍ ᑖᓕᒪᐅᓚᐅᖅᑐ ᓂᖅᔪᑎᑦ ᐊᔾᔨᒌᖏᑦᑐ: ᑎᑎᖓᓂᐊᖅ (11), ᐅᑲᓕᖅ (1), ᕐᑯᐸᖁᐊ (1), ᕿᕐᓂᖅᑖ (1), ᐊᒻᒪᓗ ᐊᕿᒡᒋᖅ (1). ᓄᓇᒃᑰᕈᑎᒧᑦ ᑐᖁᖅᑕᐅᔪᑦ ᓇᒧᓇᐃᖅᑕᐅᓚᐅᖅᑐᑦ ᐅᕝᕙᓗᓐᓂ ᐸᓴᕆᔭᐅᔪᑦ 8ᖑᔪᑦ ᐱᕈᓗᖕᓂᐅᔪᐅᑦ. ᐊᑕᐅᓯᖅ ᑐᖅᑯᔪᖅ ᐃᓚᖃᓚᐅᖅᐳᖅ ᓂᒐᖅᑎᑎᓇᓱᖏᓪᓗᑎ ᓂᒐᖅᓯᒧᑎ ᓂᕐᔪᑎᒥ ᐊᒃᑖᓯᕝᕕᖕᒥ, ᐊᒻᒪᓗ ᒪᕈᒃ ᑐᖅᑯᓚᐅᖅᑐ ᐱᓪᓚᖏᓴᕐᓂᕐᒧᑦ, ᑎᓴᒪᐅᔪᑦ ᐅᖃᐅᓯᐅᓯᒪᖏᓪᓗᑎ ᖃᓄᖅ ᑐᖅᑯᓗᒍᐊᒪᖓᖏᓐᓂ. ᖃᓄᑐᐃᓐᓇᑦᑎᐊᖅ ᑐᖅᑯᔭᕌᖓᒥ ᓂᕐᔪᑎ, ᑐᖅᑰᔪᑎᑦᑎᔭᖏᑦ ᒥᒃᓵᑎᒋᐊᖅᑕᐅᓇᓱᒃᑕᖅᐸᑦ ᐱᓕᕆᐊᖑᔪᒥ.

ᑎᑎᕋᖅᓯᒪᔪᖅ 0. ᓇᐃᓈᖅᓯᒪᔪᑦ ᐊᕙᑎᒥ ᐊᒃᑐᐃᓂᕐᓂᒃ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᙱᓐᓇᕐᓂᕐᒧᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᕐᓃᑦ ᐱᓕᕆᐊᕐᒍᓚᐅᖅᑐᑦ ᓄᓘᔾᓐᓂ ᐱᓕᕆᐊᒥ 2022-ᖑᑎᓪᓗᒍ.

ᖃᐅᔨᓴᕐᓂᖅ	ᐱᔾᔪᑎᐊ ᖃᐅᔨᓴᕐᓂᖅ[1]	ᐱᐊᓂᒃᑕᐅᓯᒪᔪᑦ ᐊᒃᑐᐃᓂᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ, ᐊᒃᑐᐃᓗᐊᔾᔭᐃᒃᑯᑎᖃᕆᐊᖃᕐᓗᑎᒃ ᐊᒻᒪᓗ ᐊᑐᓕᕐᑯᔭᐅᓯᒪᔪᑦ ᓯᕗᓂᑦᑎᓐᓂ.	ᖃᓄᖅ ᐋᖅᑭᐊᕿᓐᓇᖅᐱᑕ ᐊᒃᑐᐃᓂᐅᔪᑦ ᐃᓱᒪᕆᔭᐅᔪᑦ[2]
ᓯᓚᒥᑦ ᖃᐅᔨᓴᕐᓂᖅ	ᐃᑲᔪᖅᓱᖅᓗᒋᑦ ᑕᒪᕐᒥ ᑲᑎᑕᐅᓯᒪᔪᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᕐᓂᑦ ᐱᓕᕆᐊᑦ	ᓯᓚᐅᑉ ᖃᓄᐃᓐᓂᖏᑦ ᖃᐅᔨᓴᖅᑕᐅᙱᓐᓇᓚᐅᖅᐳᑦ ᐃᑳᕋᑕᒫᑦ ᓯᓚᓕᕆᔩᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥ ᐊᒻᒪᓗ ᕿᙵᑯᐊᓂ ᓯᓚᒧᑦ ᖃᓄᐃᓂᖓ ᑎᑎᖅᑲᑦ ᑲᑎᑕᐅᙱᓐᓇᓚᐅᖅᓱᑎ ᑕᐃᒪᖓ 2005 ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥ ᐊᒻᒪᓗ (2006) ᕿᙵᑯᐊᓂ. ᓯᓚᒥ ᖃᐅᔨᓴᕐᓂ ᑲᑎᑕᐅᓚᐅᕐᒥᔪᑦ ᖃᐅᔨᓴᕈᑎᑦ ᐱᓕᕆᐊᑦ ᐊᒃᑐᐃᓗᐊᖅᑕᐃᓕᑎᑦᑎᓂᖅ ᐱᑕᖃᓗᐊᙱᑦᑐᖅ, ᓯᓚᓕᕆᓂᖅ ᓯᓚ ᖃᓄᐃᓐᓂᖓᓂ ᑲᑎᖅᓱᐃᖏᓐᓇᕐᓂᐊᖅᑐ ᑎᑎᖅᑲᓂ.	ᐱᑕᖃᙱᑦᑐᖅ
ᖁᓕᒦᓕᒃᑯᑦ ᖃᖓᑕᓂᕐᒧᑦ ᖃᐅᔨᓴᖅᑕᐅᓂᖏᑦ	ᑐᕌᑕ ᐱᓕᕆᐊᖅ ᖃᓄᐃᓐᓂᖓ 59, 71, ᐊᒻᒪᓗ 72	ᐱᖃᓯᐅᑎᖏᓪᓗᒍ ᐊᐅᓚᓂᐅᔪᑦ ᐱᔾᔪᑎᖏᑦ, ᐊᒻᒪᓗ ᖃᖓᑕᓲᒃᑯᑦ ᒪᓕᒐᐃᑦ ᒪᓕᒃᑐᓂᔾᔪ ᖃᖓᑕᓲᖅᑎᐅᑉ ᑎᖏᕐᓲᒃᑯᑦ ᐃᓄᖕᓄᓪᓗ ᐊᑦᑕᕐᓇᖅᑕᐃᓕᒪᔾᔪᓃᑦ, ᖃᖓᑕᓲᖅᑎᓪᓗ ᑭᒡᓕᖃᖅᓱᑎ ᐊᒃᑎᓈᕆᐊᖃᕐᓂᖏᓐᓄᑦ 650 ᐃᖏᕐᕋᓂᖓ ᖃᖓᑕᓂᐊᖅᑎᓪᓗᒋᑦ ᐃᓂᐅᔪᒥᒃ ᐃᓂᐅᔪᒧᑦ ᑎᖏᐊᓄ ᐊᖅᑰᕝᕕᐅᕙᒃᑐᒃᑯᑦ, ᐊᒻᒪᓗ 110 ᐃᖏᕐᕋᓂᖓ ᓴᓂᒧᑦ, 1,500 ᐃᖏᕐᕋᓂᖓ ᑐᑭᒧᑦ ᐅᖓᓯᖕᓂᖃᕐᓗᑎᓪᓗ ᖃᐅᔨᓴᕐᕕᐅᔪᓂᒃ ᑎᖏᐊᓄᑦ ᐊᖅᑰᖅᑕᐅᕙᒃᑐᒃᑯᑦ (ᓱᕐᓗ, ᑲᖑᖃᐅᖅᑐᓂᒃ) ᑎᖏᕐᓲᕐᒧᓪᓗ ᒪᓕᒐᐃᑦ ᐊᑐᖃᑦᑕᖅᑐᑦ ᐅᐸᒍᑎᔭᕆᐊᖃᙱᓐᓂᖏᓐᓄᑦ ᓂᕐᔾᔪᑎᓄᑦ ᐱᒻᒪᕆᐅᔪᓂᒃ. 2022-ᒥ, ᖁᑦᑎᓈᕆᐊᖃᕐᓂᖏᑦ ᒪᓕᒃᑕᐅᑲᐅᑎᒋᔭᐅᓚᖅᑐᑦ ᑲᑯᐃᑦ ᖃᓂᒋᔭᖏᑦᑎᒍᑦ ᐃᕙᑎᓪᓗᒋᑦ (ᔪᓚᐃᒥ ᐋᒋᓯᒧ) 95%-ᒥ 96%-ᒧ. 6-ᒋᓕᖅᑕᖓ ᐊᕐᕌᒍᑕᒫᒧᑦ, ᑎᖏᕐᓲᑦ ᖁᑎᖕᓂᖓ ᑎᑎᕋᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᕿᒥᕐᕈᔭᐅᓚᐅᖅᑐᑦ ᐱᖃᓯᐅᑎᓪᓗᒍ ᖃᖓᑕᓲᖅᑎᐅᑉ ᑎᑎᕋᖅᓯᒪᔭᖏᑦ ᓇᓗᓇᐃᖅᑲᐃᖃᕐᓂᖏᓐᓄᑦ ᐳᒃᑭᓂᓕᕇᑎᒍᑦ ᖃᖓᑕᓂᖏᓐᓄᑦ 2022-ᒥ. ᐳᒃᑭᓈᕐᓂᖏᑦ ᖃᖓᑕᑎᓪᓗᒋᑦ ᒪᓕᒋᐊᓕᖏᓐᓂᒃ "ᒪᓕᒋᐊᓖᑦ". ᐱᖃᓯᐅᑎᓯᒪᔪᑦ ᓯᓚ, ᐊᐅᓚᓂᕐᒧᑦ, ᖃᐅᔨᓴᕐᓂᕐᒧᑦ, ᐊᔾᔨᖅᓯᓂᕐᒧᑦ/ᐊᐃᑉᓯᕐᓂᕐᒧᑦ ᖃᐅᔨᓴᕈᑎᓂᒃ, ᐊᒻᒪᓗ ᖃᑎᑦᑐᒧᑦ ᖃᖓᑕᓂᐊᖅᑎᓪᓗᒋᑦ. ᖁᓕᒦ ᖃᖓᑕᔭᖏᑦ ᐳᖅᑐᓂᖏᑦ ᕿᒥᕐᕈᔭᐅᓯᒪᐃᓐᓇᖅᑐᑦ ᓈᒻᒪᒃᓯᕈᑎ ᐊᔾᔨᒌᖅᑎᑕᐅᓗᑎᓪᓗ.	ᓂᕆᐅᒋᔭᐅᓚᐅᖅᑐᑦ ᐃᓚᖏᑦ ᑲᒍᐃᑦ ᐃᓂᒋᖏᑦᑕᖓᓃᓪᓗᑎᒃ ᐱᔾᔪᑎᒋᓪᓗ ᐱᓕᕆᐊᖅ ᐱᓕᕆᐊᖑᑎᓪᓗᒋᑦ ᑭᓯᐊᓂᓕ ᖃᓂᒋᔭᖏᓐᓇᓚᔪᒃᓗᑎᒃ, ᐅᓚᕕᑕᐅᓇᖏᓐᓂᖓᓄᑦ. ᐅᓄᖏᓐᓂᖅᓴᐃᑦ ᑲᒍᐃᑦ ᓇᓗᓇᐃᖅᑕᐅᓚᐅᖅᑐᑦ ᖁᓕᒥᒍᑦ ᖃᓘᒍᑕᐅᓪᓗᑎᒃ ᐊᒻᒪᓗ ᓇᓃᖏᓐᓂᖏᓄᑦ ᓯᓚᑖᓂ ᑭᒡᓕᐅᔩᑉ ᐊᒃᑐᐊᓂᖓᓄᑦ, ᑭᒡᓕᖃᖅᑎᑕᐅᓪᓗᑎᒃ ᐊᒃᑐᐃᓗᐊᖅᑕᐃᓕᑎᑦᑎᓪᓗᑎᒃ. ᑕᐃᒪᐃᓄ, ᐅᓚᕕᓴᐅᑎᐅᔪᑦ ᐊᒃᑐᐊᓂᖃᖅᑐᑦ ᐱᕚᓕᐊᕝᕕᐅᑐᐃᓐᓇᕆᐊᓕᖕᓄᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᕐᕕᐅᔪᓄᑦ ᐊᕆᒡᓕᒥᐊᖅᑕᐅᓚᐅᖅᑐᑦ ᓂᕆᐅᒋᔭᐅᓚᐅᖅᑎᒃ ᐃᒃᐱᓐᓂᐊᓂᕐᒧᑦ ᐅᓚᕕᓴᐅᑐᐃᓐᓇᕆᐊᖃᕐᓂᖏᓐᓄᑦ, ᑭᓯᐊᓂᓕ ᓴᖅᑮᓚᐅᖏᑦᑐᑦ ᐊᒃᑐᐃᔾᔪᑎᓂᒃ ᑲᒍᐃᑦ ᐅᓄᕐᓂᓴᙱᓐᓂᒃ. ᑐᖁᔭᑕᐅᓯᒪᖏᑦᑐᑦ ᑎᖏᕐᓲᒃᑲᑕᖕᓂᖓᓄᑦ ᐊᒻᒪᓗ, ᑕᐃᒪᓗ, ᓂᕆᐅᒋᔭᐅᓚᐅᖅᑐᑦ ᐊᒃᑐᐃᔾᔪᑎᖃᕐᓇᖅᑐᐃᓐᓇᕐᓂᖏᓐᓂᑦ. ᒪᓕᑦᑎᐊᕐᓂᕐᒧᑦ ᖁᓕᒦ ᐳᕐᑐᓂᕐᒧᑦ ᐋᖅᑭᐊᖅᑕᐅᓚᐅᖅᑐᖅ 2022-ᒥ ᐃᓱᒪᕆᔭᐅᓗᑎᒃ ᖃᖓᑕᓲᖅᑎᐅᑉ ᐳᒃᑭᓈᕈᓇᕐᓂᖓ ᖃᖓᑕᑎᓪᓗᒋᑦ

[1] ᐱᓕᕆᐊᒥ ᒪᓕᒋᐊᖄᑦ ᐊᒻᒪᓗ ᐱᓕᕆᐊᒥ ᐱᓂᐊᕐᓂᕋᕈᑏᑦ ᒪᓕᒃᓱᒋᑦ ᓄᓇᕗᒥ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᑲᑎᒪᔩᑦ ᐅᔭᕋᖕᓂᐊᕈᓐᓇᐅᑎ ᓈᓴᐅᑖ 005 (ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦ 2014).

ᖃᐅᔨᓴᕐᓂᖅ	ᐱᔾᔪᑎᐊ ᖃᐅᔨᓴᕐᓂᖅ[1]	ᐱᐊᓂᒃᑕᐅᓯᒪᔪᑦ ᐊᒃᑐᐃᓂᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ, ᐊᒃᑐᐃᓗᐊᕐᔭᐃᒃᑯᑎᖃᕆᐊᖃᕐᓗᑎᒃ ᐊᒻᒪᓗ ᐊᑐᓕᖁᔭᐅᓯᒪᔪᑦ ᓯᕗᓂᑦᑎᓐᓂ.	ᖃᓄᖅ ᐋᖅᑭᒋᐊᕈᓐᓇᖅᐱᑕ ᐊᒃᑐᐃᓂᐅᔪᑦ ᐃᓱᒪᒋᔭᐅᔪᑦ[2]
			ᐊᒻᒪᓗ ᐃᑲᕐᕋᖕᒋᑦ ᖃᖓᑕᑎᓪᓗᒋᑦ ᑲᖑᖃᕐᕕᖕᓄᑦ ᐃᕚᕚᓪᓕᐊᓕᖅᑎᓪᓗᒋᑦ ᐃᕚᑎᓪᓗᒋᓪᓗ. ᑭᒡᓕᖃᖅᑎᑕᐅᓚᐅᖅᑐᑦ ᐊᑦᑎᓐᓂᕆᑦ ᖃᖓᑕᓂᐊᖅᑎᓪᓗᒋᑦ ᑲᖑᖃᕐᕖᖕᓄᑦ, ᒪᓕᒃᓱᒍ ᑭᖑᓪᓕᖅᐹᒥᑦ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐃᓂᐊᓂᐊᖅᑐᑦ ᐅᓂᒃᑳᕆᑦ ᑕᐃᒪᐃᓂᐊᕋᓱᒋᔭᐅᔪᑦ. ᑭᓯᐊᓂᓕ, ᐊᔪᕐᓇᕈᔪᐃᓐᓇᓚᐅᖅᑐᖅ ᖃᐅᔮᓴᐃᓐᓇᕐᓗᑎᒃ ᐊᒃᑐᐃᔾᔪᑎᐅᑐᐃᓐᓇᖃᐊᓖᒃ ᐊᒃᑎᓈᑎᓪᓗᒋᑦ ᖃᖓᑕᓗᑎᒃ ᑲᖑᖃᕐᕖᓐᓂᑦ ᐅᑀᕚᓘᓐᓃ ᐊᖅᑰᓵᖅᑕᐅᕙᒃᑐᓄᑦ ᑎᒥᒥᐊᓄᑦ ᐱᖃᓱᐅᑎᓇᔅᓂᖕᒋᓐᓄᓪᓗ ᐅᐸᒍᑎᔪᓐᓇᕐᓗᑎᒃ ᑲᖑᕐᓄᑦ ᐃᕙᕝᕕᐅᕙᒃᑐᒃᑯᑦ ᖁᓕᒥᔫᒃᑯᑦ, ᑖᓐᓇ ᐅᓚᕕᓴᐅᑎᐅᒻᒪᕆᙱᓐᖏᓐᓄᑦ. ᑐᖁᔭᖅᖃᖅᓯᒪᓕᕐᑦᑐᑦ ᑎᖕᒥᓲᖃᑲᑕᒃᑎᓪᓗᒍ ᑎᑎᕋᖅᑕᐅᓯᒪᔪᓂᑦ, ᒪᓕᑦᑎᐊᕐᓂᕐᒧᑦ ᐊᒃᑐᐃᔾᔪᑎᐅᓂᐊᕋᓱᒋᔭᐅᔪᓂᒃ.
ᓄᓇᓯᐅᑎᑦ ᐅᓯᑲᖅᑕᐅᑎᑦ ᐊᖅᑯᑎᖓ ᖃᐅᔨᓴᖅᑕᐅᓂᖓ	ᑐᕌᓚᓕ ᐆᒪᔪᓄᑦ ᐅᓚᕕᓴᐅᑏᑦ ᐊᒻᒪᓗ ᐃᑲᔫᑎᓂᒃ ᐱᑎᑦᑎᓗᑎᒃ ᑎᑎᕋᕐᑕᐅᕐᖓᖅᓯᒪᔪᓂᒃ ᐳᔪᕋᕐᓂ ᓯᐊᒻᒪᒃᑕᐅᓯᒪᔪᓄᑦ ᐱᓕᕆᐊᖅ.	ᐊᕐᕌᒍᑕᒫᑦ ᓇᐃᓈᖅᓯᒪᔪᖅ ᐃᖏᕐᕋᓂᐅᔪᓂᒃ ᖃᐅᔨᓴᐃᓂᕐᒥᒃ. ᖃᐅᔨᔭᐅᑲᐅᑎᒋᓯᒪᙵᕐᑦᑐᑦ ᓂᕈᐅᓇᙵᕐᑦᑐᑦ ᐊᒃᑐᐃᓂᐅᔪᑦ. ᐃᖏᕐᕋᔭᒃᑐᑦ ᐅᓄᕐᓂᖏᓐᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ ᑲᔪᓯᖃᑦᑕᕐᓂᐊᖅᑐᖅ	ᑐᑭᖃᕐᓂᖓᓄᑦ ᖃᐅᑕᒫ ᓄᓇᓯᐅᑎᒃᑯᑦ (ᐅᓯᑲᑦᑕᖅᑐᑦ ᐊᓯᖏᓕᓗ) ᐊᖅᑯᑎᑯᑖᒃᑯᑦ 2022-ᒥ 269.7 ᓄᓇᓯᐅᑏᑦ ᐃᖏᕐᕋᓚᐅᖅᑐᑦ ᐊᖅᑯᑎᒃᑯᑦ ᐊᑕᐅᓯᖅ ᐅᓪᓗᕐᒥᒃ. ᓈᓴᐅᑖ ᑐᑭᖃᖅᑐᖅ ᓴᕕᒃᓴᓂᑦ ᐊᑕᐅᓯᖅ ᐅᓪᓗᕐᒥᒃ ᐊᖅᑯᑎᑯᑖᒃᑯᖅᑐᑦ, ᔫᓄᐊᕆ 1-ᒥ ᑎᓯᐱᕆ 31, 2022-ᒥ, 243.6−ᖑᓚᐅᖅᑐᑦ, ᐅᓄᕐᓂᖅᓴᐅᓪᓗᑎᒃ ᑭᖑᓪᓕᖅᐹᒥᑦ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐃᓂᐊᓂᐊᖅᑐᑦ ᐅᓂᒃᑳᖅᑎᑦ ᓂᕈᐅᕆᔭᐅᔪᓂᒃ (236 ᓴᕕᒃᓴᓂᑦ ᐅᓯᔪᑦ) ᐊᓯᖏᑦ ᐃᖏᕐᕋᔪᑦ ᐊᓯᖏᓐᓂᒃ ᐱᔾᔪᑎᖃᖅᖢᑎᒃ 26.7−ᖑᓗᑎᒃ ᐊᑕᐅᓯᖅ ᐅᓪᓗᕐᒥᒃ.
ᐳᔪᕋᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᖕᒋᓇᕐᓂᕐᓂᖕᒋᓄᑦ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᖕᒋᓇᕐᓂᖅ	ᑲᒪᒋᔭᐅᕐᑯᓗᒋᑦ ᐱᕆᐊᒥ ᒪᓕᒋᐊᖓᑦ 36, 50, 54ᑭ, ᐊᒻᒪᓗ58ᑎ, ᐊᒻᒪᓗ ᐱᓕᕆᐊᒥ ᐱᓂᐊᕐᓂᕋᕈᑎ 60	ᐳᔪᕋᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᖕᒋᓇᕐᓂᖕᒋᓄᑦ ᖃᐅᔨᓴᐃᓇᕐᓂᖅ ᓇᓗᓇᐃᖅᓯᓯᒪᔪᖅ ᐃᓂᓂᒃ ᐳᔪᕋᖃᓗᐊᕐᓂᖕᒋᓄᑦ 1,000M−ᖑᓗᔪᒃᑐᑦ ᐱᓕᕆᕚᓪᓕᐊᔪᓂᒃ; ᖃᐅᔨᓴᕐᓂᐅᔪᖅ ᐳᔪᕋᑦ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᔪᑦ ᖃᐅᔨᓴᐃᓇᕐᓂᕐᒧᑦ ᓯᓚᑖᓂᒃ ᐱᓕᕆᕚᓪᓕᐊᕖᐅᔪᓂᒃ, ᐅᖓᓯᖕᓂᖃᕐᓗᓂ 5,000 ᒦᑕᓂᒃ ᓇᓗᓇᐃᖅᓯᓯᒪᓗᓂᓗ ᐳᔪᕋᑦ ᓯᐊᒻᒪᒃᐸᔪᑦ ᐳᔪᕋᖃᓗᐊᕐᒋᓐᓂᖅᓴᐅᓚᐳᖅᑐᖅ 2022-ᒥ. ᐊᔾᔨᒋᙱᑦᑕᖕᒋᓐᓂᒃ ᓇᓂᓯᔪᖃᓚᐅᕐᒥᖅᑐᑦ ᐳᔪᕋᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᑎᓪᓗᒍᑦ ᐳᖅᑐᓂᖃᕐᓂ 2.9 ᒦᑕᑦ ᐊᒻᒪᓗ 0.5ᒦᑕᒥᒃ.	ᐊᕐᕌᒍᑕᒪ ᑲᑎᕐᓗᒥ ᖃᖓᑦᑕᖅᑐᑦ ᒥᑭᑦᑑᑎᑦ ᐃᓱᒪᒋᔭᐅᓚᐅᖅᑐᑦ ᖁᑦᑎᓂᓂᕠᖕᓂᖕᒋᓄᑦ ᑎᑭᐅᑎᔪᓇᖅᑐᑦ 50 g/m²/ᐊᕐᕌᒍ ᒪᓕᒃᓱᑎ ᐱᓕᕆᕚᓪᓕᐊᔪᓂᒃ, ᐱᖃᓯᐅᑎᓗᒍ ᑲᑎᕐᓗᒥ ᓄᖃᖅᑎᑕᐅᓯᒪᔪᑦ ᐃᓚᐅᔾᔪᑎᓂᒃ ᒪᓕᖕᓕᕐᓗᑎᒃ ᐱᓕᕆᕚᓪᓕᐊᓂᐅᔪᒥᒃ ᓯᓚᑖᓂ. 2022−ᒥ ᐳᔪᕋᖅ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᔪᑦ ᖃᓄᐃᓕᖓᓂᕆᔭᖕᒋᑦ ᓂᕈᐅᕆᔭᐅᓚᐅᖅᑐᑦ ᐊᖏᔪᓂᒃ ᐳᔪᖃᒃᓄᑦ

ᖃᐅᔨᓴᕐᓂᖅ	ᐱᔾᔪᑎᐊ ᖃᐅᔨᓴᕐᓂᖅ[1]	ᐱᐊᓂᒃᑕᐅᓯᒪᔪᑦ ᐊᒃᑐᐃᓂᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ, ᐊᒃᑐᐃᓗᐊᔾᔭᐃᒃᑯᑎᖃᓇᐊᖃᕐᔪᑎᒃ ᐊᒻᒪᓗ ᐊᑐᓕᕐᑯᔭᐅᓯᒪᔪᑦ ᓱᕚᓂᑦᑎᓐᓂ.	ᖃᓄᖅ ᐋᖅᑭᒋᐊᕈᓐᓇᖅᐱᑕ ᐊᒃᑐᐃᓂᐅᔪᑦ ᐃᓱᒪᒋᔭᐅᔪᑦ[2]
		ᓱᕚᓂᑦᑎᓐᓂᒃ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᑲᔪᓯᓂᐊᖅᑐᖅ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᐳᔪᕋᑦ ᓯᐊᒻᒪᒃᐸᓪᓕᐊᑎᓪᓗᒍ 47-ᓂᒃ ᐃᓂᐅᔪᓂᒃ ᐊᐅᓚᐅᓂᐊᖅᑐᒥ ᐊᒻᒪᓗ ᐱᓕᕆᕕᐅᑐᐃᓐᓇᕆᐊᓕᖅᑭᓈᓄᑦ ᐊᕐᕌᒍ 26-ᓄᑦ ᐃᓃᑦ.	ᓯᐊᒻᒪᒃᑎᑦᑎᓗᑎᒃ ᑭᒡᓕᖃᓕᖅᑎᑕᐅᓗᓂ ᐱᓕᕆᐊᖑᕙᓪᓕᐊᔪᓂᒃ.
ᐱᕈᖅᑐᑦ ᐃᔾᔪᐃᓪᓗ ᓴᕙᕋᔭᖃᕐᓂᖅᑭᓈᓄᑦ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᖅ	ᑲᒪᒋᔭᓕᒃ ᐱᓕᕆᐊᒧᑦ ᒪᓕᒋᐊᓖᑦ 24, 36, 38 ᐊᒻᒪᓗ 50, ᐱᓕᕆᐊᒧᑦ ᐱᓕᕆᓂᐊᕐᓂᕋᕐᓂᖅ 60 ᐊᒻᒪᓗ 107	ᐃᔪᐃᑦ–ᓴᕙᕋᓕᒃ ᐊᒻᒪᓗ ᓂᕐᓇᑦ-ᓴᕙᕋᔭᓕᒃ ᐃᓚᐅᖅᑐᒐᖅᑭᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ 2022-ᒥ. ᖃᐅᔨᓴᕈᑕᐅᔪᑦ ᐱᓕᕆᐊᓂᒎᕙᓪᓕᐊᔪᓂᖔᖅᑐᑦ (ᖃᓂᒋᔭᖅᑭᓈᓂᒃ 0-100M, ᐅᖓᓯᖕᓂᖓᓄᑦ 100-1,100M ᐊᒻᒪᓗ ᖃᐅᔨᓴᕈᑏᑦ >1,000M) ᐃᔾᔪᕐᒥᒃ–ᓴᕙᕋᔭᓖᒃ ᐊᒻᒪᓗ ᓂᕐᓇᑦ-ᓴᕙᕋᔭᓖᑦ ᐃᓚᐅᖅᑐᒐᖅᑭᑦ ᐱᓕᕆᐊᒥᒃ ᓇᓗᓇᐃᖅᓯᓯᒪᒐᔪᒃᑐᑦ ᐅᓄᖅᓯᒋᐊᖅᑭᓈᓂᖓᓄᑦ ᑐᖓᕕᖅᑭᓈᓂᒃ ᐱᒪᕆᐅᑦᑎᔭᖅᑭᑦᑎᒍ. ᐃᓚᖅᑭᑦ ᐅᓄᕈᓐᓃᕆᐊᖅᑐᑦ ᐱᓗᐊᖅᑐᒥᒃ ᓱᕈᕐᓇᖅᑐᑦ ᐃᓱᒫᓘᑕᐅᔪᐃᑦ ᓇᓗᓇᐃᖅᑕᐅᓚᐅᖅᑐᑦ, ᐱᒻᒪᕆᐅᔪᐃᓪᓗ ᖁᑦᑎᓈᓂᖅᓴᓃᓚᐅᖅᑐᑦ ᓈᒻᒪᖕᓂᖓᓂᓄᑦ. 2022-ᒥ, ᕿᒥᕐᕈᔭᐅᔪᑦ ᐱᕈᖅᑐᓂᒃ ᐊᒻᒪᓗ ᐃᔾᔪᕐᓂᒃ ᓴᕙᕋᔭᓕᖕᓂᑦ ᕿᒥᕈᔭᐅᓯᒪᔪᑦ, ᐱᖃᓯᐅᑎᓯᒪᔪᑦ ᑭᖑᓂᐊᒧᑦ ᖃᓄᐃᓕᖓᓂᖅᑭᓈᓄᑦ ᑐᖓᕕᓕᖕᓂᑦ ᐊᒻᒪᓗ ᐱᒻᒪᕆᐅᓂᖅᑭᓈᓄᑦ. ᓇᓗᓇᐃᖓᒃᓴᖅ, ᑎᑎᕋᖅᑕᐅᕐᖓᖅᓯᒪᔪᑦ ᐱᓕᕆᔭᐅᓚᐅᖅᑐᑦ ᐃᓱᒪᒋᔭᐅᓪᓗᑎᒃ ᐱᕈᖅᑐᑦ ᐃᔾᔪᐃᓪᓗ ᓴᕙᕋᔭᖃᕐᓂᖅᑭᓈᓄᑦ ᑎᑎᕋᖅᑕᐅᕐᖓᖅᓯᒪᔪᑦ (2012–ᒥᓂ ᐅᓪᓗᒥᒧᑦ)	ᐃᔾᔪᖅ–ᓴᕙᕋᔭᓕᒃ ᓂᕐᓇᑦ-ᓴᕙᕋᔭᓕᒃ ᐃᓚᐅᖅᑐᒐᐃᖅ ᓴᖅᐱᓚᐅᕐᓂᖅᑭᓈᓄᑦ ᐊᑦᑕᕐᓇᓗᐊᖅᑭᕐᔪᓂ ᐊᕙᑎᒧᑦ ᐃᓄᖕᓄᓪᓗ ᖃᓄᐃᖅᑭᑦᑎᐊᕐᓂᕐᒧᑦ 2022-ᒥ
ᐊᐳᒥ ᑐᒥᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ	ᑐᕌᖓᔪᑦ ᐱᓕᕆᐊᒧᑦ ᒪᓕᒋᐊᓖᑦ 54dii ᐊᒻᒪᓗ ᑐᕌᖔᔪᖅ ᕿᑭᖅᑕᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᖕᓄᑦ ᐃᓱᒫᓘᑎᖅᑭᓈᓄᑦ ᐳᖅᑐᓂᖓᓄᑦ ᐊᐳᑏᑦ ᐊᒻᒪᓗ ᐊᒃᑐᐃᔾᔪᑏᑦᓄ ᓂᕐᔪᑎᓄᑦ.	ᑎᓴᒪᑦ ᐊᐳᑏᑦ ᑐᔾᔭᖅᑕᐅᔪᑦ ᖃᐅᔨᓴᕐᓂᒧᑦ ᐱᔭᕇᖅᑕᐅᓚᐅᖅᑐᖅ ᐱᖃᓯᐅᑎᓪᓗᓂ ᐊᖅᑯᑎᑯᑖ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᐊᐅᓚᓂᐅᔪᓂᒃ ᐊᒻᒪᓗ ᖃᓄᐃᓇᓂᖅᑭᓈᓄᑦ ᑐᒃᑐᐃᑦ ᕖᕗᐊᕆᒥ, ᒫᔾᔨ, ᐊᐃᕆᓕ, ᐅᑐᐱᕆ, ᐊᒻᒪᓗ ᓄᕖᐱᕆ 2022-ᒥ. ᑎᕆᒐᓂᐊ, ᐅᑲᓕᖅ, ᐊᕿᒡᒋᕐᓗ ᐆᒪᔪᓂᑐᐊ ᑕᑯᔭᐅᓚᐅᖅᑐᑦ 2022-ᒥ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ; ᑐᒃᑐᒥ ᑕᑯᔪᖃᖅᑭᓪᓗᓂ ᖃᓂᒋᔭᖓᓂ ᐅᕝᕙᓘᓐᓂ ᐊᖅᑯᑎᑯᑖᖅᑭᑦ 2020-ᒥ. ᐆᒪᔪᑦ ᓇᓗᓇᐃᖅᓯᖃᑦᑕᓚᐅᖅᑐᑦ ᐊᖅᑯᑎᓂᑦ ᑎᑎᕋᖅᑕᐅᓪᓗᑎᒃ ᓇᓃᓐᓂᖅᑭᓈᓂᒃ ᐃᓃᓪᓗ ᑕᑯᔭᐅᓯᒪᔪᑦ. ᐊᐳᑎᓂᒃ ᑐᒃᓯᕐᓂᖅ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᖅ ᑲᔪᓯᓂᐊᖅᑐᖅ 2023-ᒥ.	ᓂᕆᐅᒋᔭᐅᔪᑦ ᐅᓄᕈᓐᓃᕆᐊᕐᓂᖅᑭᓈᓄᑦ ᑐᒃᑐᐃᑦ ᐃᖅᑭᕋᓂᖅᑭᑦ ᐱᓕᕆᐊᑉ ᒪᑭᒪᔾᔪᑎᖅᑭᓈᓄᑦ ᐱᓕᕆᐊᒎᕙᓪᓕᐊᑎᓪᓗᒍᑦ, ᑭᓯᐊᓂᓕ ᓂᕆᐅᖅᑭᑦᑐᑦ ᐅᓄᕐᓂᖅᑭᓈᓄᑦ ᕿᑭᖅᑖᓗᑉ ᐅᐊᖓᓇᖓᓂ ᑐᒃᑐᐃᑦ ᐅᓄᕐᓂᖅᑭᑦ. ᑎᑎᕋᖅᑕᐅᕐᖓᖅᓯᒪᔪᑦ ᐊᐳᒥ ᑐᒃᓯᕐᓂᕐᒥᒃ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᐊᑐᓚᐅᖅᑐᑦ ᖃᐅᔨᓴᕈᑎᓂᒃ ᓂᕆᐅᒋᔭᐅᔪᓂᒃ ᖃᖓᒃᑯᑦ ᑐᒃᑐᐃᑦ ᐅᓄᕐᓂᖅᓴᐅᓇᔭᕐᓂᖅᑭᓈᓄᑦ ᐃᖅᑭᕋᓂᖅᑭᓂᓪᓗ ᐅᑎᖅᐸᓪᓕᐊᓪᓗᑎᒃ ᖃᐅᔨᓴᕐᕕᖕᓂᑦ ᐊᕕᒃᑐᖅᓯᒪᔪᓂ. ᐱᔾᔪᑎᒋᓪᓗᒍ ᑐᒃᑐᓂ ᑐᒥᓯᓚᐅᖅᑭᓂᖅᑭᓈᓄᑦ ᓇᓗᓇᐃᖅᓯᓚᐅᖅᑐᑦ ᐊᐳᒥ ᑐᒃᓯᕐᓂᖅ ᖃᐅᔨᓴᕐᓂᖅ 2022-ᒥ, ᓇᓗᓇᐃᖅᑕᐅᔪᓇᖅᑭᑦᑐᑦ ᐱᓕᕆᐊᒧᑦ ᒪᑭᒪᔾᔪᑎᓂᒃ ᐊᒃᑐᐃᓂᐅᒪᖔᒍ ᑐᒃᑐᐃᑦ ᐃᖅᑭᕋᓂᖅᑭᑦ.

ᖃᐅᔨᓴᕐᓂᖅ	ᐱᔾᔪᑎᐊ ᖃᐅᔨᓴᕐᓂᖅ[1]	ᐱᐊᓂᒃᑕᐅᓯᒪᔪᑦ ᐊᒃᑐᐃᓂᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ, ᐊᒃᑐᐃᓗᐊᔾᔭᐃᒃᑯᑎᖃᓐᓇᐊᖅᑲᕐᓂᒃ ᐊᒻᒪᓗ ᐊᑐᓕᕐᑯᔭᐅᓯᒪᔪᑦ ᓯᕗᓂᑦᑎᓐᓂ.	ᖃᓄᖅ ᐋᖅᑭᑦᐊᕈᓐᓇᖅᐱᑕ ᐊᒃᑐᐃᓂᐅᔪᑦ ᐃᓱᒪᕆᔭᐅᔪᑦ[2]
ᐊᐳᔭᕆᖕᓂᕐᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ	ᑲᒪᕆᔭᓕᒃ ᐱᓕᕆᐊᒧᑦ ᒪᓕᒋᐊᓖᑦ 53ai ᐊᒻᒪᓗ 53c ᑲᒪᕆᔭᓕᒃ ᕿᑭᖅᑕᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᒃ ᐃᓱᒫᓘᑎᖕᒋᓐᓄᑦ ᐊᐳᑎᐅᑉ ᐳᖅᑐᓂᖓᓄᑦ ᐊᒃᑐᐃᓂᐅᑐᐃᓐᓇᕆᐊᓖᓪᓗ ᓂᕈᐊᑎᓄᑦ.	ᐊᐳᑎᐅᑉ ᐳᖅᑐᓂᖓ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᖅ ᐱᓕᕆᔭᐅᖃᑦᑕᓗᐅᖅᑐᖅ ᑕᖅᑭᑕᒫ ᐅᕙᓘᓐᓃ ᒪᕐᕈᕐᓗᓂ ᑕᕿ ᔾᓄᐊᕆ 2022-ᒥ ᑎᓯᐱᕆ 2022-ᒧ ᒪᓕᒃᑯᒍ 1M–ᒥ ᐳᖅᑐᓂᖃᖅᑎᓪᓗᒍ. ᐊᐅᑦᑎᓂᕐᒧᑦ ᐊᐳᒻᒥ ᐳᖅᑐᓂᓕᕐᒥᑦ ᒪᓕᒃᑐᖅ . ᓂᕈᐊᑎᓂᒃ ᐊᖅᑯᓭᖅᐸᒃᑐᓄᑦ ᐃᖏᕐᕋᓂᐅᓚᐅᒃᑐᓂᓪᓗ ᐃᑳᐄᑎᐅᓪᓗᓂ ᒥᒃᓵᕆᐊᕈᑎᐅᓪᓗᓂᓪᓗ ᐅᒫᔪᑦ ᐃᖏᕐᕋᓂᖓᓄᑦ. ᓄᓇᐅᑉ ᐊᕙᑎᖓᓄᑦ ᑲᑎᒪᔨᐊᓛᒃᑯᑦ ᑐᒃᓯᕋᖅᑕᖏᑦ, ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᓇᓃᓐᓂᖓᓄᑦ ᑕᒫᖓᑐᐃᓐᓇᐅᓂᖏᓐᓂᒃ 2020–ᒥ. 2022-ᒥ, ᒪᓕᒃᑕᐅᓚᔪᓗᐅᖅᑐᑦ ᐊᐳᑦ ᐳᖅᑐᓂᖓ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ 91%–ᖑᓗᐅᖅᑐᖅ, ᐳᖅᑐᓂᖅᓴᐅᓪᓗᓂ 2021–ᒥ (90%). ᐃᓚᖏᓐᓂᒃ ᐃᓂᓂᑦ, ᐊᐳᑦ ᓇᓗᓇᐃᖅᑕᐅᔪᓇᓗᐅᖏᑦᑐᑦ ᓄᓇᐅᑉ ᖃᓄᐃᓕᖓᓂᖓᓄᑦ ᐅᕙᓘᓐᓃ ᐊᑦᑕᕐᓇᖅᑕᐃᓕᒪᓂᕐᒧᑦ ᑭᒡᓕᕆᔭᐅᔪᓄᑦ. ᐊᐳᑦ ᐳᖅᑐᓂᖓᓄᑦ ᖃᓄᐃᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᑲᔪᓯᓂᐊᖅᑐᖅ ᐅᑭᐅᖑᓂᐊᖅᑐᒥ 2023-ᒥ.	ᓂᕆᐅᒋᔭᐅᓚᐅᖅᑐᑦ ᐅᓄᕈᓐᓃᕆᐊᕐᓂᖓᓄᑦ ᑐᒃᑐᐃᑦ ᐃᖏᕐᕋᓂᖏᓐᓄᑦ ᐱᓕᕆᐊᒥᒃ ᒪᑭᒪᓖᔪᑎᓄᑦ ᐱᓕᕆᐊᖑᕙᓖᓕᐊᑎᓗᒍ. ᐱᔾᔪᑎᒋᓗᒍ ᓅᑦᑕᖅᐸᖕᓂᖏᓐᓄᑦ ᐊᖅᑯᑎᒃᑯᑦ (ᓲᕐᓗ, ᐊᐳᒻᒥ ᐊᐅᓚᓂᕐᒥᒃ, ᐊᐳᑎᑭᓐᓂᖓᓄᑦ), ᐊᖅᑯᑎᑯᑖᖕᒥᑦ ᓂᕆᐅᒋᔭᐅᓚᐅᖏᑦᑐᑦ ᐊᒃᑐᐃᔾᔪᑎᓄᑦ ᑐᒃᑐᐃᒃ ᐃᖏᕐᕋᓂᖏᓐᓄᑦ. ᑲᖏᑦᒋᔭᐅᓚᐅᖅᑐᑦ ᐅᓄᕈᓐᓃᕐᓂᕋᖅᑕᐅᓗᑎᒃ ᑐᒃᑐᐃᑦ ᐃᖏᕐᕋᓂᖏᓐᓄᑦ ᐱᓕᕆᐊᒥᖖᕋᓱᒋᔭᐅᓗᑎᒃ, ᐊᒻᒪᓗ ᓂᕆᐅᒋᔭᐅᔪᑦ ᐊᒃᑐᐃᔾᔪᑏᒃ ᐅᔾᔨᕐᓇᖅᑐᒃᑯᑦ ᕿᑭᖅᑖᓘᑉ ᐅᐊᖕᓇᖕᒐᓂ ᑐᒃᑐᐃᑦ ᐅᓄᕐᓂᖏᓐᓄᑦ. ᒪᓕᒋᐊᓖᒪᓇᑦ ᐊᐳᑦ ᐳᖅᑐᓂᖏᑦ ᒥᑭᓰᖑᓚᐅᖅᑐᑦ ᐊᖅᑯᑎᑰᑖ ᐊᐅᓚᓂᕆᔭᖏᑦᑎᒍᑦ ᑐᒃᑐᓄᑦ ᐃᖏᕐᕋᓂᕐᒧᑦ ᐊᓯᔾᔮᒍᑕᐅᑐᐃᓐᓇᕆᐊᓕᒃ. ᑭᓯᐊᓂᓕ, ᑕᒻᒪᖅᓯᒪᔪᓂᒃ ᖃᐅᔨᓴᕈᑎᕕᓂᖚᖅᑐᑦ ᖃᔅᓯᐅᓂᒃ ᐊᒃᑐᐃᔾᔪᑎᖃᑐᐃᓐᓇᕆᐊᓕᖏᓐᓄᑦ ᐊᒃᑐᐃᓗᐊᔾᔭᐃᒃᑯᑎᓂᒃ ᑐᒃᑐᓄᑦ ᐃᖏᕐᕋᓂᐅᔪᓂᑦ ᖃᔅᓯᐅᓂᖏᓐᓄᑦ. ᑐᒃᑐᐃᑦ ᖃᔅᓯᐅᓂᖏᑦ ᐅᓄᖅᓯᒋᐊᑐᑦ, ᓂᕆᐅᕆᔭᐅᔾᔪᑎᒋᑦᑎᒍᑦ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᑦᑎᒍ, ᐅᓄᖅᓯᒋᐊᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᐃᓇᕐᓂᕐᒥᒃ ᑐᒃᑐᐃᑦ ᐃᖏᕐᕋᓂᖏᑦ ᐊᖅᑯᑎᒃᑯᑦ ᐊᑐᓕᕐᑯᔭᐅᔪᑦ.
ᓇᓯᑦᑕᖅᑐᖃᑦᑕᕐᓂᒃᑯᑦ ᑐᒃᑐᓂᒃ ᖃᐅᔨᓴᕐᓃᑦ	ᑲᒪᒋᔭᖃᖅᑐᖅ ᐱᓕᕆᐊᒥᒃ ᒪᓕᒋᐊᓕᒃ 53a, 53b, 54b ᐊᒻᒪᓗ 58b	ᒪᕐᕈᒃ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᑕᐃᓅᒥᒃ ᐃᓂᑯᐊᐳᕆᒃ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᐱᓕᕆᔭᐅᓚᐅᖅᑐᑦ ᐳᖅᑐᔪᓂᒃ ᓄᓇᓂᒃ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᑐᒃᑐᐃᑦ ᓄᕆᐅᓕᖅᑎᓪᓗᒥᑦ (ᐱᒋᐊᓰᕐᓂᖓᓂᒃ ᔪᓂ 2022-ᒥ) ᑕᒪᐃᓐᓄ ᐳᖅᑐᔪᓂᒃ ᓄᓇᓂ ᖃᐅᔨᓴᕐᓂᕐᒥᒃᐃᓂᐅᔪᓂᒃ ᐅᕙᒃᑕᐅᓚᐅᖅᑐᖅ ᒪᕐᕈᐃᖅᑲᕐᓂᒃ. ᑲᑎᓪᓗᒃᑖᖅᑲᕐᒥᑦ ᖃᐅᔨᓴᕈᑏᑦ ᐃᑲᕐᕋᓂᒃ 36-ᖑᕗᑦ, ᖃᐅᔨᓴᕐᑎᓪᓗᒥᑦ ᐃᑲᕐᕋᒥᔭᐅᓚᔪᒃᑐᑦ 45 ᒥᓂᑦ. ᑐᒃᑐᓂ ᑕᑯᔪᖃᓚᐅᖏᑦᑐᑦ ᖃᐅᔨᓴᕐᓂᖅᑎᓪᓗᒍᑦ 2022-ᒥ. 2016-ᒥ, ᓄᓇᖑᐊᓕᕆᓂᖅ ᐱᔭᓇᖅᑕᐅᓗᐳᖅᑐᖅ ᐋᖅᑭᒃᓯᒪᓂᖓᓄᑦ ᐊᖏᓪᓕᒋᐊᕐᓗᒍ ᖃᐅᔨᓴᕐᕕᐅᔪᑦ ᖃᐅᔨᓴᕐᓂᖅᑎᓪᓗᒍᑦ ᓄᓇᓂᒃ ᐳᖅᑐᓕᖏᓂᑦ. 2016-ᒥ ᖃᐅᔨᓴᕐᓂᕕᓃᒃ ᑲᔪᓯᔪᖅ ᐊᕐᕌᒍᑕᖅᓯᐅᑎᓄᑦ ᓄᕐᓇᐅᖅᑎᓪᓗᒥᑦ. 2022-ᒥ ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᐃᓚᓕᐅᑎᒃᑲᓂᖅᑐᑦ	ᓂᕆᐅᒋᔭᐅᓚᐅᖅᑐᑦ ᐃᓚᖏᑦ ᓇᔪᕐᕕᐅᔪᓂᒃ ᐊᓯᐅᔨᓂᐊᕋᓱᒋᓇᐃᓪᓗᑎᒃ ᑐᒃᑐᓄᑦ ᐃᒃᐱᖕᓂᐊᓂᕐᒧᑦ ᐅᓚᕕᓴᐅᑕᐅᑐᐃᓐᓇᐊᖃᕐᓂᖓᓄᑦ ᐊᒻᒪᓗ ᐳᔪᖃᓕᕐᓂᕐᒧᑦ, ᐅᓄᕈᓐᓃᕆᐊᕈᑎᐅᓪᓗᑎᒃ ᓇᔪᕐᕕᖕᓂᑦ ᑭᒡᓕᓂ ᐊᒃᑐᐃᓂᐅᔪᓂᑦ. ᑭᓯᐊᓂᓕ, ᓇᔪᕐᕕᐅᕙᒃᑐᑦ ᐊᒃᑐᐃᓂᐅᑐᐃᓐᓇᕆᐊᓕᖕᓂᑦ ᒥᑭᔅᓴᐅᓇᒃᑕᐅᓚᐅᖅᑐᑦ ᐅᓄᕈᓐᓃᕐᓗᑎᒃ 2.00% ᐊᒻᒪᓗ 4.25%-ᒥ. ᐃᓚᖏ ᐅᓚᕕᓴᐅᑕᐅᔪᑦ (ᓲᕐᓗ, ᐃᖏᕐᕋᓂᕐᓄᑦ) ᕿᓚᒥᐅᔪᒃᑯᑦ ᐊᒻᒪᓗ ᑐᒃᑐᐃ ᐅᐃᓇᓯᒪᓕᑐᐃᓐᓇᕆᐊᓕᖕᓄᑦ ᐅᓚᕕᓴᐅᑎᓄᑦ, ᑖᓐᓇ ᑭᒡᓕᖃᓕᑐᐃᓐᓇᕆᐊᓕᒃ ᐊᒃᑐᐃᔾᔪᑎᓄᑦ. ᐊᒥᓱᐃᑦ ᓄᕐᓇᐅᕕᖃᒃᑲᓂᑐᐃᓐᓇᕆᐊᓕᒃ ᐃᓂᐅᔪᓂᒃ ᐊᒻᒪᓗ ᓯᓚᑖᓂ ᑭᒡᓕᐅᔪᑦ ᐊᒃᑐᐃᓂᐅᑐᐃᓐᓇᕆᐊᓕᖕᓄᑦ.

ᖃᐅᔨᓴᕐᓂᖅ	ᐱᔾᔪᑎᐊ ᖃᐅᔨᓴᕐᓂᖅ[1]	ᐱᐊᓂᒃᑕᐅᓯᒪᔪᑦ ᐊᒃᑐᐃᓂᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ, ᐊᒃᑐᐃᒧᐊᔾᔭᐃᒃᑯᑎᖃᓕᐊᖃᕐᓗᑎᒃ ᐊᒻᒪᓗ ᐊᑐᓕᕐᑯᔭᐅᓯᒪᔪᑦ ᓯᕗᓂᑦᑎᓐᓂ.	ᖃᓄᖅ ᐋᖅᑭᒋᐊᕈᓐᓇᖅᐱᑕ ᐊᒃᑐᐃᓂᐅᔪᑦ ᐃᓱᒪᒋᔭᐅᔪᑦ[2]
		ᖃᐅᔨᓴᕐᕕᖕᓂᑦ ᖃᐅᔨᓴᕈᑕᐅᑐᐃᓐᓇᕆᐊᓕᖕᓂᑦ ᓄᓇᓂ ᐳᖅᑐᔪᓂᒃ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ. 12 ᐃᓂᐅᔪᓂᒃ ᐊᔾᔨᓕᐅᕈᑎᓂᒃ ᐃᓕᓯᒪᐅᖅᑐᑦ 2021-ᒥ, 6 ᓄᓇᓂ ᐳᖅᑐᓕᖕᒥᑦ ᐃᓂᐅᔪᓂᒃ, ᐊᒻᒪᓗ ᓂᐱᓕᐅᕈᑎᓂᒃ ᐊᔾᔨᖑᐊᖃᖕᒋᕐᓗᑎᒃ ᑐᒃᑐᓂᑦ ᐅᑐᐱᕆ 2021-ᒥ ᐊᒻᒪᓗ ᔫᓂ 2022–ᒥ.	ᓂᕆᐅᒋᔭᐅᓪᓗᐅᖅᑐᑦ ᑐᑦᕆᖓᖕᒋᑦᑐᑦ ᓇᔪᕐᕕᐅᔪᓂᒃ ᓇᔪᕐᕕᖃᕈᓐᓃᕐᓗᑎᒃ ᓯᓚᐅᑉ ᐊᐅᓚᓂᖓᓄᑦ ᐊᒻᒪᓗ ᐊᓯᔾᔨᖕᒋᒃᑭᓪᓗᓂ ᕿᑭᖅᑖᔫᑉ ᐅᐊᖕᓇᖓᓂ ᑐᒃᑐᐃᑦ ᐅᓄᕐᓂᖕᒋᓐᓄᑦ. ᐅᓪᓗᒥᒧᑦ, ᐊᓯᔾᔩᔪᓂᒃ ᑐᒃᑐᓂᑦ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᓄᓇᒥ ᐳᖅᑐᓂᓕᖕᒥᑦ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᖃᐅᔨᓴᕈᑎᖃᕐᓇᐊᖃᕐᓂᖕᒋᓐᓄᑦ ᐱᓕᕆᐊᒧᑦ ᐊᒃᑐᐃᔾᔪᑎᑦ ᑐᒃᑐᓄᑦ ᖃᓄᐃᓕᐅᕈᓯᖕᒋᓐᓄᑦ ᓇᔪᕐᕕᒋᔭᖕᒋᓐᓄᓪᓗᓐᓂ ᓇᔪᕐᕕᐅᕙᒃᑐᓂᓪᓗ.
ᐊᖑᓇᓱᒃᑏᑦ ᐊᒻᒪᓗ ᐳᓚᕐᑐᑦᓄᑦ ᑎᑎᕋᖅᑕᐅᕙᓪᓕᐊᔪᖅ	ᑲᒪᒋᔭᖅᑐᖅ ᐱᓕᕆᐊᒥ ᒪᓕᒃᑕᐅᔭᕆᐊᓕᒃ 54ᒥ	ᒪᓕᒋᐊᓕᖅ ᓃᕆᑦᑐᑦ ᑭᓯᐊᓂᓕ ᐸᕙᓖᓐᑯᑦ ᒪᓕᒋᐊᖃᕐᑐᖃᓕᕈᑎᒃ, ᐳᓛᑦᑐᑦ ᐃᓂᓄᑦ ᖃᐅᔨᒋᐊᕐᓗᑎᒃ ᐸᕙᓖᓐᑯ ᖃᐅᔨᓴᕐᑎᖓᓄᑦ. 2022-ᒥ, ᑲᑎᓗᒃᑖᕐᓗᒋᑦ 541 ᐊᑐᓂᒃ ᐅᐸᕐᓯᒪᔪᑦ ᐅᕝᕙᓘᓐᓃ ᐅᔾᕋᖕᓂᐊᕐᕕᖕᒧᑦ ᐅᕝᕙᓘᓐᓃ ᕿᖕᒍᐊᓄᑦ ᐃᓂᓄᐊᕐᓯᒪᔪᑦ. ᐊᖑᓇᓱᒋᐊᕐᑐᑦ ᐳᓛᕆᐊᕐᓯᒪᔪᓗ ᓇᐃᓈᕐᓯᒪᑎᑕᐅᔪᑦ ᑲᔪᓯᒪᔪᑦ ᐃᓅᓯᓗᒃᑖᒃᑯᑦ ᐱᓕᕆᐊᖑᓂᐊᕐᑎᓗᒍᑦ.	ᐱᓕᕆᐊᖑᓂᕐᒧᑦ ᐊᒃᑐᐊᔪᑦ ᑲᑎᙵᑐᐃᓐᓇᕆᐊᓖᑦ ᓄᓇᒧᑦ ᐱᓕᕆᐊᓂᑦ, ᐊᖑᓇᖕᓂᕐᒧᑦ, ᓅᑦᑕᕐᓂᕐᒧᑦ, ᐊᐅᓛᓂᕐᒧᓗ, ᐊᒃᑐᐃᓂᐅᑐᐃᓐᓇᕆᐊᓕᖕᓂᑦ ᓂᕆᐅᒋᔭᐅᔪᑦ ᐊᓯᔾᔩᔪᒃᑳᖅᑎᑦᑐᖅ. ᑭᓯᐊᓂ 2020-ᒥ ᐊᒻᒪᓗ ᑮᓕᖅᑎᑕᐅᓂᖏᓄᑦ ᐱᓕᕆᐊᓂᑦ ᐱᔾᔪᑎᒋᓗ ᓄᕙᒡᔪᐊᕐᓇ ᑲᔪᓯᓚᐅᕐᑐᓗᒍ 2021-ᒧ, ᐊᖑᓇᓱᒃᑏᑦ ᐳᓛᕆᐊᕐᑐᑦ ᐅᓄᕐᓯᒋᐊᕐᐸᓪᓕᐊᔪᑦ 2017-ᒥᓂᒃ ᓈᓴᐅᑎᖏᑦ, ᐱᖃᓯᐅᑎᓗᒋᑦ ᖃᔅᓯᐅᓂᖏᑦ ᐊᖑᓇᓱᒋᐊᕐᑐᑦ ᐊᒻᒪᓗ ᐊᐅᓛᕆᐊᕐᓯᒪᔪᓄᑦ. 2022-ᖑᑎᓗᒍ, ᓈᓴᐅᑏᑦ ᐅᓄᕐᓯᒋᐊᕐᑐᑦ, ᐊᔾᔨᐸᓗᖏᑦ ᑕᑯᔭᐅᓯᒪᔪᑦ 2018-ᒥ.
ᑎᑭᐸᒃᑐᑦ ᑎᖕᒥᐊᑦ ᐃᕙᕝᕕᖕᒋᓐᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ	ᑲᒪᒋᔭᓕᒃ ᐱᓕᕆᐊᒧᑦ ᒪᓕᒋᐊᓖᑦ 66 ᐊᒻᒪᓗ 70	2022-ᒥ, ᒥᒃᓴᐅᓴᒃᑕᐅᓯᒪᔪᑦ 512 m² (0.05 ha) ᓄᓇᐅᑉ ᐋᕿᒋᐊᕐᓂᖓ ᐱᓕᕆᐊᒧᑦ ᒪᑭᒪᔾᔪᑎᓂᒃ. ᑖᓇ ᐃᓂᐅᔪᖅ, ᑕᒪᐃᓐᓄ ᐋᕿᒋᐊᕈᑎᖕᒋᑦ ᓯᓚᑖᓄᑦ ᑎᖕᒥᐊᖃᐅᓕᕐᐸᓪᓕᐊᓂᕐᒧᑦ ᑕᒃᑯᓴᐅᔪᖅ. (ᐊᐅᒡᒍᓯ 20ᒥ ᒪᐃ 16ᒧᑦ) ᑎᖕᒥᐊᑦ ᐃᕐᓂᐅᓕᖅᑎᓗᒋᑦ (ᒪᐃ 17ᒥᑦ ᐊᐅᒡᒍᓯ 19) ᓄᓇᒥᑦ ᐊᑐᕈᓐᓂᓚᐅᖕᒋᑦᑐ, ᑎᑭᐸᒃᑐᑦ ᑎᖕᒥᐊᑦ ᐃᕙᕝᕕᖕᒋᓐᓂᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐱᐊᓂᒃᑕᐅᓚᐅᖅᑐ ᐊᒻᒪᓗ ᐃᕙᕝᕕᒃᓯᐊᓚᐅᖕᒋᑦᑐ. ᖃᐅᔨᓴᕐᓂ ᑲᔪᓲᓐᓇᕐᓂᐊᖅᑐ ᖃᙳᑐᐃᓐᓇᒃᑯ ᐱᕈᖅᑐᑦ ᖃᐅᔨᓴᖅᑕᐅᓕᕋᖕᒪᒥ ᐊᒻᒪᓗ ᑎᖕᒥᐊᑦ ᐃᕐᓂᐊᓕᕋᖕᒪᒥ.	ᒥᒃᓵᒋᐊᕐᓗᒍ ᐱᓕᕆᐊᐸ ᐱᓕᕆᔾᔪᑎᑲᓂᖕᒋᑦ, ᖃᐅᔨᓴᕈᑏᑦ ᓅᑦᑕᖅᐸᒃᑐᓄᑦ ᑎᖕᒥᐊᓂ ᐃᕙᕝᕕᐅᕙᒃᑐᓂᒃ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ, ᒪᓕᖁᔭᐅᓯᒪᔪᑦ ᐃᕙᕝᕕᖕᓂᑦ ᐊᐅᓚᓂᖃᕐᓗᑎᒃ ᐸᕐᓇᐅᑎᓂᒃ, ᓂᕆᐅᒋᔭᐅᔪᑦ ᐱᓕᕆᐊᒧᑦ ᐊᒃᑐᐃᔾᔨᑏᑦ ᐃᕙᑎᓗᒋᑦ ᑎᖕᒥᐊᑦ ᐊᑦᑎᓇᓂᖕᓴᐅᓗᓂ ᐱᑕᖃᖕᒋᑦᑐᒧᑦ.
ᓂᖕᔪᑎᓂᒃ ᑐᑯᖃᑦᑕᐅᑎᖃᑦᑕᕐᓂᖅ ᐊᒻᒪᓗ ᑐᕐᑯᔪᑦ	ᑲᒪᒋᔭᓕᒃ ᐱᓕᕆᐊᒧᑦ ᒪᓕᒋᐊᓕᖕᓄᑦ 53a, 53b, ᐊᒻᒪᓗ ,57d	ᐊᖅᑯᓯᕐᓃᑦ ᐅᕝᕙᓘᓐᓃ ᑐᕐᑯᖕᒐᔪᓄᑦ ᐅᒪᔪᓂᒃ ᐱᓕᕆᐊᑉ ᖃᓂᒋᔭᖕᒋᓐᓂᒃ ᐅᓂᒃᑲᐅᓯᖃᑦᑕᖅᑐᑦ ᖃᐅᔨᓴᖅᑕᐅᕙᒃᑐᑎᓗ ᐊᕐᕋᒍᓕᒫ. ᐊᔪᕐᓇᖕᒋᒃᑯᓂ, ᐊᒃᑐᐃᓗᐊᔾᔭᐃᒃᑯᑏᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᐊᑐᓕᕐᑯᔭᐅᓯᒪᔪᑦ ᒥᒃᓵᒋᐊᖅᑎᑦᑎᓗᓂ ᓯᕗᓂᑦᑎᓐᓂᒃ ᐊᖅᑯᓯᖅᐸᓐᓂᕐᒧᑦ ᓂᕐᔪᑎᓂᒃ ᑐᕐᑯᖕᒐᔪᓂᓗ.2022-ᒥ, 15 ᐊᑐᓂ ᓂᕐᔪᑏᑦ ᑐᕐᑯᖕᒐᔪᑦ ᑕᑯᔭᐅᔪᑦ ᐅᓂᒃᑲᐅᓯᐅᓯᒪᔪᖅ ᐱᖃᓯᐅᑎᓗᒍ	ᓂᕆᐅᒋᔭᐅᔪᑦ ᑐᕌᖕᒐᔪᖅ ᓂᕐᔪᑎᓂᒃ ᑐᕐᑯᖕᒐᔪᓄᑦ ᐱᓕᕆᐊᒧᑦ ᐊᒃᑐᐊᔪᑦ ᐱᓕᕆᓂᖅᑕᖅᑎᓗᒍ ᐅᓄᖕᒋᓐᓂᖅᓴᐅᓗᑎᒃ ᐱᑕᖅᖕᒋᓗᓂᓗᓐᓃ, ᓂᕿᑐᖅᑏᑦ, ᑎᖕᒥᐊᑦ, ᑐᒃᑐᑦ ᐊᒻᒪᓗ ᐆᒪᔪᑦ. ᑐᕐᑯᖕᒐᔪᓗᒃᑖᑦ ᑕᑯᔭᐅᔪᑦ ᓂᕆᐅᒋᔭᐅᓚᐅᖅᑐᑦ ᐱᔾᔪᑎᒋᓗᓂᔾᔪ ᒥᒃᑭᑦᑐᒥᑦ ᐅᓄᕈᓃᕐᓇᐊᕐᓗᑎᒃ.

ᖃᐅᔨᓴᕐᓂᖅ	ᐱᔾᔪᑎᐊ ᖃᐅᔨᓴᕐᓂᖅ[1]	**ᐱᐊᓂᒃᑕᐅᓯᒪᔪᑦ ᐊᒃᑐᐃᓂᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ, ᐊᒃᑐᐃᒍᐊᔾᔭᐃᒃᑯᑎᖃᕆᐊᖃᕐᓂᒃ ᐊᒻᒪᓗ ᐊᑐᕆᕐᑯᔭᐅᓯᒪᔪᑦ ᓯᕗᓂᑦᑎᓐᓂ.**	**ᖃᓄᖅ ᐋᖅᑭᒋᐊᕈᓐᓇᖅᐱᑕ ᐊᒃᑐᐃᓂᐅᔪᑦ ᐃᓱᒪᒋᔭᐅᔪᑦ[2]**
		ᑕᓪᓚᒦᑦ ᐊᔾᔨᒌᖕᒋᑦᑐᑦ ᐆᒪᔪᑦ. ᓂᕈᐋᑦ ᑐᕐᑯᖓᔪᑦ ᐃᓚᓕᐅᑎᔪᖅ 11 ᑎᓇᒐᓂᐊᖅ, ᐅᖃᓕᖅ, ᕐᑯᐸᓄᐊ, ᑎᓇᐊᖅ ᐊᒻᒪᓗ ᐊᕿᒡᒋᖅ. ᐹᕙᓖᓐ ᑲᔪᓯᔪᑦ ᐊᒃᑐᐃᓂᐅᓗᐊᖅᑕᐃᓕᒫᔪᑎᓄᑦ ᐆᒪᔪᓂᒃ ᐊᖅᑯᓈᖅᓯᓂᕐᒧᑦ ᐱᓕᕆᐊᑉ ᖃᓂᒋᔭᖕᖓᑦᑎᒍᑦ ᐃᖕᒋᕐᕋᔾᔪᑎᓄᑦ, ᐅᐸᒍᑎᒧᑦ, ᐊᒻᒪᓗ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᐃᒋᑦᑎᓂᕐᒧᑦ ᐊᐅᓚᓂᖃᕈᓐᓇᕐᓂᕐᒥᒃ ᒪᓕᒋᐊᓕᖕᓂᓪᓗ. ᐆᒪᔪᑦ ᐊᖅᑰᖅᑐᑦ ᑐᕐᑯᖓᔫᓪᓗ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᑲᔪᓯᓂᐊᖅᑐᖅ 2022-ᒥ	ᐆᒪᔪᑦ ᑐᕐᑯᖓᒧᑦ 2022-ᒥ ᐊᑐᓂ ᑕᒪᐃᓐᓄ ᐊᓯᐅᓯᒪᔪᑦ ᐊᒻᒪᓗ ᐊᒃᑐᐃᓂᐅᔫᖕᒋᑦᑐᑦ ᐆᒪᔪᓄᑦᑖ ᐊᑦᑕᕐᓇᕈᑕᐅᔾᔫᖕᒋᑦᑐᑦ. ᑕᐃᒫ, ᐆᒪᔪᑦ ᑐᕐᑯᖓᔪᑦ ᐅᓄᖕᒋᓐᓂᖅᓴᐅᓗᑎᒃ ᒥᒃᑭᓪᓕᒋᐊᕐᓗᑎᒃ ᐅᓄᕐᓂᖕᒋᑦ, ᐊᒃᑐᐃᓂᐅᑐᐃᓐᓇᖃᐊᖃᕋᓱᕆᔭᐅᔪᑦ. 2022-ᒥ ᑐᕐᑯᖓᔪᑦ ᑲᑎᓗᒃᑖᖅᑯᒋᑦ ᐊᔾᔨᒌᖕᒋᓐᓂᖕᒋᑦ ᐋᖅᑭᑕᐅᓪᓗᑎᒃ ᑐᕐᑯᔪᕖᓃᑦ, 2015-ᒥ ᒥᑭᓐᓂᖅᓴᐅᔪᑦ (ᑕᓪᓚᒦᑦ) ᐊᒻᒪᓗ 2016-ᒥ ᑎᑎᕋᖅᑕᐅᔪᑦ ᐅᓄᕐᓂᖅᓴᐅᓪᓗᑎᒃ (25) ᓈᓴᐅᑎᖕᒋᑦ ᑐᕐᑯᖓᔪᑦ.

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.

In 2022, Baffinland hauled roughly 5.7 million tonne (mt) of iron ore from the Mine Site to the Milne Port stockpile and shipped 4.7 mt of iron ore out of Milne Port. Construction in 2022 was limited to continued development and construction of infrastructure and laydowns required at the Mine Site and Milne Port to support operations for additional supplies and equipment occurred. At the end of 2022, the total project footprint was 605 ha.

The Nunavut Impact Review Board Project Certificate No. 005 includes numerous conditions that require Baffinland Iron Mines Corporation (Baffinland) to conduct effects monitoring for the terrestrial environment. Work performed for the Terrestrial Environment Monitoring Program is guided by the Terrestrial Environment Mitigation and Monitoring Plan (Baffinland Iron Mines Corporation 2016a). It is overseen by the Terrestrial Environment Working Group (TEWG), including members from Baffinland, the Qikiqtani Inuit Association (QIA), the Government of Nunavut, Environment and Climate Change Canada, and the Mittimatalik Hunters and Trappers Organization. An additional four Hunter Trapper Organizations (Ikahutit Hunters and Trappers Association, Nangmautuq Hunters and Trappers Association, Igloolik Hunters and Trappers Organization, Hall Beach Hunters and Trappers Organization) were included as of February 2023 and can obtain TEWG member status if they elect to participate. The Terrestrial Environment Monitoring Program began in 2012 and continued through 2022 with adaptations to the program based on results and input from the TEWG. This report summarizes the data collection and monitoring programs conducted in 2022 for the Project, including the following components (summaries provided in Table 0):

- weather monitoring;
- helicopter flight height analysis;
- passive dustfall monitoring;
- dustfall extent imagery analysis;
- noise monitoring;
- vegetation and soil base metals monitoring;
- snow track surveys;
- snowbank height monitoring;
- Height of Land (HOL) caribou surveys;
- remote camera monitoring;
- hunter and visitor log summaries;
- Active Migratory Bird Nest Surveys; and,
- wildlife interactions and mortalities.

Inuit Participation — In 2022, territorial and site restrictions associated with the COVID pandemic were lifted. Four Inuit field assistants assisted with HOL caribou surveys and/or soil, vegetation, or noise monitoring for 415 hours during the 2022 field season.

Climate — Weather conditions in 2022 were summarized and compared to average conditions from previous years. Notable trends included warmer weather in summer months during 2022 compared to baseline, while wind speeds and precipitation remained consistent with baseline years.

Helicopter Overflights — The helicopter flight height analysis monitors potential disturbance to birds and other wildlife within the Regional Study Area and designated Snow Goose area. In 2022, overflight analysis was the sixth consecutive year in which additional analysis (i.e., accounting for pilot rationale) was performed. Notably, categorization of flights as 'compliant with rationale' represented 53.5% of the total flight hours evaluated in the analysis. Upon closer evaluation of pilot rationale for low-level flying (e.g., slinging, pickups/drop-offs, weather), most low-level flight segments were flown along defined flight corridors, with 61.6% flown over the Potential Development Area (PDA). Overall compliance increased in 2022 (42.22%) compared to 2021 (33.92%), with the highest percentage of compliant flight hours since 2016.

Tote Road Traffic — The mean daily total vehicle transits (haul and other) on the Tote Road in 2022 was 269.7 vehicle transits per day. The mean number of ore haul transits per day on the Tote Road, from January 1 to December 31, 2022, was 243.6, slightly above the Final Environmental Impact Statement (FEIS) addendum predictions. Other vehicle traffic (i.e., transport of personnel and supplies) had an annual mean of 26.7 vehicle transits per day.

Noise — Noise monitoring was conducted in the summer of 2022 to verify background sound levels and sound associated with the Project's ground operations, for comparison with the analysis presented in the FEIS and the guideline criteria adopted from D038. At the Mine Site and Milne Port, average sound levels at 1.5 km from the PDA were at or below the levels predicted in the FEIS (40 DBA). Along the Tote Road (1.5 km, 3 km, and 6 km distances), sound levels were consistently higher than modelled in the FEIS. This is likely due to the higher truck traffic levels than initially considered. Overall, it is probable that in most areas, the impacts of noise by the Project have remained in compliance with the criteria presented in the FEIS.

Dustfall — The 2022 passive dustfall monitoring program used 53 passive dustfall collectors to measure dust deposition related to Project activities. Twenty-six collectors are sampled monthly, while the rest are sampled during summer months only. The magnitude of annual dustfall at the Mine Site sample locations in 2022 was elevated in comparison with recent years. In 2022, the highest dustfall at the Mine Site area was associated with the airstrip and the Tote Road. The magnitude of dustfall at Milne Port has remained constant, or in some cases has slightly decreased, a trend that began in 2018. Along the Tote Road, dustfall in 2022 was consistent at the north crossing location when compared with recent years. However, increased dustfall was noted at the South Crossing. Dustfall extent was also characterized by examining satellite images. This analysis was done to verify Inuit land users' reports of seeing dust beyond what was predicted in baseline dust modelling, and a visual representation of the extent of dustfall in areas where it is below detection in dust collectors. The pattern of dustfall extent on the landscape was similar from 2014 to 2022 for all areas, with the highest concentrations near the Project and dustfall extending northeast along Milne Inlet, west and south of the Mine Site, and southwest of the South Crossing (KM78) in the direction of prevailing and/or strong winds. Baffinland uses numerous site-wide dust suppression measures to reduce these emissions, including water and calcium chloride on roads, continued use of shrouds and coverings on ore crushers, and improved methods of transferring ore onto stockpiles. DustBlockr® was applied to the entire Tote Road in the summer of 2022. Continued use of dust suppressant, DusTreat, was applied to ore stockpiles regularly in 2022. DusTreat is a non-toxic, water-based, and long-lasting suppressant that acts as a sealant on the stockpiles to prevent dust and is planned to be applied more frequently to stockpiles at Milne Port.

Vegetation — The vegetation monitoring program in 2022 focused on monitoring of base metals —namely Contaminants of Potential Concern (CoPCs)— in soil and vegetation (i.e., lichen). Soil-metal concentrations at the Project predominantly indicated no significant change or were significantly lower in relation to baseline values across all Project areas and sample distances. Many mean lichen-metals concentrations across Project areas and sample distances showed no significant changes in relation to baseline values. However, discrete increases in CoPCs in soil (i.e., copper, zinc) and lichen (i.e., arsenic, cadmium, copper, lead, selenium) were recorded at the Mine Site, Milne Port and along the Tote Road, with some individual values at or above indicator values. Indicator values where established as early values of potential changes in vegetation health. Whereas some increases and exceedances were attributed to occasional 'spikes' in metal concentration and sample variability, other CoPC increases appeared to be due to proximity to Project operations. Should these values continue to increase or result in continued (year-over-year) exceedances of threshold values, it may be necessary to re-evaluate and refine potential triggers and corrective actions. Ancillary analysis of dust deposited metals on lichen and examination of the relationship between metals in dustfall versus soil-metal and lichen-metal were also completed to cross-reference potential trends from the passive dustfall monitoring program. No unifying trends were observed from the analyses of deposited metals on lichen or the relationship between metals in dustfall versus soil-metal and lichen-metal.

Wildlife — Snow track surveys were conducted to assess wildlife response to the Tote Road, particularly for caribou. Four surveys were completed in 2022. As in previous surveys, most tracks observed were from Arctic foxes and Ptarmigan, and no caribou tracks were observed in 2022. Only 6% of observed tracks were noted to deflect from the Tote Road.

Snowbank height monitoring was conducted to assess compliance with the operational 1 m height, which facilitates wildlife crossings and improves visibility for drivers to avoid wildlife collisions. Snowbank height surveys were conducted in 2022 during winter months. In response to a TEWG request, measurement locations have been randomized since 2020 instead of using repeated kilometre markers for measurements. Overall, compliance was very high at 91%, slightly higher than 2021 (90%).

The HOL surveys were conducted to assess caribou presence, distribution, and behaviour in response to Project activities during the calving season, should they be observed. The HOL surveys were completed between June 3 and June 12, 2022. All stations were visited twice. The total observation time was 36 hours, with an average observation time of 45 minutes per station. During these surveys, no caribou were observed, consistent with all previous surveys after 2013 and the low regional caribou population. Results from remote camera monitoring, a supplemental program to the HOL surveys, also show that no caribou were observed from October 31, 2021, to June 5, 2022.

Birds — Active Migratory Bird Nest Surveys (AMBNS) were completed before any vegetation clearing or surface disturbance at the Project during the breeding bird season (May 17 to August 19). Surveys consisted of observers using a rope-drag method (Rausch 2015) to detect any nesting birds before construction. One survey was completed, and no nests were detected.

After several years of raptor effects monitoring, occupancy and productivity were deemed to be stable, and no evidence was found of Project-related effects on raptors. Therefore, raptor occupancy and productivity surveys were paused in 2021 and 2022. No future surveys are proposed at this time.

Wildflife Interactions — Fifteen wildlife mortalities were reported in 2022, slightly more then in 2021 (10), all of which were individual losses. Mortalities in 2022 involved five different species: Arctic fox (11), Arctic hare (1), Snow Bunting (1), Lapland Longspur (1), and Ptarmigan (1). Vehicle collisions were confirmed or suspected in eight of these incidents. One incident involved non-target trapping of a species in a waste bin, and two incidents involved euthanization of wildlife suspected of rabies. Cause of mortality was undetermined for the four remaining reported incidents. Whenever possible, mitigations are implemented to reduce the risk of wildlife injury or mortality on the Project.

Table 0. Summary of environmental effects monitoring and research activities at the Mary River Project in 2022.

Survey	Reason for Survey[1]	Work Completed, Effects Observed, Required Mitigation and Recommendations for Future Work	Comparison to Impact Predictions[2]
Weather monitoring	Supports all other data collection and monitoring programs	Weather conditions were recorded hourly at meteorological stations at the Mine Site and Milne Port. Weather data were recorded since 2005 (Mine Site) and 2006 (Milne Port). Weather data are used to support other monitoring programs; mitigations are not necessary. Meteorological stations will continue to collect weather data in 2023.	N/A
Helicopter flight height analysis	Addresses Project Conditions 59, 71, and 72	Except for operational purposes, and subject to pilot discretion regarding aircraft and human safety, pilots must maintain a cruising altitude of at least 650 m during point-to-point travel in areas likely to have migratory birds, and 1,100 m vertical and 1,500 m horizontal distance from observed concentrations of migratory birds (e.g., Snow Geese area). Flight corridors are also used to avoid areas of significant wildlife importance. In 2022, compliance with height requirements within the Snow Geese area during the moulting season (July to August) was 95% to 96%, and compliance outside the Snow Geese area and in all areas in all months of analysis (May to September) was 69% to 97%. For the sixth consecutive year, flight height data were cross-referenced with daily pilot logs to justify low-level flights in 2022. Low-level flights with reasonable rationales were considered "compliant with rationale". Reasonable rationales included weather, slinging, surveys, drop off/pick up sampling, and short-distance flights. Helicopter flight height analysis will continue until consistent trends are identified.	It was expected that some Snow Geese would be displaced by Project-related activities but would relocate to nearby, less disturbed areas. As only a small portion of the Snow Geese area is subject to helicopter flyovers and is mainly located outside the Zone of Influence (ZOI), effects would likely be limited. Overall, local disturbance relative to the PDA and Local Study Area (LSA) extents was expected to cause some sensory disturbance, but not result in significant adverse effects to the Snow Goose population. Direct mortality due to aircraft was deemed unlikely and, thus, expected to have no significant adverse effect. Compliance with minimum helicopter flight heights was moderate in 2022 when considering the pilots' rationale for low-level flying and flight hours within the Snow Geese area during the moulting season. Flights over the Snow Geese area were limited to its southeastern edge, such that any sensory disturbance would be minimal relative to the entire Snow Geese area, consistent with FEIS predictions. However, it has not been possible to directly monitor the potential effects of low-level flying on Snow Geese or other migratory birds as doing so would involve accessing the Snow Goose mountling areas by helicopter, thus introducing greater disturbance potential.

[1] Project Conditions and Project Commitments as per Nunavut Impact Review Board Project Certificate No. 005 (Nunavut Impact Review Board 2014).

[2] Mary River Project Final Environmental Impact Statement: Volume 6 – Terrestrial Environment (Baffinland Iron Mines Corporation 2012a) and Mary River Project Early Revenue Phase Addendum to Final Environmental Impact Statement: Volume 6 – Terrestrial Environment (Baffinland Iron Mines Corporation 2013a).

Survey	Reason for Survey[1]	Work Completed, Effects Observed, Required Mitigation and Recommendations for Future Work	Comparison to Impact Predictions[2]
			No direct mortality due to aircraft has been documented, which is consistent with impact predictions.
Tote Road traffic monitoring	Correlate to wildlife disturbance and provide supporting data to the dustfall monitoring program	Annual summary of continual traffic monitoring. No directly observed unexpected effects. Traffic volume monitoring will continue regularly.	The mean daily total vehicle transits (haul and other) on the Tote Road in 2022 was 269.7 vehicle transits per day. The mean number of ore haul transits per day on the Tote Road, from January 1 to December 31, 2022, was 243.6, slightly above the FEIS addendum predictions (236 ore haul transists). Other traffic had an annual mean of 26.7 vehicle transits per day.
Passive dustfall monitoring	Addresses Project Conditions 36, 50, 54d, and 58c, and Project Commitment 60	Fifty-three dustfall collectors at 47 different locations are distributed around the Project area, some further away from the PDA as Reference sites monitoring background levels. 2021 included the addition of six 'short' monitors as part of a pilot study (requested by the QIA and the TEWG) to investigate the variability between dustfall sampling at the standardized height of 2.0 m and that closer to ground level (0.5 m). Ten years of monitoring from August 2013 to December 2022 are now complete using the 2.0 m height collectors. Passive dustfall monitoring indicated the areas with the greatest dustfall deposition are restricted mainly to within 1,000 m of the PDA; an investigation of dustfall at monitors outside the PDA, but within a 5,000 m radius indicated dustfall was generally low throughout 2022. No difference was found in the dustfall measured at a standardized height of 2.0 m and at 0.5 m. Future monitoring will continue to investigate dustfall at the 47 sites through the summer season and a subset of 26 year-round sites.	Annual Total Suspended Particulates (TSP) deposition levels were predicted to exceed 50 g/m²/year within the PDA, with TSP levels decreasing to background outside of the PDA. The 2022 dustfall results were consistent with predictions that the highest dustfall would be limited mainly within the PDA.
Vegetation and soil base metals monitoring	Addresses Project Conditions 34, 36, 38, and 50, and Project Commitments 60 and 107	Soil-metal and lichen-metal concentrations were sampled in 2022. Sampling was conducted at three distances from the PDA (Near: 0–100m, Far: >100–1,000 m, and Reference: >1,000 m). Soil-metal and lichen-metal concentrations at the Project mainly indicated no significant increases compared with baseline values. Some discrete increases in CoPCs were identified, but all values were either below or within an acceptable range. In 2022, a full review of the vegetation and soil base metals analysis was conducted, including historic reference standards and	Soil-metal and lichen-metal concentrations represented a low risk to environmental and human health in 2022.

Survey	Reason for Survey[1]	Work Completed, Effects Observed, Required Mitigation and Recommendations for Future Work	Comparison to Impact Predictions[2]
		indicator values. Notably, a central database was created to consolidate all vegetation and soil base metals data (from 2012 to present).	
Snow track surveys	Addresses Project Conditions 54dii and 58f Addresses QIA concerns about snowbank heights and the effects on wildlife	Four snow track surveys were completed along the Tote Road to investigate the movement and behaviour of caribou in March, April, October, and November 2022. Arctic fox, Arctic hare, and Ptarmigan were the only species detected during the 2022 surveys; no evidence of caribou has beenobserved near or crossing the Tote Road since January 2020. Wildlife response to the road was recorded at each location where tracks were seen. Snow track monitoring will continue in 2023.	A reduction in caribou movement across Project infrastructure throughout the Operation phase was predicted, but not expected to be significant at the scale of the North Baffin caribou population. Data from the snow track survey can be used to investigate that prediction when caribou numbers increase and movement resumes in the Regional Study Area. If ground monitoring of caribou suggests barrier effects (trails approaching but not crossing the road) and anecdotal caribou abundance indices show increasing numbers, then aerial surveys may be used to investigate the potential impact further. Because no caribou tracks were identified during snow track surveys in 2022, it cannot be determined whether Project infrastructure is impacting caribou movement.
Snowbank height surveys	Addresses Project Conditions 53ai and 53c Addresses QIA concerns about snowbank heights and the effects on wildlife	Snowbank height monitoring was conducted monthly or bi-monthly from January 2022 to December 2022 to assess compliance with the 1 m height threshold. Management of snowbank height facilitates wildlife crossings and increases driver visibility to help reduce wildlife-vehicle collisions. As per TEWG's request, measurement locations were randomized in 2020. In 2022, the average compliance for snowbank height surveys was 91%, slightly higher then in 2021 (90%). In some areas, snowbanks could not be modified because of landscape or safety limitations. Snowbank height monitoring will continue during the winter in 2023.	A reduction in caribou movement across Project infrastructure throughout the Operation phase was predicted. Due to mitigations on the road (e.g., snowbank management, low embankments), the Tote Road was not expected to be a barrier to caribou movement. A negligible increase in caribou mortality was anticipated due to the Project, and impacts were predicted to be not significant at the scale of the North Baffin caribou population. High compliance with snowbank heights minimizes the Tote Road's potential to act as a barrier to caribou movement. However, insufficient observational data exist to quantify the effectiveness of this mitigation on caribou movement due to low caribou numbers. As caribou numbers increase, as is predicted by Inuit Qaujimajatuqangit (IQ), increased monitoring of caribou movement across the roadway will be implemented.

Survey	Reason for Survey[1]	Work Completed, Effects Observed, Required Mitigation and Recommendations for Future Work	Comparison to Impact Predictions[2]
Height of Land (HOL) caribou surveys	Addresses Project Conditions 53a, 53b, 54b, and 58b	Two EDI Environmental Dynamics Inc (EDI) biologists conducted HOL surveys during the caribou calving season (early June 2022). All HOL stations were visited on two occasions. The total observation time was 36 hours, while the average observation time per station was 45 minutes. No caribou were observed during these surveys in 2022. In 2016, viewshed mapping was completed to demonstrate the extent of area surveyors could observe while conducting HOL surveys. The HOL surveys will continue annually during the calving season. The 2022 observations add to a more extensive database as monitoring efforts continue through the Project's life. Twelve remote cameras were deployed in 2021, at six HOL stations, and recorded no images of caribou between October 2021 and June 2022.	The assessment predicted some indirect habitat loss for caribou due to sensory disturbance and dust deposition, leading to reduced habitat effectiveness within the ZOI. However, habitat effectiveness was estimated to be reduced by 2.00% to 4.25%. Some disturbances (i.e., traffic) are short-duration and caribou may adapt to these disturbances, thus limiting potential impacts. Many alternate calving sites exist within and outside the ZOI. Indirect habitat loss was predicted to be indistinguishable from natural variation and not significant at the scale of the North Baffin caribou population. To date, insufficient caribou observations during HOL surveys have occurred to assess any Project-related effects on caribou behaviour or habitat use.
Hunter and visitor log summaries	Addresses Project Condition 54f	Though not compulsory unless using Baffinland facilities, visitors to the site may check in with Baffinland security. In 2022, a total of 541 individuals checked in at either the Mine Site or Milne Port camps. Use of the hunter and visitor log summaries will continue throughout the life of the Project.	Although Project-related effects may interact with land-use activities, such as harvesting, travel, and camping, the impacts were expected to be not significant. Except for 2020 and restrictions associated with the COVID pandemic that continued into 2021, hunter and visitor check-ins have steadily increased from pre-2017 numbers, including numerous hunting and camping trips. During 2022, these numbers increased, similar to trends seen in 2018.
Active Migratory Bird Nest Surveys (AMBNS)	Addresses Project Conditions 66 and 70	In 2022, approximately 512 m² (0.05 ha) of land were disturbed for Project infrastructure. Of this area, all was disturbed outside the breeding bird window (August 20 to May 16). During the breeding bird window (May 17 to August 19), no land was cleared. One AMBNS was completed, and no bird nests were found. Surveys will continue to be conducted whenever vegetation clearing or surface disturbance occur within the breeding bird window.	By minimizing the Project footprint, conducting AMBNS, and implementing a nest management plan, Project-related effects on nesting birds were expected to be low to nil.
Wildlife interactions and mortalities	Addresses Project Conditions 53a, 53b, and 57d	Any interactions or mortalities involving wildlife within the Project area are reported and investigated year-round. If possible, mitigation measures are implemented to reduce future wildlife interactions and mortalities.	Direct wildlife mortality from Project-related activities was predicted to be low to nil for raptors, birds, caribou, and other wildlife. Any mortalities that do occur were expected to represent a small fraction of the overall population.

Survey	Reason for Survey[1]	Work Completed, Effects Observed, Required Mitigation and Recommendations for Future Work	Comparison to Impact Predictions[2]
		In 2022, 15 individual wildlife mortality incidents were reported involving five different species. Wildlife mortalities involved 11 Arctic foxes, one Arctic hare, one Snow Bunting, one Lapland Longspur, and one Ptarmigan. Baffinland continues to mitigate wildlife interactions in the Project area by training, enforcing, and monitoring waste management practices and guidelines. Wildlife interaction and mortality monitoring will continue in 2022.	Wildlife mortalities in 2022 were all individual losses and did not impact any species at risk. Thus, wildlife mortalities were low overall and represented a very small proportion of overall populations, consistent with impact predictions. The 2022 mortality totals were well withing the range of past mortalities, with 2015 being the lowest (5) and 2016 recording the highest (25) number of mortalities.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
AICc	Akaike's Information Criteria
ΔAIC	Difference in AICc between the given model and the lowest AICc.
Al	Aluminum
AMBNS	Active Migratory Bird Nest Surveys
ANOVA	Analysis of Variance
As	Arsenic
Baffinland	Baffinland Iron Mines Corporation
CCME	Canadian Council of Ministers of the Environment
Cd	Cadmium
CI	Confidence interval
CoPC	Contaminant of potential concern
Cu	Copper
CVAAS	Cold Vapour-Atomic Absorption
CWS	Canadian Wildlife Service
dB	Decibel
dBA	The decibel (dB) sound pressure level filtered through the A filtering network to approximate human hearing response at low frequencies.
DEM	Digital Elevation Model
ECCC	Environment and Climate Change Canada
EDI	EDI Environmental Dynamics Inc.
EPP	Environment Protection Plan
ERP	Early Revenue Program
FEIS	Final Environmental Impact Statement
GIS	Geographic Information System
GN	Government of Nunavut
GPS	Geographic Positioning System
HOL	Height of Land
Leq	The energy equivalent sound level over a specified period of time.
LSA	Local Study Area
MHTO	Mittimatalik Hunters and Trappers Organization
MSI	Multispectral Instrument
NIRB	Nunavut Impact Review Board
OLI	Operational Land Imager
Pb	Lead
PC	Project Condition
PDA	Potential Development Area
PRISM	Program for Regional and International Shorebird Monitoring
Project	Mary River Project
PSC	Port Site Main Camp

Acronym/Abbreviation	Definition
PSL	Permissible sound levels
QIA	Qikiqtani Inuit Association
RDL	Laboratory detection limit
RSA	Regional Study Area
SAR	Search-and-Rescue
SDI	Snow Darkening Index
Se	Selenium
SLM	Sound level meter
SNGO	Snow Geese
TEMMP	Terrestrial Environment Mitigation and Monitoring Plan
TEWG	Terrestrial Environment Working Group
TSP	Total Suspended Particulates
VEC	Valued Ecosystem Component
Zn	Zinc
ZOI	Zone of Influence

1 OVERVIEW

The Mary River Project (the Project) is an iron ore mine located in the Qikiqtaaluk Region on North Baffin Island, Nunavut. As a condition of Project approval, the Nunavut Impact Review Board (NIRB) Project Certificate No. 005 includes numerous conditions that require Baffinland Iron Mines Corporation (Baffinland) to conduct effects monitoring for the terrestrial environment. Work completed for the Terrestrial Environment Monitoring Program is guided by Inuit Qaujimajatuqangit and the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP) (Baffinland Iron Mines Corporation 2016a). This work is overseen by the Terrestrial Environment Working Group (TEWG; refer to Section 2), comprised of representatives 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). While outside of this reporting period, four additional Hunter and Trapper Organizations (HTOs) from Clyde River, Arctic Bay, Hall Beach, and Igloolik were offered member status in Feburary 2023 on both the TEWG and Marine Environment Working Group (MEWG), should they elect to participate. World Wildlife Fund (WWF), the Nunavut Impact Review Board (NIRB), the Canadian Northern Economic Development Agency (CANNOR), and Natural Resources Canada (NRCan) all participate as observers on the TEWG. Several data collection and monitoring programs are conducted as part of the Terrestrial Environment Monitoring Program, the frequency of which is outlined in the TEMMP (Baffinland Iron Mines Corporation 2016a).

The Terrestrial Environment Monitoring Program provides a holistic assessment of potential Project-related effects on multiple (often interrelated) Valued Ecosystem Components (VECs). Where possible, monitoring design and data capture facilitate cross-referencing between monitoring components to better determine cause and effect and support more effective corrective actions. For example, dustfall deposition is captured by passive dustfall sampling. Dustfall effects on vegetation are captured by vegetation monitoring (including abundance, composition, and health). Potential bioaccumulation effects in caribou (associated with metal uptake and transfer up the food chain) are monitored by a caribou tissue regional sampling program. Table 1-1 summarizes components of the Terrestrial Environment Monitoring Program at the Project (2010 to present). Results and trend summaries from these monitoring programs are presented in each respective Terrestrial Environment Annual Monitoring Report (EDI Environmental Dynamics Inc. 2013−2022).

Figure 1-1 illustrates the Project's Terrestrial Environment Monitoring Program. The Terrestrial Environment Monitoring Program included the following data collection and monitoring programs in 2022, the results of which are summarized in this report:

- weather monitoring;
- helicopter flight height analysis;
- Tote Road traffic monitoring;
- passive dustfall monitoring;
- dustfall extent imagery analysis;
- vegetation and soil base metals monitoring;
- snow track surveys;

- noise monitoring;
- snowbank height monitoring;
- Height of Land (HOL) caribou surveys;
- remote camera monitoring;
- active migratory bird nest surveys (AMBNS);
- hunter and visitor log summaries; and,
- wildlife interactions, incidental observations, and mortalities

Table 1-1. Overview of Terrestrial Environment Monitoring Program components (2010 to present).

Monitoring Programs and Endpoints	Previous Monitoring	Next Anticipated Monitoring
Passive Dustfall	2013–2021	2023
Dustfall Extent Imagery Analysis	2020–2021	2023
Soil and Vegetation Base Metals Monitoring	2012–2017, 2019-22	2025
Vegetation Abundance Monitoring	2012–2017, 2019	2023
Normalized Difference Vegetation Index Analysis	2020	None Scheduled *(may reassess in future years)*
Exotic Invasive Vegetation Monitoring and Natural Revegetation	2014, 2019, 2020	2023
Height of Land Caribou Surveys	2013–2021	2023
Snow Track Surveys and Snowbank Height Monitoring	2014–2021	2023
Noise Monitoring	2020, 2022	None Scheduled *(may reassess in future years)*
Hunter and Visitor Logs	2010–2021	2023
Wildlife Observations, Incidents, and Mortality Logs	2020–2021	2023
Active Migratory Bird Nest Surveys	2013–2021	2023
Helicopter Flight Height Analysis	2015–2021	2023
Cliff-nesting Raptor Occupancy and Productivity Surveys	2011–2020	None Scheduled *(may reassess in future years)*
Caribou Fecal Pellet Collection	2011–2014, 2020	None Scheduled
Caribou Water Crossing Surveys	2014	None Scheduled *(single occurrence monitoring, may reassess in future years)*
Carnivore Den Survey	2014	None Scheduled *(single occurrence monitoring, may reassess in future years)*
Communication Tower Surveys	2014–2015	None Scheduled
Roadside Waterfowl Surveys	2012–2014	None Scheduled
Staging Waterfowl Surveys	2015	None Scheduled
Tundra Breeding Bird PRISM (Program for Regional and International Shorebird Monitoring) Plots	2012–2013, 2018	2023 *(to be completed by Environment Climate Change Canada)*
Bird Encounter Transects	2013	None Scheduled *(single occurrence monitoring, may reassess in future years)*
Coastline Nesting and Foraging Habitat Surveys	2012 (Steensby Inlet), 2013 (Milne Inlet)	None Scheduled *(single occurrence monitoring, may reassess in future years)*
Red Knot (*Calidris canutus*) Surveys	2014, 2019	None Scheduled *(may reassess in future years)*

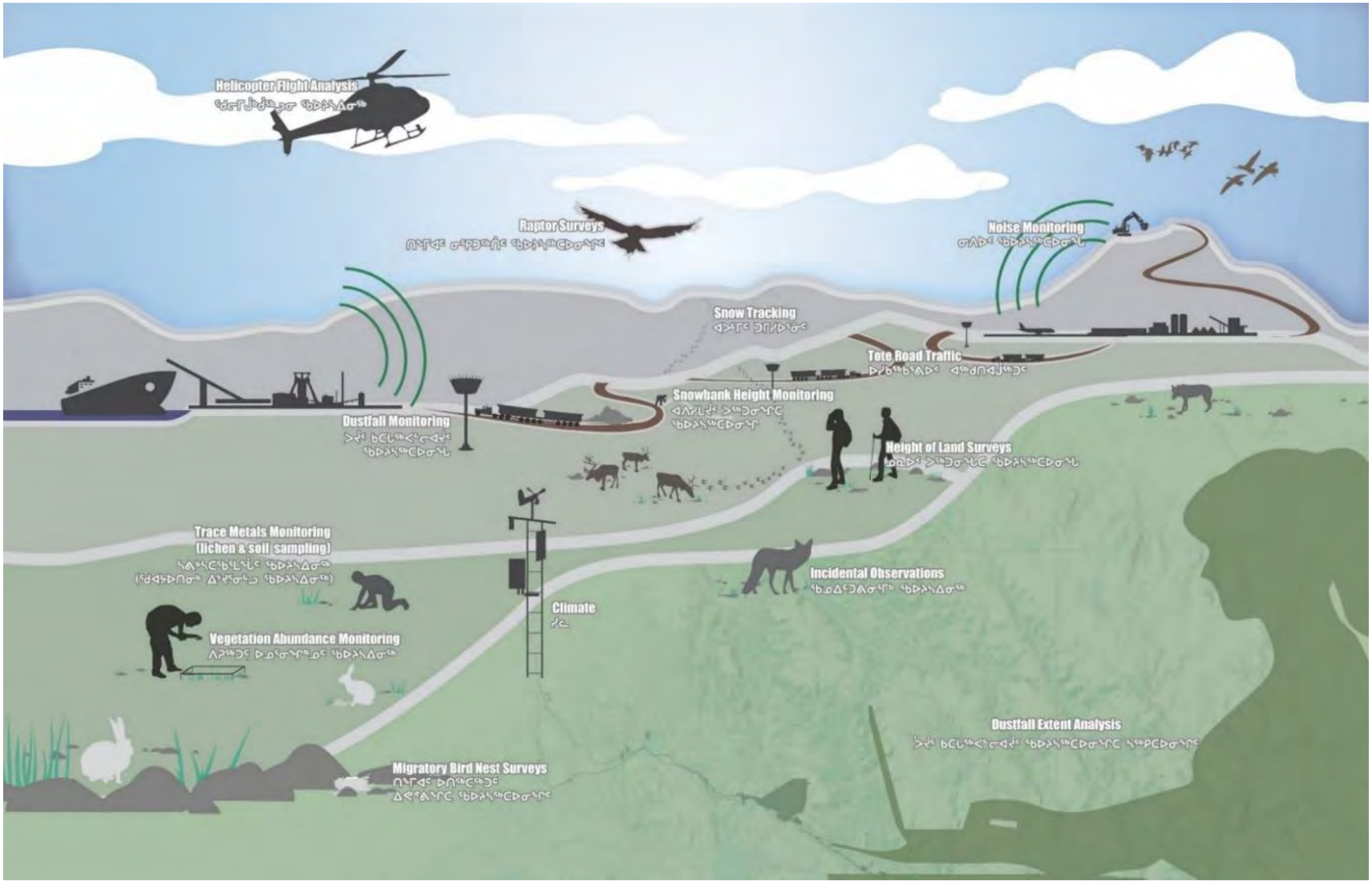


Figure 1-1. Graphical overview of the Project's Terrestrial Environment Monitoring Program.

2 TERRESTRIAL ENVIRONMENT WORKING GROUP

The Terrestrial Environment Working Group (TEWG) was formed in 2012 as a collaborative forum to discuss monitoring approaches and refine procedures based on data trends, local knowledge, and recent advances in science and technology. Historically, the TEWG has (at a minimum) convened biannually via in-person or teleconferene meetings, typically before and after the summer field monitoring period. If/where possible, annual technical reports and other relevant discussion content are distributed before meetings. Baffinland invites commentary from all representatives, reviews all comments and recommendations and tries to provide meaningful responses to the TEWG.

Baffinland hosted three TEWG meetings (via teleconference) on April 28, June 23, and December 1, 2022. Besides standing discussion of the monitoring programs and recent outcomes, these meetings focused on ongoing dustfall monitoring, mitigation, and experimental design for a proposed caribou aerial survey. Action items and strategic initiatives from TEWG commentary and dialogue included: (1) a commitment to review available information regarding known migratory bird areas in the vicinity of the Mary River Project (the Project); (2) an evaluation of potential patterns of non-compliant helicopter flights and a commitment to improving compliance; and (3) engagement with Natural Resources Canada to discuss research opportunities at the Project. Feedback responses and actions from 2022 annual report are presented in Appendix F.

3 INUIT PARTICIPATION

Baffinland Iron Mines Corporation (Baffinland) actively encourages and facilitates recruitment of Inuit participants at the Mary River Project (the Project) via:

- hiring and training Inuit to work on terrestrial monitoring programs;
- supporting the participation of the Mittimatalik Hunters and Trappers Organization (Ikahutit Hunters and Trappers Association, Nangmautuq Hunters and Trappers Association, Igloolik Hunters and Trappers Organization, Hall Beach Hunters and Trappers Organization as of February 2023) in the Terrestrial Environment Working Group;
- funding for four full-time, on-site Environmental Monitors to be appointed and solely employed by the Qikiqtani Inuit Organization following Article 15.8 of the Inuit Impact and Benefit Agreement (Qikiqtani Inuit Association and Baffinland Iron Mines Corporation 2018); and,
- resourcing a community-based monitoring program through the Mary River Inuit Impact and Benefit Agreement (Qikiqtani Inuit Association and Baffinland Iron Mines Corporation 2018).

In their capacity as research assistants and consultants, Inuit from numerous communities on Baffin Island have contributed to many components of the Terrestrial Environment Monitoring Program since its inception (e.g., HOL caribou surveys, vegetation abundance surveys, vegetation and soil base metals sampling, and raptor monitoring), and have provided strategic support and insight on field programs. Inuit research assistants have gained essential skills and training through participation in field programs, such as plant identification, bird identification, Arctic biology, field logistics, Geographic Positioning System (GPS) navigation, data collection methods, and data management.

A pause in Inuit participation in the Project occurred because of health and safety measures imposed during the COVID pandemic, starting in March 2020. In 2022, territorial and site restrictions associated with the COVID pandemic were lifted. Four local Inuit residents assisted with HOL caribou surveys and/or soil, vegetation, or noise monitoring for 415 hours during the 2022 field season (Figure 3-1). Additionally, two Inuit Baffinland staff assisted with certain components of the 2022 Terrestrial Environment Monitoring Program as on-site environmental technicians. All but one of the Inuit assistants reside within Nunavut in one of the following communities: Arctic Bay, Pond Inlet, or Igloolik.

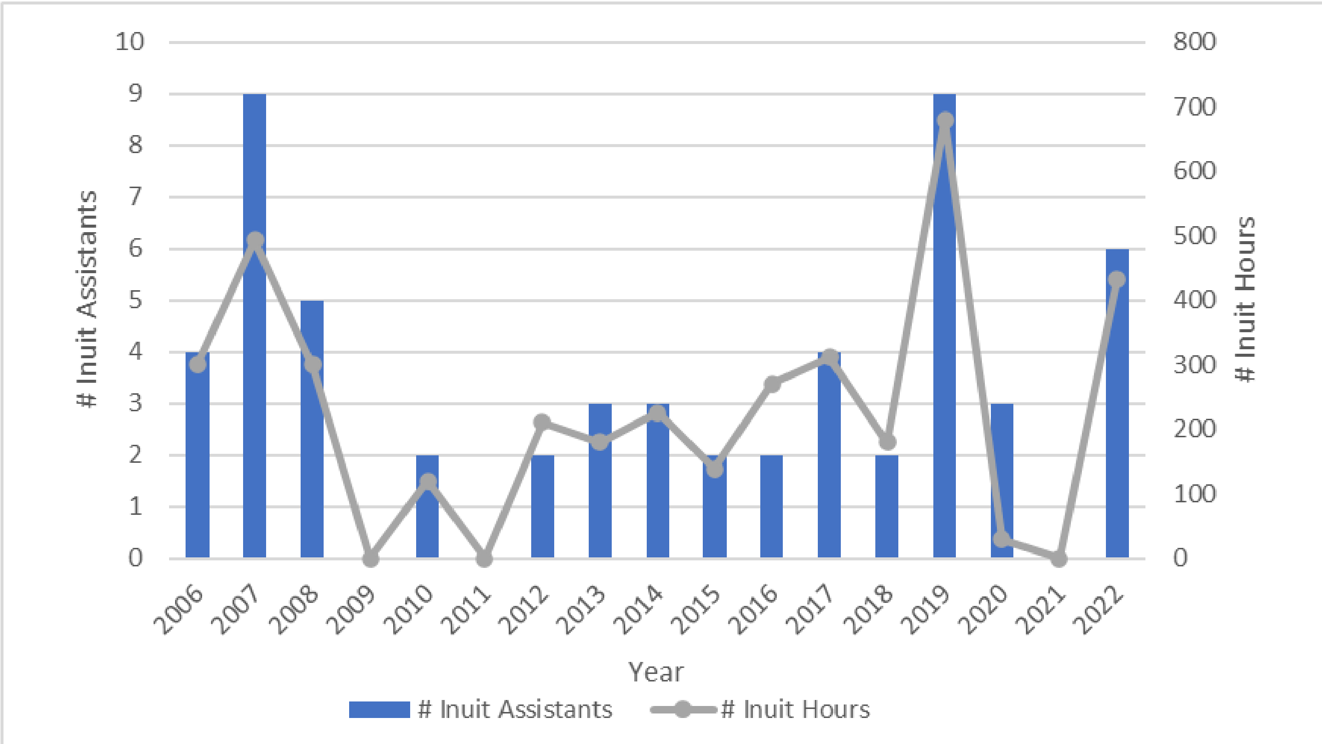


Figure 3-1. **Inter-annual trend (2006 to 2022) of Inuit participation in the Terrestrial Environment Monitoring Program.**
** the COVID-19 pandemic resulted in little to no Inuit participation to minimize its spread.*

4 CLIMATE

Climate data are recorded and summarized for the Mary River Project (the Project) according to Nunavut Impact Review Board (NIRB) Project Certificate No. 005 Project Condition #57(g) (Nunavut Impact Review Board 2020):

- *"The Proponent shall report annually regarding its terrestrial environment monitoring efforts, with inclusion of the following information: an assessment and presentation of annual environmental conditions including timing of snowmelt, green-up, as well as standard weather summaries."*

Recent climate data are compared to historical baseline data to assess changes in climate patterns in the Regional Study Area. The climate data recorded at the Project then contribute to several other datasets and analyses. For example, dustfall dispersion and deposition are strongly related to weather conditions (e.g., dustfall dispersion tends to be higher during dry, windy conditions than rainy conditions). Incorporating observed weather conditions into the dustfall analyses can help explain specific patterns and trends in dustfall. Wind data are also used to estimate snow distribution before and during snow tracking surveys.

From 1963 to 1965, Environment Canada operated a meteorological (MET) climate station at Mary River during the summer (Baffinland Iron Mines Corporation 2012b). These climate data have been included to compare to data collected from Baffinland's on-site meteorological stations.

Baffinland established a meteorological station at Mary River Camp in June 2005 and Milne Port in June 2006. Data from these stations created a 'baseline' dataset from 2005 to 2010, preceding the development of the mine. Baffinland continues to collect data from these stations (Baffinland Iron Mines Corporation 2012b). Where relevant, the 2022 weather data were compared with the baseline (2005 to 2010) and post-baseline (2013 to 2021) weather data. Data included hourly air temperature, precipitation, and wind speed and direction.

Weather conditions from January 1, 2022, to December 31, 2022, were reported from on-site meteorological stations at the Mine Site and Milne Port (Photo 4-1, Photo 4-2). Summaries of 2022 weather conditions at the Mine Site and Milne Port included monthly air temperatures (mean, minimum and maximum), monthly precipitation (quantity and frequency), wind direction and speed. Temperature and precipitation data were accurate and reliable throughout 2022.

Comparisons of 2022 weather data were made against baseline (2005 to 2010) and post-baseline (2013 to 2021) periods. Baseline data were referenced from Appendix 5A of the Mary River Project Final Environmental Impact Statement (Carrière et al. 2010). Mean air temperatures and precipitation (quantities and frequencies) were averaged across the years when those data were collected within the baseline and post-baseline periods. Cumulative wind speed and direction proportions were calculated based on data across all years within each period. The complete 2022 climate dataset is contained in Appendix A.

Photo 4-1. Mine Site meteorological weather station.

Photo 4-2. Milne Port meteorological weather station.

4.1 AIR TEMPERATURE AND PRECIPITATION

4.1.1 MINE SITE

In 2022, monthly mean temperatures at the Mine Site were lowest in February (−33.7°C), rising above zero in June (3.4°C) and peaking in July (13.4°C). Monthly means fell back below zero in October (−10.6°C). December 2022 presented the largest monthly anomaly, 6.8°C warmer than the baseline average, while November was 5.6°C below the baseline. The temperature from June 17 until September 18 remained above zero, except for seven hours on August 30 and 31 (Figure 4-1).

Minimum and maximum temperatures in 2022 at the Mine Site were recorded on December 20 (−45.3°C) and July 16 (24.1°C), respectively. These extremes lie within the recorded historical range, although the summer high is within half a degree of the recorded maximum from 2016. The lowest temperature recorded at the Mine Site during the baseline period was −59.1°C in April 2007[3] and −46.6°C in January 2015[4]. Comparable historical data (1963 to 1965) in winter months are lacking, but the lowest temperature recorded in late winter/spring was −40.6°C in April 1964. The highest temperatures previously registered at the Mine Site were 22.8°C in July 2009 and 24.5°C in July 2016. These peak temperatures in the baseline, post-baseline and 2022 study periods are all higher than what was identified in the historical record (20.6°C in July 1965). For a complete monthly comparison among the baseline (2005 to 2010) and all post-baseline years (2013 to 2022), see Appendix A.

June through August tend to be the wettest months for North Baffin Island, as presented in historical data trends from the Mine Site. By counting the days with precipitation, 2022 appears comparable to previously recorded means (Figure 4-2). May, June, and July 2022 were comparatively dry, each with roughly two-thirds of their regular rainy days. September was twice as rainy as was typical in the baseline and post-baseline periods. May and July 2022 were unusually dry, while June, September and October were unusually wet. The apparent inconsistency of June, with many days with rain but low total precipitation, illustrates the difficulties of using rain days as a direct proxy for precipitation levels. The days of precipitation are still reported to allow for direct comparisons with years when exact precipitation amounts became unclear due to rain gauge failures.

[3] Excluding erroneous readings of extreme lows below −60°C, post September 2009.

[4] Excluding an erroneous low of −73°C in September of 2014.

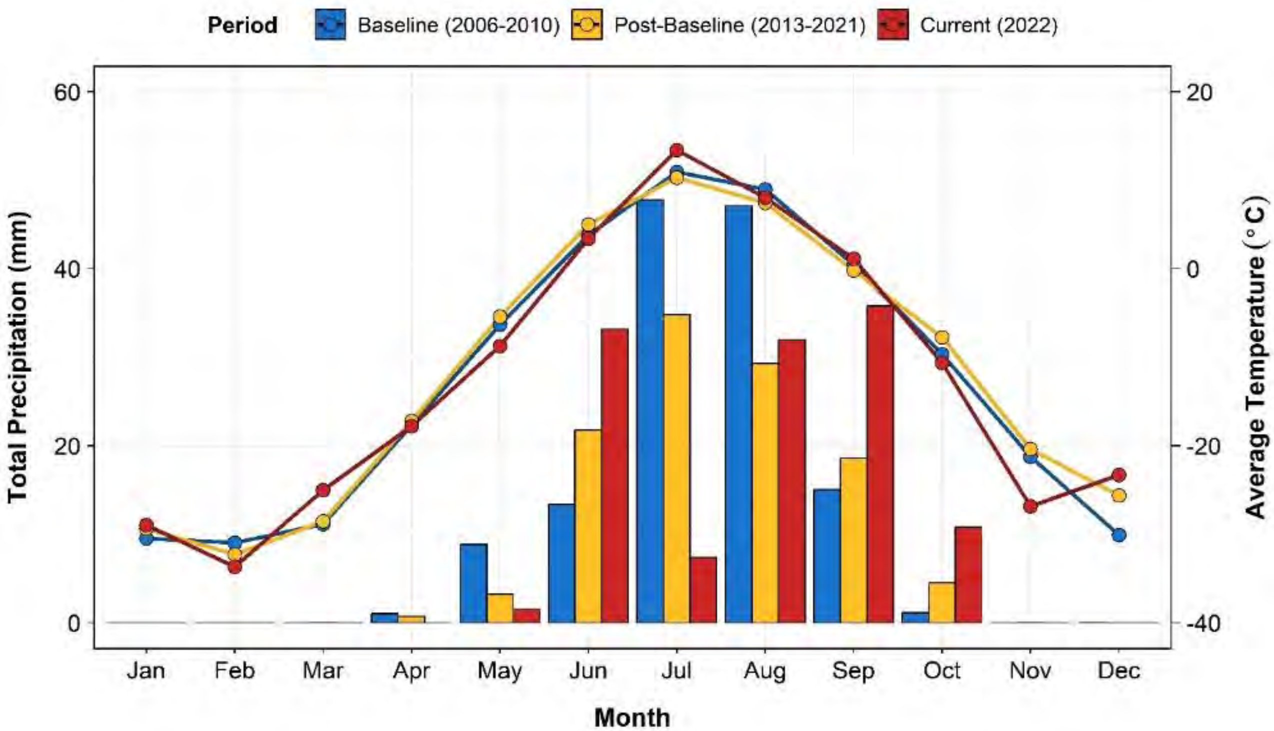


Figure 4-1. Mine Site monthly average air temperatures (lines) and total precipitation (bars) during the baseline period (2005 to 2010), post-baseline period (2013 to 2021) and most recent year (2022).

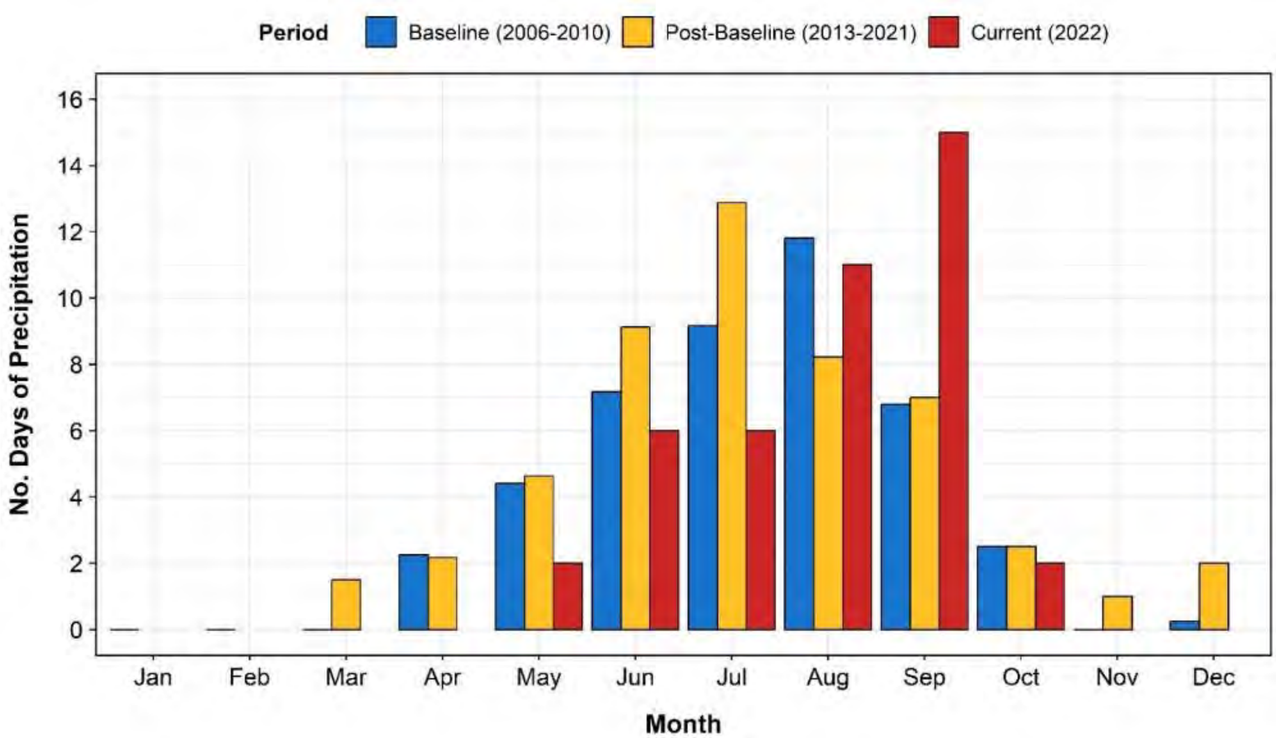


Figure 4-2. Mine Site monthly precipitation frequency (number of days experiencing precipitation) during the baseline period (2005 to 2010), post-baseline period (2013 to 2021) and most recent year (2022).

4.1.2 MILNE INLET

The 2022 trends measured at the Mine Site meteorological station closely reflect the readings from Milne Port. Monthly mean temperatures at Milne Port were at their lowest in February (−33.4°C), rising above freezing in June (2.4°C) and peaking in July (11.3°C) before dropping back below freezing in October (−10.3°C). From June 26 to September 18, 2022, the temperature remained above the freezing point (Figure 4-3). The year of 2022 at Milne Port can be characterized as closely matching baseline temperatures.

The lowest temperature of 2022 at Milne Port was −41.6°C on February 2, while the highest was 21.7°C on July 13. The coldest temperature noted since the beginning of baseline data recording in 2006 was −50.2°C in January 2019, while the record high of 22.7°C was set in July 2020. For a complete monthly comparison among the baseline (2006 to 2010) and post-baseline years (2013 to 2022), see Appendix A.

Milne Port experienced 32 rain days in 2022, 13 of which were in September. As with the Mine Site, September was the most unusually rainy month, while July was substantially more dry than previous years (Figure 4-4). This holds across both precipitation depth and precipitation daily frequency measurements.

Comparing trends between the two weather stations, Milne Port is consistently cooler and drier than the Mine Site. In 2022, temperatures recorded at Milne Port were, on average, 0.4°C cooler than the Mine Site throughout the year. The effect is more pronounced in the summer and less in the winter. Since the start of the baseline recording, Milne Port has averaged 2.1°C cooler than simultaneous measurements from the Mine Site.

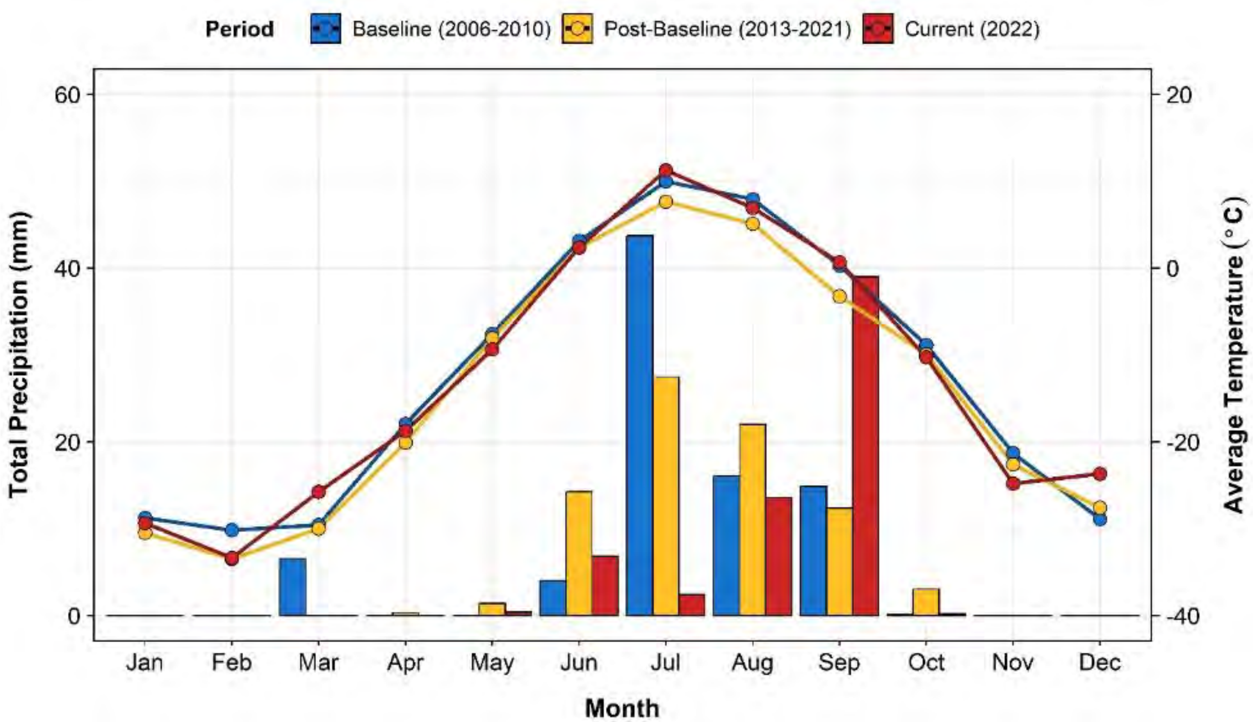


Figure 4-3. **Milne Port monthly average air temperatures (lines) and total precipitation (bars) during the baseline period (2005 to 2010), post-baseline period (2013 to 2021) and most recent year (2022).**

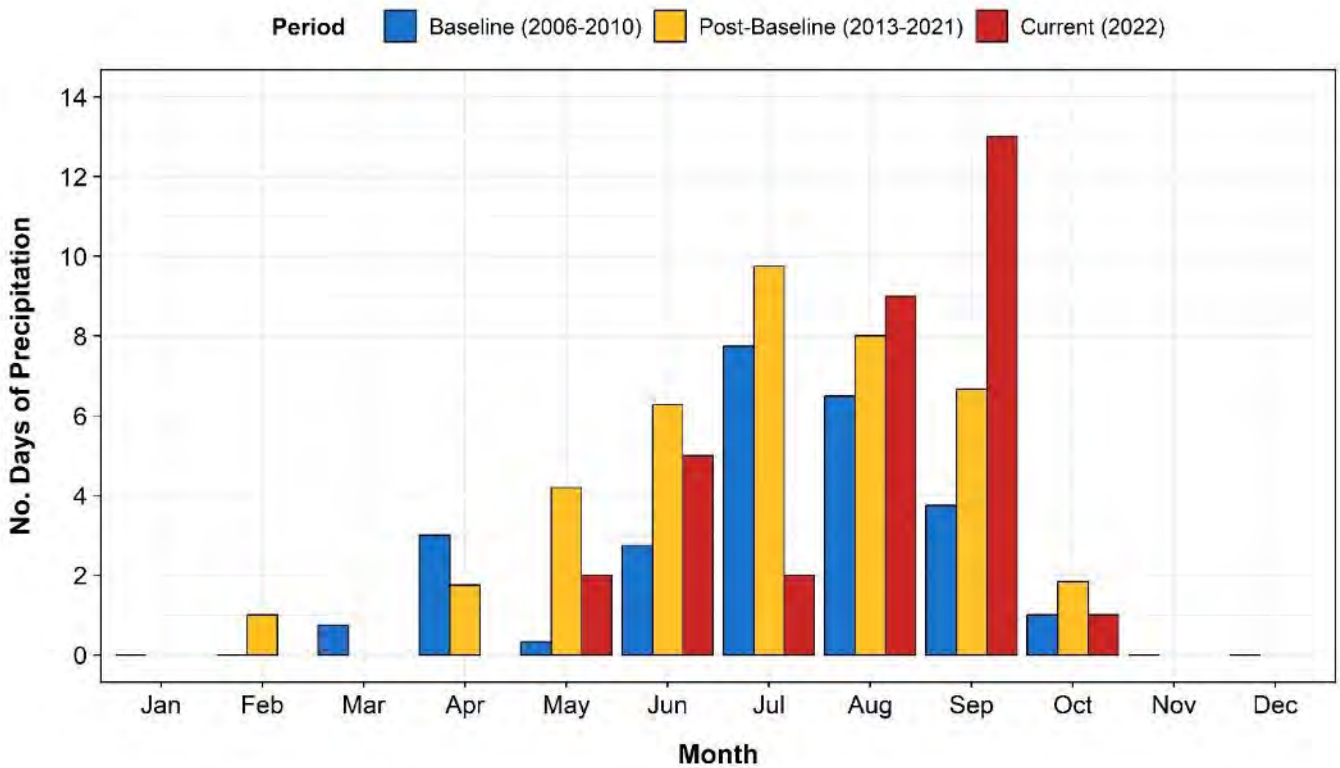


Figure 4-4. Milne Port monthly precipitation frequency (number of days experiencing precipitation) during the baseline period (2005 to 2010), post-baseline period (2013 to 2021) and most recent year (2022).

4.2 WIND SPEED AND DIRECTION

A comparison between wind conditions in 2022, post-baseline, and baseline periods is provided in this subsection. To visualize wind speed and direction using wind rose plots, any average speeds >20.8 m/s were classified as 'gale' on the Beaufort scale (Table 4-1) because of their relatively low frequency of occurrence. Wind data with zero values for hourly average wind speed and wind direction were excluded from analyses. Environment Canada did not record wind data at the Mine Site meteorological station between 1963 to 1965, so no comparison was possible.

Table 4-1. Beaufort scale used for wind speed at the Project.

Beaufort Number	Name	Knots	km/h	m/s
0	Calm	<1	<1	<0.3
1	Light Air	1–3	1–5	0.3-1.5
2	Light Breeze	4–6	6–11	1.6-3.3
3	Gentle Breeze	7–10	12–19	3.4-5.5
4	Moderate Breeze	11–16	20–28	5.5-7.9
5	Fresh Breeze	17–21	29–38	8.0-10.7
6	Strong Breeze	22–27	39–49	10.8-13.8

Beaufort Number	Name	Knots	km/h	m/s
7	Near Gale	28–33	50–61	13.9-17.1
8	Gale	34–40	62–74	17.2-20.7
9	Strong Gale	41–47	75–88	20.8-24.4
10	Storm	48–55	89–102	24.5-28.4
11	Violent Storm	56–63	103–117	28.5-32.6
12	Hurricane	64>	117>	32.7>

4.2.1 MINE SITE

At the Mine Site meteorological station in 2022, the prevailing wind direction was southeast, followed by northwest (Figure 4-6). Relative wind speeds were also proportional to the most frequent wind direction: southeastern winds had more episodes characterized as 'gentle breeze' (3.3 to 5.6 m/s), 'moderate breeze' (5.6 to 8.1 m/s), and 'fresh breeze' (8.1 to 10.8 m/s) on the Beaufort scale. A few episodes of east and northeast winds were the only ones to reach speeds classified as 'gale' (17.2 to 20.8 m/s). Northerly, westerly and southwesterly winds were uncommon and generally weak. The maximum velocity recorded at the Mine Site station was 26.5 m/s from the north-northeast on the afternoon of January 19, 2022. Such windspeeds have a Beaufort classification of 'storm' (24.5 to 28.4 m/s).

Baseline (2005 to 2010) and post-baseline (2013 to 2021) wind directions and speeds at Mine Site were consistent compared to those in 2022 (Figure 4-6). In baseline years, most winds were southeasterly and characterized as 'moderate breeze' to 'strong breeze'. Post-baseline years also had predominantly southeasterly winds, typically ranging between a 'gentle breeze' and a 'fresh breeze', though occasional 'gale' (17.2 to 20.8 m/s) and 'strong gale' winds occurred. Maximum wind speeds during baseline and post-baseline years were similar to 2022, except for a 41.9 m/s 'hurricane' reading in June 2006. A 28.4 m/s storm in December 2016 remains the fastest post-baseline windspeed measurement.

In summary, wind blows predominately along a northwest-southeast axis at the Mine Site, although uncommon eastward winds tend to be the very strongest to hit the station.

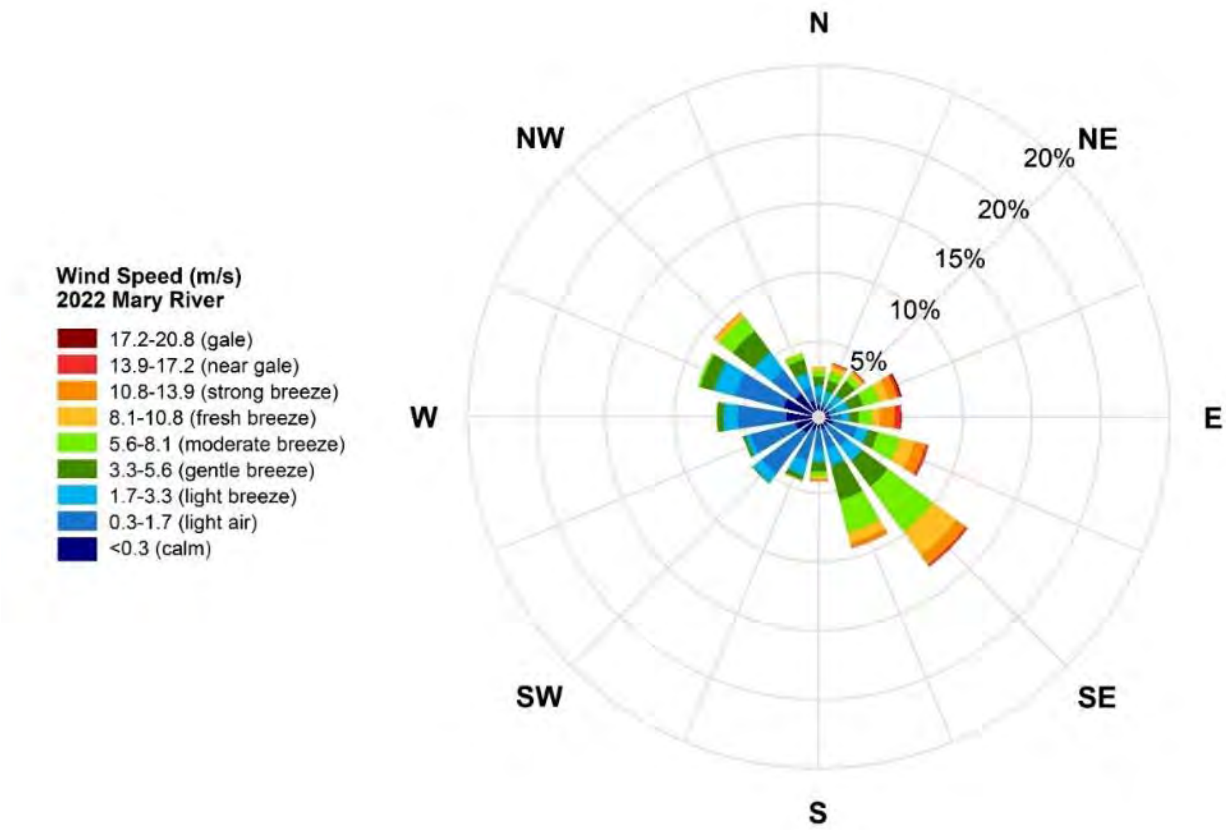


Figure 4-5. The cumulative proportions of wind speeds and directions at the Mine Site meteorological station in 2022.

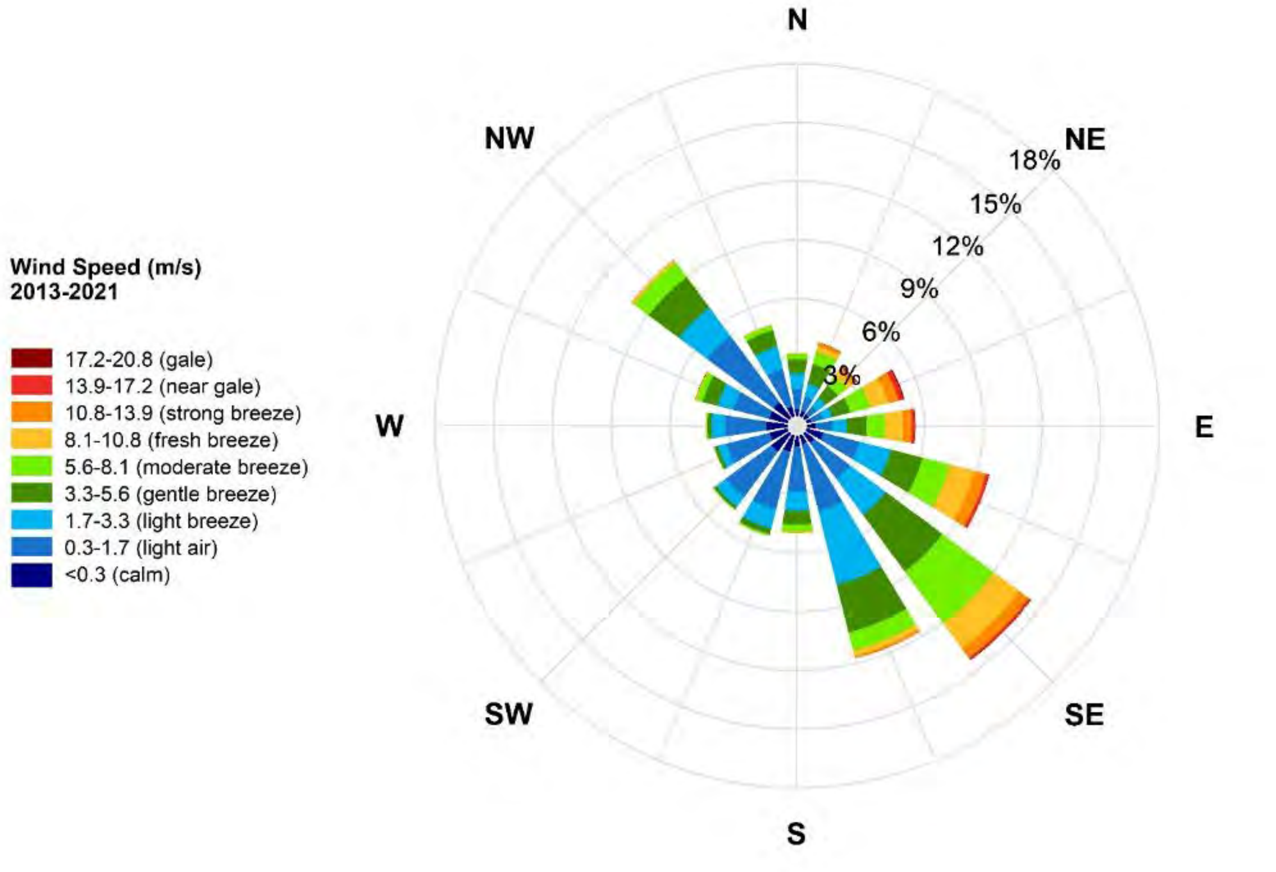


Figure 4-6. The cumulative proportions of wind speeds and directions at the Mine Site meteorological station from 2013 to 2021.

4.2.2 MILNE INLET

The prevailing wind directions at Milne Port in 2022 were north-northwest (onshore winds from the direction of the Project) and southwest (onshore winds blowing down the length of the inlet), with very little wind from the west or east (Figure 4-7). Winds exceeding 'gale' force were detected primarily in these prevailing directions from all directions except for the east and west. The prevailing southwesterly winds were predominately below a 'fresh breeze' while the north-northeasterly winds were most frequently 'gentle breeze'. The maximum velocity recorded in 2022 was a 'violent storm' of 30.12 m/s in the early morning on April 27.

The 2022 wind records at Milne Inlet varied notably from baseline (2005 to 2010) and post-baseline (2013 to 2021) wind directions and speeds (Figure 4-8). Earlier records show prevailing winds blowing to the south-southeast (offshore winds blowing across the inlet) and north-northeast (down the inlet and toward the ocean). However, despite this variation, the overall pattern remains consistent, with winds blowing along the northeast-southwest axis and north-northwest to south-southeast axis. Gale-strength winds were recorded from all four compass quadrants in 2022. Maximum wind speeds during baseline and post-baseline years were comparable to 2022, such as a 29.9 m/s 'violent storm' in October 2008 and, excluding anomalous readings from 2018, a 40.35 m/s 'hurricane' in April 2016.

An investigation of 2022 monthly wind patterns shows distinctive seasonal variation. Winter winds blew predominately along the northwest-southeast axis, which is along the direction of the inlet (Figure 4-9). During the warmer months, the onshore wind blowing from south-southeast to north-northwest (across the inlet) became more prominent (Figure 4-10). This pattern began as early as March, ran as late as October, and was strongest from July to September. As winter returned, the frequency of winds blowing to the north-northwest returned to a lower level. However, this north-northwest wind remained present throughout the year.

Comparing this to the post-baseline monthly wind patterns shows that the north-northwest to south-southeast axis has been the major direction for winds in the last decade. The trend of greater wind frequency and intensity along the northeast-southwest axis during the winter remains true in the long-term data, but with much less prominence than in 2022.

The period from 2019 to 2021 saw instrument failures occasionally interrupt the collection of climate data, causing difficulties with interpreting the annual data for dustfall and dust control measures and understanding satellite imagery. No such issues have been detected since August 2021, and the 2022 data set is complete. Improvements to the meteorology monitoring program included monthly meteorology data quality checks. The data are also reviewed quarterly by independent subject matter experts and compared against other weather monitoring data in the region.

When data quality issues arise, the meteorology monitoring equipment is physically checked. Physical checks for the Milne Port meteorology stations are only possible when a helicopter is available; no helicopter is available during winter.

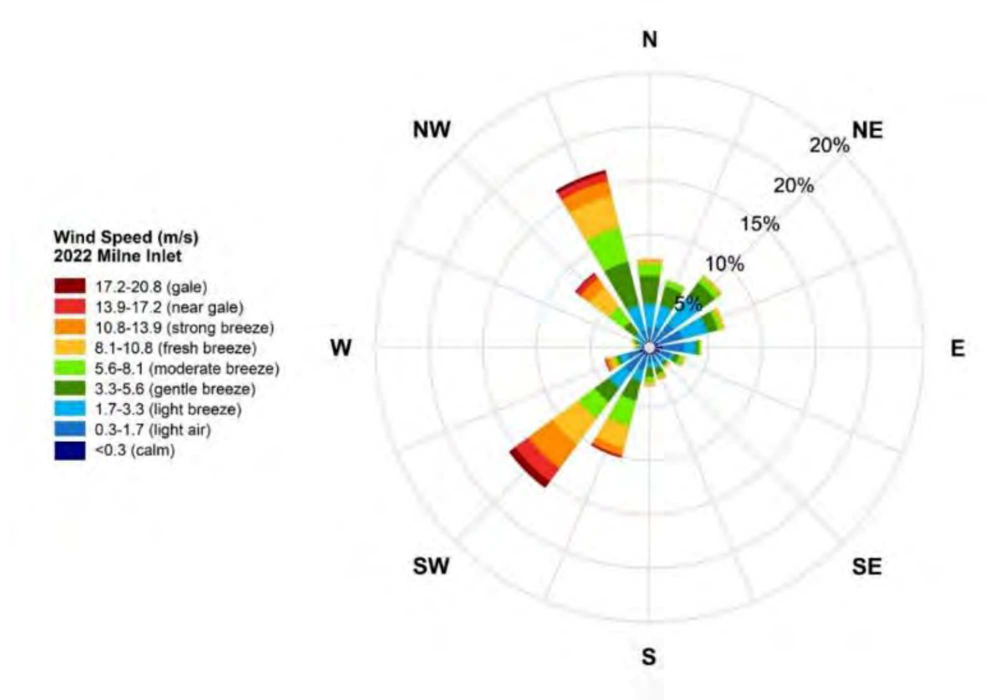


Figure 4-7. **The cumulative proportions of wind speeds and directions at the Milne Port meteorological station in 2022.**

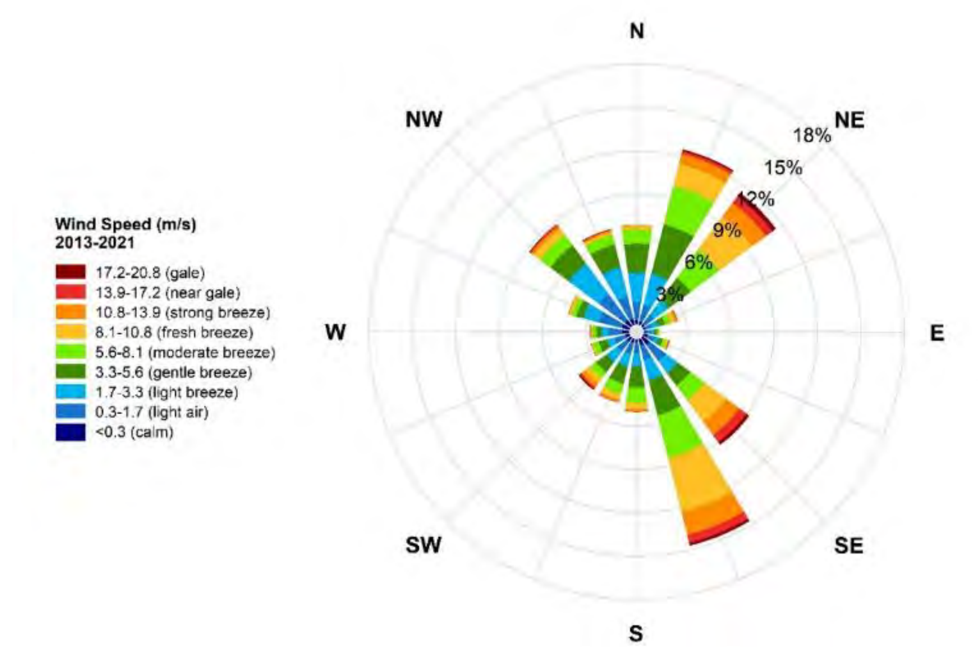


Figure 4-8. **The cumulative proportions of wind speeds and directions at the Milne Port meteorological station from 2013 to 2021.**

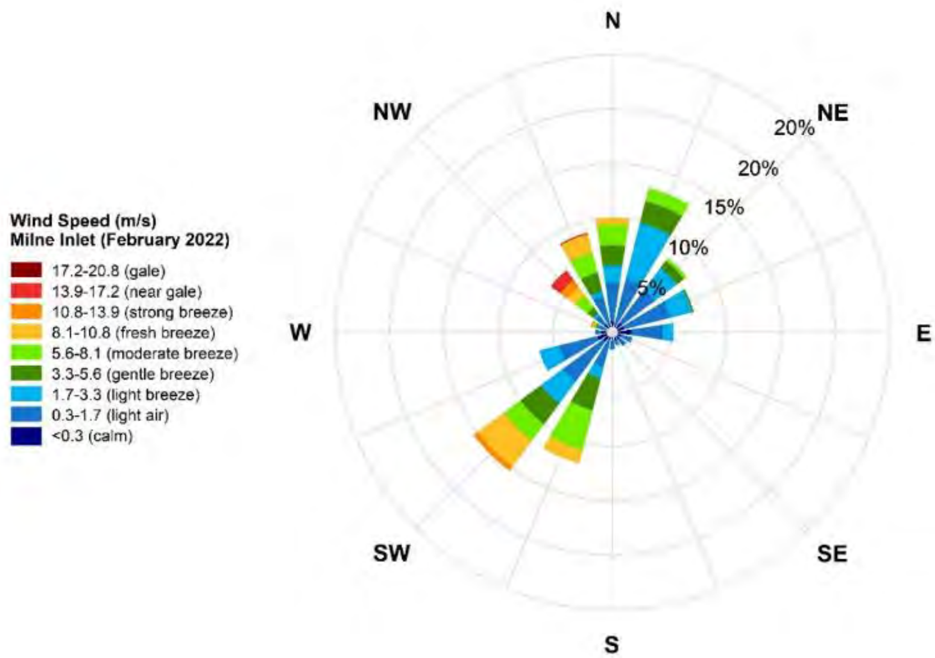


Figure 4-9. Representative winter wind pattern at the Milne Port meteorological station in February 2022.

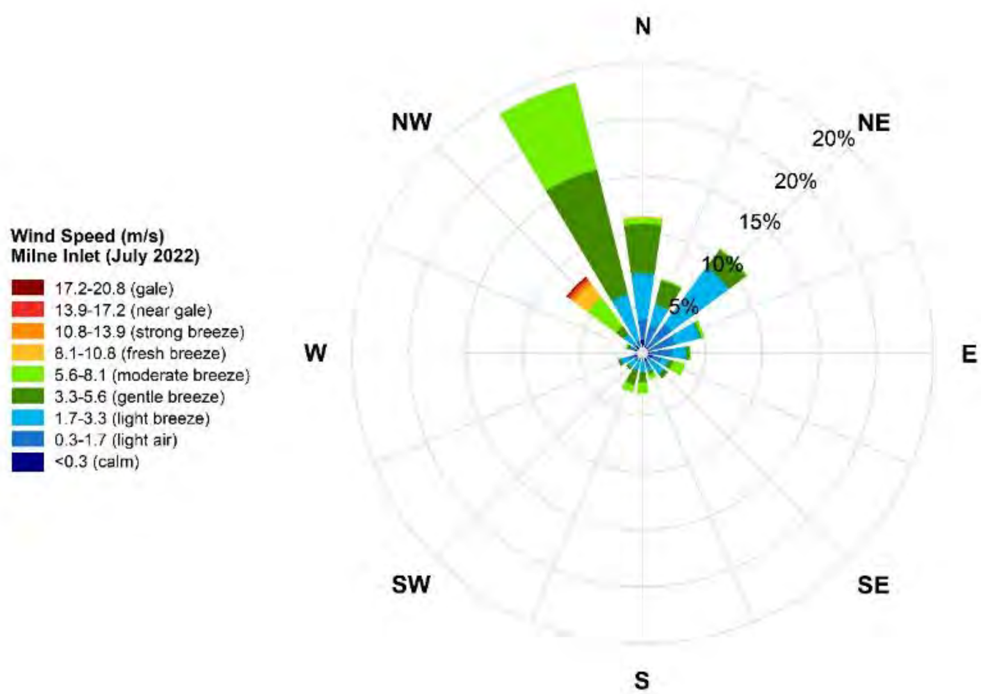


Figure 4-10. Representative summer wind pattern at the Milne Port meteorological station in July 2022.

5 HELICOPTER OVERFLIGHTS

The Nunavut Impact Review Board (NIRB) Project Certificate No. 005 Amendment 3 includes three Project Conditions (PCs) to confirm that disturbance to birds and wildlife caused by aircraft at the Mary River Project (the Project) is minimized whenever possible (Nunavut Impact Review Board 2020). The conditions are as follows:

- **PC #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…"*
- **PC #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 1,500 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."*
- **PC #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 Iron Mines Corporation (Baffinland), in collaboration with the Terrestrial Environment Working Group (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). Data from helicopter flight logs were analyzed to determine compliance with these Project Conditions and Baffinland's commitment.

5.1 METHODS

5.1.1 MONITORING HISTORY AND CHANGES IN ANALYTICAL PROCEDURES

When the helicopter overflight analysis initially began in 2015, compliance was reported based on the elevation above the ground of points using data from helicopter flight logs. As of 2017, the pilot rationale for low-level flights were included in flight logs and used in compliance evaluation. During 2020 TEWG meetings, additional reporting on helicopter pilot rationale and flight time was requested (Baffinland Iron Mines Corporation 2020). Therefore, the helicopter flight database used for assessing compliance was re-analyzed from 2017 to 2019 and incorporated into the 2020 analysis to address this request. The 2017 to 2019 re-analysis results were previously presented in Appendix D of the 2020 Terrestrial Environment Annual Monitoring Report (TEAMR) (EDI Environmental Dynamics Inc. 2021).

In their commentary to the 2020 TEAMR (refer to comment GN AR#02; Nunavut Impact Review Board 2021), the Government of Nunavut (GN) requested a reanalysis of the 2015 and 2016 helicopter overflight data using the methods described in this section. Only the flight time portion of the analysis could be conducted. The re-analysis results were presented in Appendix B of the 2021 TEAMR (EDI Environmental Dynamics Inc. 2022a). No analysis was completed regarding the pilot rationale because that information was not collected in 2015 and 2016.

5.1.2 MONITORING AND DATA ANALYSIS

A discrepancy exists between Project Condition #59 (i.e., which prescribes a cruising altitude requirement of 610 metres above ground level (magl) in areas likely to have migratory birds) and Project Condition #71 (i.e., which prescribes a cruising altitude requirement of 650 magl in areas likely to have migratory birds). Considering that most (if not all) areas where Baffinland operated from May through September 2022 were likely to have migratory birds present, the default minimum cruising altitude for the analysis was 650 magl.

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

- 1,100 magl while travelling within the key moulting area for Snow Geese during the moulting season (July and August), or maintaining 1,500 m horizontal distance from the boundary of the key moulting area (the combined areas hereafter referred to as the Snow Geese area);
- 650 magl during point-to-point travel in areas outside the Snow Geese area during the moulting season, and in all areas in all other months; and,
- 1,100 magl and 1,500 m horizontal distance from observed concentrations of migratory birds year-round (i.e., all months).

Canadian Helicopters supplied flight tracklog data and daily pilot timesheets (with flight details) to provide context and further explain the need for transits that did not meet cruising altitude requirements. Point data were provided in feet above sea level and converted to metres above sea level (masl). A Digital Elevation Model (DEM) was used to estimate ground-level elevation above sea level, which provided elevation data to calculate the helicopter tracklog's altitude above ground level. To calculate the elevation above ground level in metres (i.e., magl) at each tracklog point, the masl from the DEM was subtracted from the masl from the helicopter tracklog.

Quality Assurance/Quality Control procedures were completed by comparing calculated values in relation to the status field of the flight tracklog data. It was assumed that when the helicopter status was 'TakeOff' or 'Landing Time', the elevation would be at or close to 0 magl. With a sample size of 12,253 points, the average elevation above ground level was 5.3 m. The standard deviation in 2022 indicated accuracy was approximately ±7.6 m.

The flight tracklog points were joined with the pilot rationale from daily timesheets and converted to flight line segments for analysis. Each line segment represented a straight line between two consecutive flight tracklog points within the same transit. Tracklog points were recorded approximately every two minutes during flight, resulting in line segments with a duration two minutes, but of variable length, depending on the flight speed. The flight time and minimum cruising altitude were calculated for each flight line segment. Flight time was calculated for each pilot rationale stated in the daily timesheets.

Data were split into two categories: (1) data within the Snow Geese area during the moulting season (July and August) in relation to the 1,100 magl cruising altitude and 1,500 m horizontal distance requirement; and (2) data outside the Snow Geese area during the moulting season, and in all areas during all other months, in relation to the 650 magl cruising altitude requirement. The datasets were then analyzed separately to assess specific cruising altitude allowances using the different areas and minimum cruising altitude requirements. The first and last flight line segments of a flight as the helicopter takes off or lands were considered compliant, despite being below the cruising altitude requirement. Flight data with rationale for flying at lower elevations than required were deemed "compliant with rationale". Based on these criteria, flight data were organized into six categories described in Table 5-1.

Table 5-1. Helicopter overflight compliant categories.

Compliant Category	Description
Compliant	Data within the Snow Geese area in July and August where the 1,100 magl cruising altitude requirement was achieved.
Compliant	Data outside the Snow Geese area in July and August, and in all areas during all other months, where the 650 magl cruising altitude requirement was achieved.
Compliant with rationale	Data within the Snow Geese area in July and August where the 1,100 magl cruising altitude requirement was not achieved, but a rationale for low-level flying was given.
Compliant with rationale	Data outside the Snow Geese area in July and August, and in all areas during all other months, where the 650 magl cruising altitude requirement was not achieved, but a rationale for low-level flying was given.
Non-compliant	Data within the Snow Geese area in July and August where the 1,100 magl cruising altitude requirement was not achieved and no rationale for low-level flying was given.
Non-compliant	Data outside the Snow Geese area in July and August, and in all areas during all other months, where the 650 magl cruising altitude requirement was not achieved and no rationale for low-level flying was given.

To comply with the horizontal guidelines, pilots were given the spatial boundaries of any identified concentrations of migratory birds, buffered by the required 1,500 m horizontal avoidance distance. The boundaries were programmed into the helicopter GPS and pilots were directed to avoid flying in these areas as specified in the *Canadian Helicopters Instructions Local Operating Procedures* Checklist. The only area provided for horizontal avoidance and analysis in 2022 was the key moulting area for Snow Geese provided by Environment and Climate Change Canada.

5.2 RESULTS AND DISCUSSION

5.2.1 COMPLIANCE

Only the Snow Geese key moulting area was identified for helicopter avoidance in 2022; no locations or boundaries of areas prescribed explicitly by the TEWG or areas of observed concentrations of other migratory birds were identified in 2022, As a result, except for the Snow Geese area, no analysis was required to determine compliance of 1,100 m vertical and 1,500 m horizontal distance of any other location. No known public complaints were recorded in 2022 about helicopter overflights that required specific follow-up actions.

In 2022, Canadian Helicopters operated four helicopters during the summer season, a decrease of two helicopters compared to 2021. Two helicopters supported Baffinland's environmental programs in 2022, arriving on site May 9 and May 29 and departing the site September 19 and October 17. Two helicopters supported Baffinland's drilling and exploration programs in 2022, arriving on site May 17 and June 4 and departing the site September 30 and September 17.

A total of 2,691 transits were flown from May to September 2022, of which 112 (4.2%) intersected the Snow Geese area (key moulting area plus the 1,500 m horizontal buffer; all months) during the moulting season (July and August), and 2,579 (95.8%) were outside the Snow Geese area and in all areas in other months (Table 5-2). The total flight time was 1,693.93 hours, accounting for 48.68% of the total available hours from May 9 when the first helicopter arrived on site to September 30 (480 hours). Within the Snow Geese area during the moulting season, 21.64 hours (1.28%) were flown, and outside the Snow Geese area and in all areas in other months 1,672.29 hours (98.72%) were flown (Table 5-3).

Pilots made efforts to avoid the Snow Geese area during the 2022 moulting season (July and August) whenever possible, as only 4.16% of all transits and 1.28% of total flight hours were flown within the Snow Geese area during this time. These flight hours account for 1.45% of the total available hours during the two months of the moulting period (1,488 hours). Cruising altitude compliance within the Snow Geese area during the moulting season was 40.77% compliant, 30.04% compliant with rationale and 29.19% non-compliant (Table 5-4; Map 5-3 and Map 5-4). Combined compliance (compliant plus compliant with rationale) was higher in July (83.45%) than August (64.13%). August had approximately double the flight hours (14.2 hours) of July (7.4 hours). Non-compliant flights were primarily related to the environmental monitoring of lakes and transits to Steensby Inlet. All non-compliant flights within the Snow Geese area were along the eastern edge, away from the core of the Snow Geese area identified as having higher concentrations of geese (Map 5-3 and Map 5-4).

Pilots maintain a 1,100 m vertical distance above ground level when flying within the Snow Geese area during the moulting season whenever possible. If this cruising altitude is not possible for safety or operational reasons, pilots maintain a 1,500 m horizontal distance if the flight path allows. However, this 1,500 m horizontal buffer is not always practical as it results in longer flight times, which prolongs disturbance. As an alternative, pilots sometimes fly over the eastern edge of the Snow Geese area. Baffinland understands that Snow Geese are typically concentrated in the core of the moulting area and are seldom present near the edges;

therefore, disturbance to birds under flight paths at the edge of the Snow Geese area is expected to be minimal. This alternative reduces the overall flight time and associated disturbance. Flights within the Snow Geese area are considered non-compliant if they do not meet the altitude requirements or are not provided rationale in the pilot daily timesheets.

Overall, compliance in all areas for all months between May and September 2022 was 42.22% compliant, 53.50% compliant with rationale and 4.28% non-compliant (Table 5-5; Map 5-1 to Map 5-5). Combined compliance (compliant plus compliant with rationale) was between 95.12 and 97.54% for all months except May, which was 69.09%. May had the lowest number of flights and flight hours at 22 flights and 7.75 hours, respectively. Non-compliant flights in May consisted of two ferry flights to the Mine Site and some dustfall monitoring program flights. Other non-compliant flights during the other months tended to follow defined flight corridors to work areas and monitoring sites such as Brucehead, Steensby Inlet, surrounding lakes, and survey sites (Map 5-1 to Map 5-5). No flights went to Eqe Bay in 2022.

Table 5-2. The number of transits flown per month with a breakdown of transits (№ and %) flown within and outside the Snow Geese area, May 1 to September 30, 2022.

Month	Total № of Transits	Within Snow Geese Area During Moulting Season (July and August)		Outside Snow Geese Area During Moulting Season and all areas in other months	
		№ of Transits	% Transits	№ of Transits	% Transits
May	22	-	-	22	100.0
June	529	-	-	529	100.0
July	999	40	4.0	959	96.0
August	838	72	8.6	766	91.4
September	303	-	-	303	100.0
Total	**2,691**	**112**	**4.2**	**2,579**	**95.8**

Table 5-3. Number of flight hours per month with a breakdown of flight time (hours and %) flown within and outside the Snow Geese area, May 1 to September 30, 2022.

Month	Total Hours per Month	Total Flight Hours	Within Snow Geese Area During Moulting Season (July and August)		Outside Snow Geese Area During Moulting Season and all areas in other months	
			Flight Hours	% Flight Time	Flight Hours	% Flight Time
May	552[1]	7.75	-	-	7.75	100.00
June	720	318.06	-	-	318.06	100.00
July	744	528.43	7.48	1.42	520.95	98.58
August	744	639.78	14.16	2.21	625.62	97.79
September	744	199.91	-	-	199.91	100.00
Total	**3,480**	**1,693.93**	**21.64**	**1.28**	**1,672.29**	**98.72**

[1] First helicopter arrived May 9

Table 5-4. Number of flight hours of cruising altitude compliance (≥ 1,100 magl) within the Snow Geese area during the moulting season, July 1 to August 31, 2022.

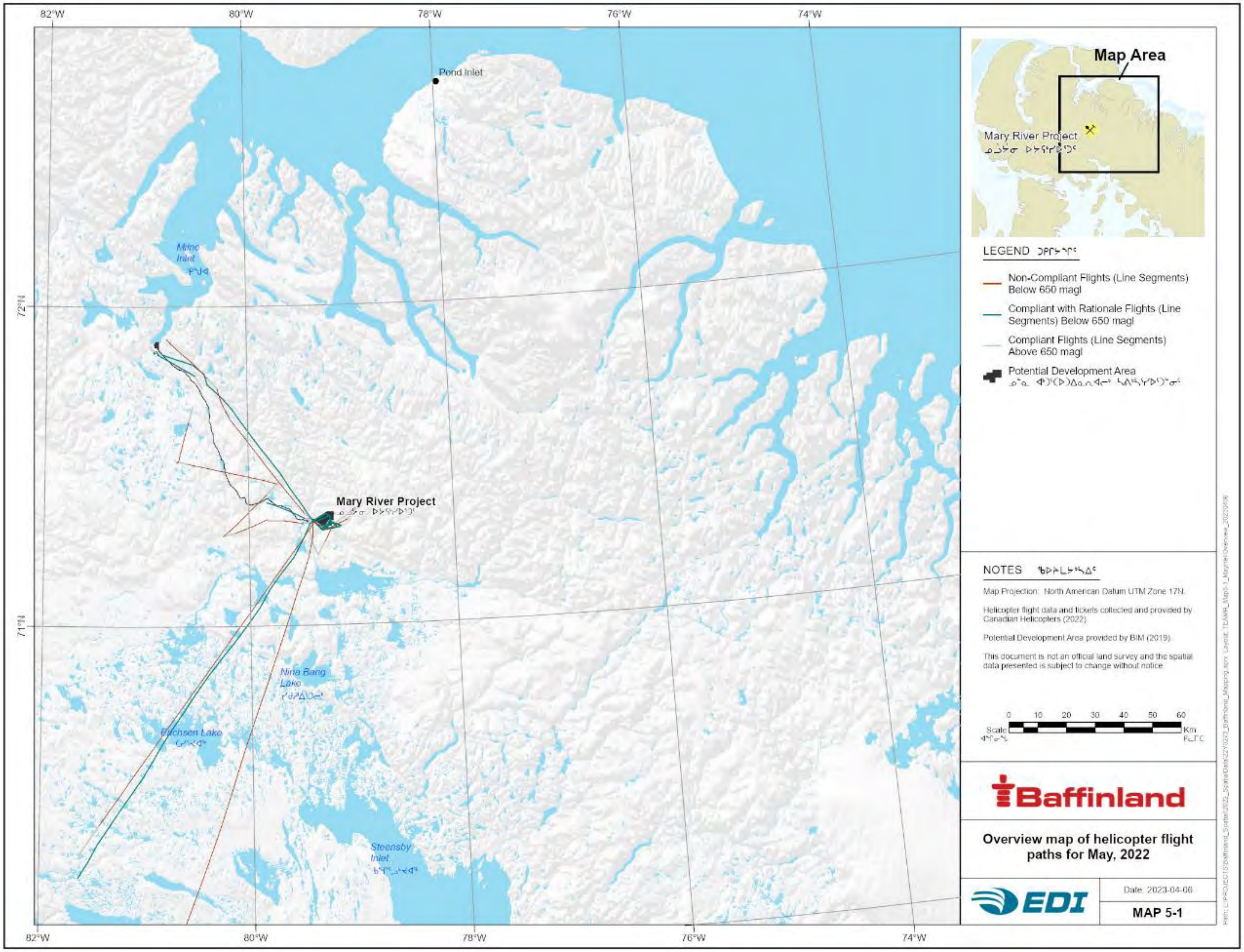
Month	Area	Total Hours per Month	Total Flight Hours	Compliant		Compliant with Rationale		Combined Compliance	Non-compliant	
				hrs	%	hrs	%	%	hrs	%
July	Within SNGO[1] Area	744	7.475	4.940	66.087	1.298	17.365	83.452	1.237	16.548
August	Within SNGO[1] Area	744	14.163	3.881	27.402	5.202	36.730	64.132	5.080	35.868
Total		**1,488**	**21.638**	**8.821**	**40.766**	**6.500**	**30.040**	**70.806**	**6.317**	**29.194**

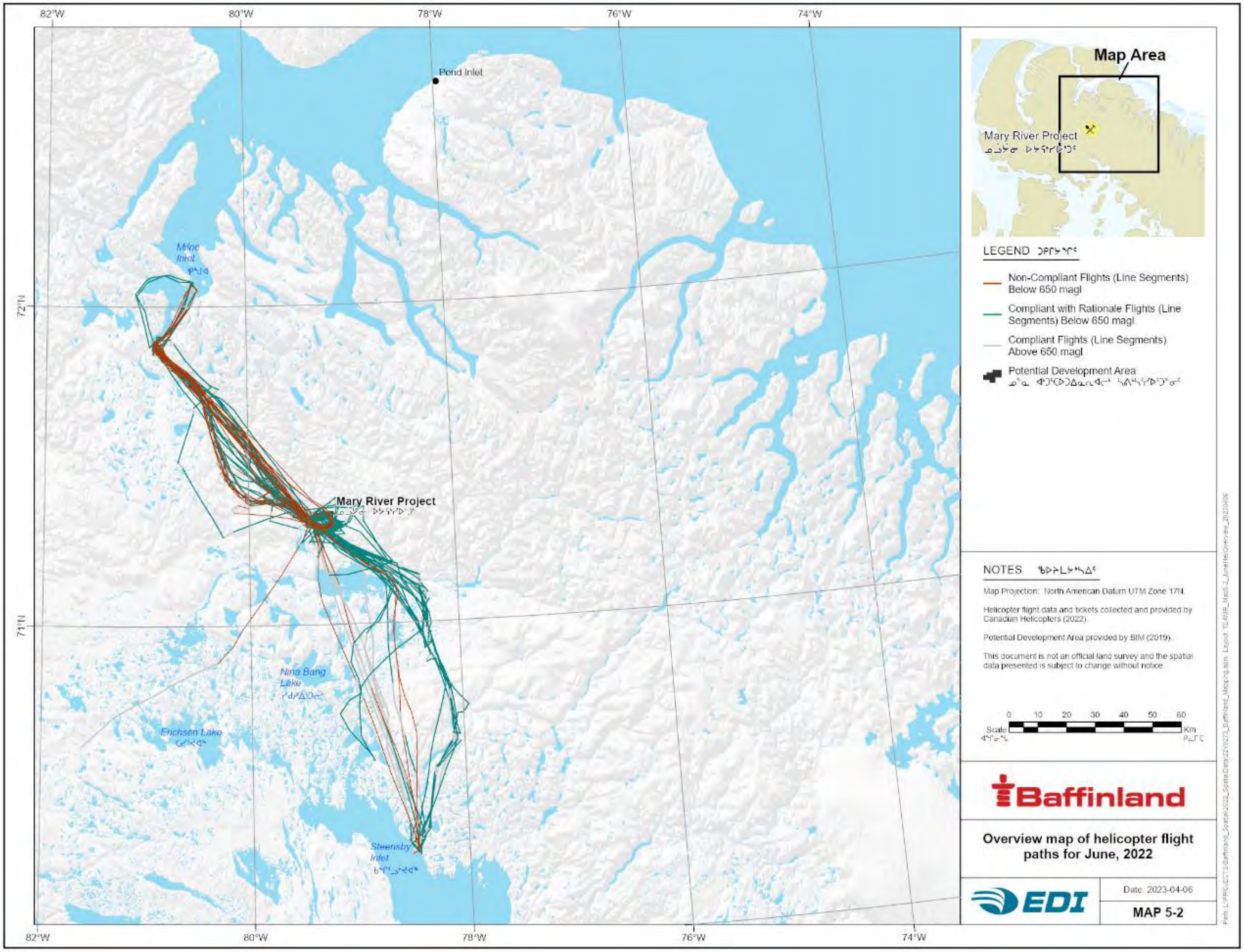
[1] SNGO = Snow Geese

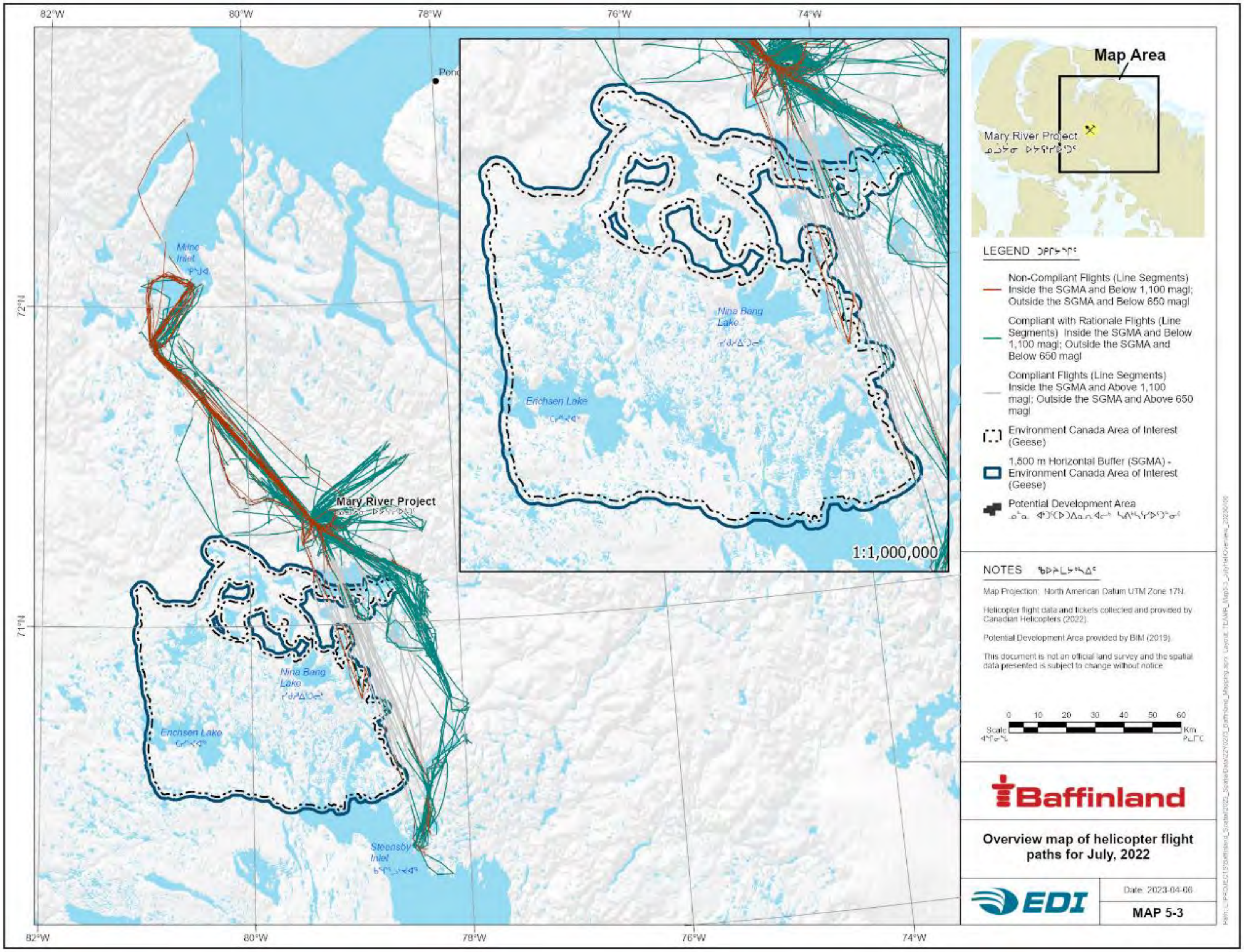
Table 5-5. Number of flight hours of overall cruising altitude compliance in all areas for all months between May 1 to September 30, 2022.

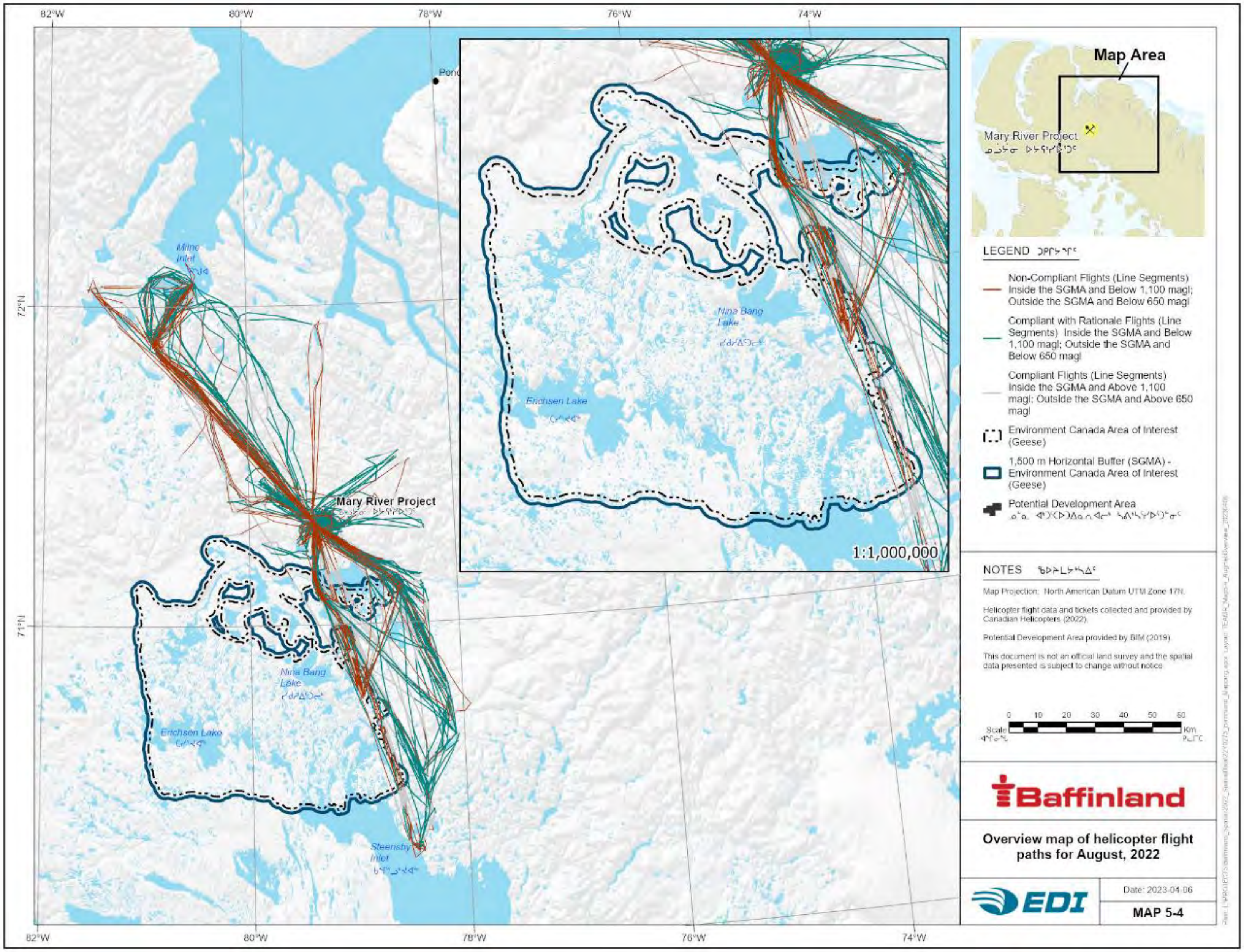
Month	Area	Total Hours per Month	Total Flight Hours	Compliant		Compliant with Rationale		Combined Compliance	Non-compliant	
				hrs	%	hrs	%	%	hrs	%
May	All Areas	552[1]	7.751	2.891	37.299	2.464	31.789	69.088	2.396	30.912
June	All Areas	720	318.065	110.998	34.898	192.333	60.470	95.368	14.734	4.632
July	All Areas	744	528.428	256.114	48.467	253.199	47.916	96.383	19.115	3.617
August	All Areas	744	639.778	297.899	46.563	310.622	48.552	95.115	31.257	4.885
September	All Areas	720	199.912	47.301	23.660	147.694	73.880	97.540	4.917	2.460
Total		**3480**	**1,693.934**	**715.203**	**42.221**	**906.312**	**53.504**	**95.725**	**72.419**	**4.275**

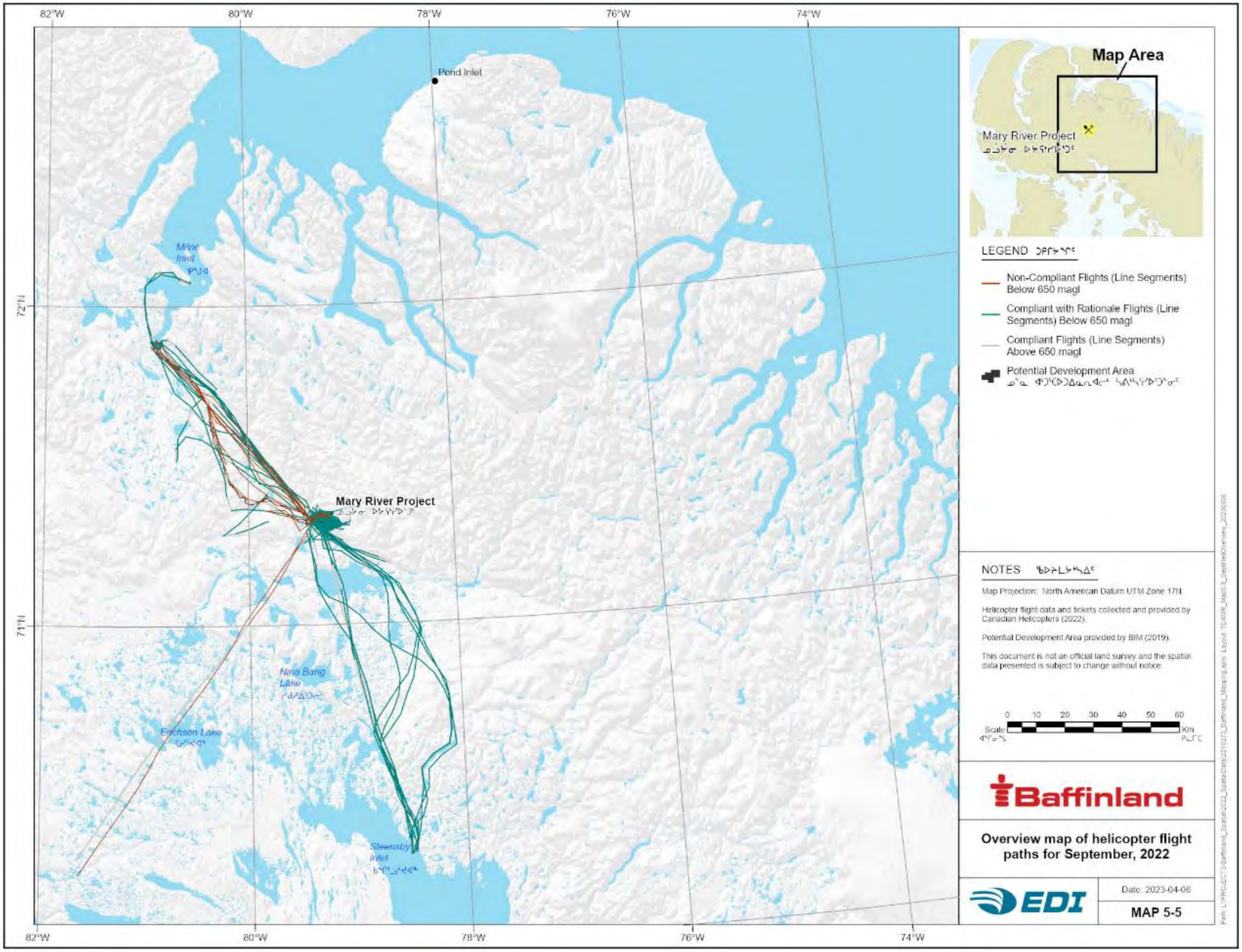
[1] First helicopter arrived May 9


Map Area
Mary River Project
Pond Inlet
Milne Inlet
Mary River Project
Nina Bang Lake
Angajurjualuk Lake
Eqalulik Lake
Steensby Inlet
82°W
80°W
78°W
76°W
74°W
72°N
71°N
LEGEND
Non-Compliant Flights (Line Segments) Below 650 magl
Compliant with Rationale Flights (Line Segments) Below 650 magl
Compliant Flights (Line Segments) Above 650 magl
Potential Development Area
NOTES
Map Projection: North American Datum UTM Zone 17N.
Helicopter flight data and tickets collected and provided by Canadian Helicopters (2022).
Potential Development Area provided by BIM (2019).
This document is not an official land survey and the spatial data presented is subject to change without notice.
0 10 20 30 40 50 60
Scale
Km
Baffinland
Overview map of helicopter flight paths for May, 2022
EDI
Date: 2023-04-06
MAP 5-1


Pond Inlet
Milne Inlet
Mary River Project
Nina Bang Lake
Erichsen Lake
Steensby Inlet
Map Area
LEGEND
Non-Compliant Flights (Line Segments) Below 650 magl
Compliant with Rationale Flights (Line Segments) Below 650 magl
Compliant Flights (Line Segments) Above 650 magl
Potential Development Area
NOTES
Map Projection: North American Datum UTM Zone 17N.
Helicopter flight data and tickets collected and provided by Canadian Helicopters (2022).
Potential Development Area provided by BIM (2019).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
Km
Baffinland
Overview map of helicopter flight paths for June, 2022
EDI
Date: 2023-04-06
MAP 5-2


Map Area
Mary River Project
LEGEND
Non-Compliant Flights (Line Segments) Inside the SGMA and Below 1,100 magl; Outside the SGMA and Below 650 magl
Compliant with Rationale Flights (Line Segments) Inside the SGMA and Below 1,100 magl; Outside the SGMA and Below 650 magl
Compliant Flights (Line Segments) Inside the SGMA and Above 1,100 magl; Outside the SGMA and Above 650 magl
Environment Canada Area of Interest (Geese)
1,500 m Horizontal Buffer (SGMA) - 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 (2022).
Potential Development Area provided by BIM (2019).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
Km
0 10 20 30 40 50 60
1:1,000,000
Milne Inlet
Nina Bang Lake
Erichsen Lake
Steensby Inlet
Mary River Project
82°W
80°W
78°W
76°W
74°W
72°N
71°N
Baffinland
Overview map of helicopter flight paths for July, 2022
EDI
Date: 2023-04-08
MAP 5-3


Map Area
Mary River Project
Milne Inlet
Mary River Project
Nina Bang Lake
Erichsen Lake
Steensby Inlet
1:1,000,000
LEGEND
Non-Compliant Flights (Line Segments) Inside the SGMA and Below 1,100 magl; Outside the SGMA and Below 650 magl
Compliant with Rationale Flights (Line Segments) Inside the SGMA and Below 1,100 magl; Outside the SGMA and Below 650 magl
Compliant Flights (Line Segments) Inside the SGMA and Above 1,100 magl; Outside the SGMA and Above 650 magl
Environment Canada Area of Interest (Geese)
1,500 m Horizontal Buffer (SGMA) - 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 (2022).
Potential Development Area provided by BIM (2019).
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 August, 2022
EDI
Date: 2023-04-06
MAP 5-4


82°W
80°W
78°W
76°W
74°W
72°N
71°N
Pond Inlet
Milne Inlet
Mary River Project
Nina Bang Lake
Erichsen Lake
Steensby Inlet
Map Area
Mary River Project
LEGEND
Non-Compliant Flights (Line Segments) Below 650 magl
Compliant with Rationale Flights (Line Segments) Below 650 magl
Compliant Flights (Line Segments) Above 650 magl
Potential Development Area
NOTES
Map Projection: North American Datum UTM Zone 17N.
Helicopter flight data and tickets collected and provided by Canadian Helicopters (2022).
Potential Development Area provided by BIM (2019).
This document is not an official land survey and the spatial data presented is subject to change without notice.
0 10 20 30 40 50 60
Scale
Km
Baffinland
Overview map of helicopter flight paths for September, 2022
EDI
Date: 2023-04-06
MAP 5-5

5.2.2 COMPLIANCE RATIONALE

Cruising altitude data were cross-referenced with pilot rationale from daily timesheets for the sixth consecutive year in 2022. For analytical purposes, flight line segments were designated as either:

- **compliant** — if/when cruising altitude requirements were followed;
- **compliant with rationale** — if/when cruising altitude requirements were not met, but pilot discretionary rationale was provided (refer to Table 5-5 for rationale categories and descriptors); or,
- **non-compliant** — if/when cruising altitude requirements were not met, and explanation and/or rationale were not provided.

A breakdown of primary low-level flight hours with rationale for 2022 is provided in Table 5-7. Flights with justification from pilot daily timesheets accounted for 53.50% of the total flight hours, lower than in 2021 (57.49%). Within the Snow Geese area during the moulting season, where the cruising altitude requirement is ≥1,100 magl, compliant with rationale flights accounted for 0.38% of the total flight hours. Outside the Snow Geese area and in all areas in all other months where the cruising altitude requirement is ≥650 magl, compliant with rationale flights accounted for 53.12% of the total flight hours.

Low-level flights with rationale will likely continue in future years as most of the helicopter work conducted at the Project requires either low-level flying for safety and operational reasons (e.g., slinging, surveys) or 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 2022, the most common reason for flying below the cruising altitude requirements was the short distance at 48.34% of the total flight hours, with slinging, surveying, and weather the next common reasons between 1% and 2% (Table 5-7). With the protocol implemented in 2021 (summarized in EDI Environmental Dynamics Inc. 2022) requiring helicopters to travel around the Snow Geese area during moulting season on poor weather days, only 0.5 hours of low-level flights with weather rationale were flown within the Snow Goose area during moulting season. The number of flight hours is comparable to 2021 (0.5 hours) and less than 2020 (1.6 hours) before the protocol was implemented.

Overall, 2022 cruising altitude combined compliance was high at 95.73%. The high percentage was due primarily to the inclusion of rationale provided by pilots for many of the transits flown below the cruising altitude requirements, as well as improved documentation (i.e., enhanced communications) of the rationale for low-level flights by pilots and Baffinland staff over the years.

Non-compliant flight line segments were those that did not achieve cruising altitude requirements and where no rationale for low-level flying was provided. Some non-compliant flight line segments included the ferrying flights to and from the Project at the start and end of the season and approaches and departures. Currently, only the first and last flight segments can be identified as takeoff or landing segments because the time and distance to reach the required cruising altitude (if reached at all) varies between flights. However, it may take multiple flight segments for a helicopter to reach or land from the required cruising altitude, resulting in non-compliant or compliant with rationale intermediary flight segments. These non-compliant segments should be considered compliant with rationale because the helicopter must ascend to or descend from cruising altitude. Non-compliant flight segments may also result from a constant flight altitude over undulating terrain. Baffinland will continue to work with Canadian Helicopters to document cruising altitude compliance and communicate elevation requirements to pilots throughout the flying season.

Table 5-6. Descriptions of pilot rationales given for low-level flights[1,2].

Rationale	Description
Drop off/pick up	The distance between take-off and landing sites does not allow enough time to gain 650 magl; the topography between sites, particularly around the drill locations, has large elevation changes over a short distance that does not allow the helicopter to reach 650 magl or it is not practical for the helicopter to climb to 650 magl (e.g., when descending from Nuluujaak Mountain).
Survey	Includes geological and environmental surveys that can involve short duration flights between survey points that do not allow enough time to gain 650 magl; some surveys require low-level flying as part of the survey method, such as flying a low-level grid pattern for a geotechnical survey, keeping a sensor at a constant elevation relative to the ground.
Slinging	Helicopters slinging heavy loads fly low for safety purposes, so if there is an issue, the load can be quickly lowered to the ground in a controlled manner or dropped and visual reference of the landing location is maintained.
Short distance	The short distance between take-off and landing sites does not allow enough time to gain 650 magl.
Sampling	Sampling can involve short duration flights between sampling points that do not allow enough time to gain 650 magl.
Staking	Very low-level flying is required while staking out a grid as stakes are deployed from the helicopter during transit and crew members are in and out of the helicopter at grid corners.
Weather	Poor visibility associated with low cloud restricts pilots to flying below the cloud line, which is under 650 magl; high winds and/or flat light conditions (which reduces a pilot's depth-of-field causing poor ground reference) can make it difficult to maintain a consistent 650 magl flight height.
Mobilization/Demobilization	Ferrying of the aircraft to and from the Project where operational constraints (e.g., fuel capacity and flight range) were a factor.
Other	The nature of the flight requires low-level flying or short distances/durations (e.g., inspections, maintenance flights, evacuations, and search and rescue).

1 Descriptions are stated with a cruising altitude requirement of 650 magl and apply to a cruising altitude requirement of 1,100 magl in the Snow Geese area during the moulting season (July and August).

2 Collaborative discussions with the GN and TEWG have been held regarding amendment and/or refinement of the rationale categories. Updated rationale categories and descriptors will provided in the 2023 TEAMR.

Table 5-7. Helicopter compliant with rationale flight hours summarized according to pilot rationale for flights within the ≥1,100 magl and ≥650 magl cruising altitude requirements, May 1 to September 30, 2022.

Rationale	Total Hours	Flight Hours	% of Total Flight Hours	≥1,100 magl Cruising Altitude Requirement		≥650 magl Cruising Altitude Requirement	
				Flight Hours	% of Total Flight Hours	Flight Hours	% of Total Flight Hours
Drop off/pick up	3480	8.99	0.53	0.00	0.00	8.99	0.53
Survey	3480	19.78	1.17	0.34	0.02	19.44	1.15
Slinging	2480	33.18	1.96	1.01	0.06	32.17	1.90
Short distance	3480	818.86	48.34	4.62	0.27	814.23	48.07
Sampling	3480	0.87	0.05	0.00	0.00	0.87	0.05
Weather	3480	19.65	1.16	0.52	0.03	19.13	1.13
Mobilization/ Demobilization	3480	0.73	0.04	0.00	0.00	0.73	0.04
Other	3480	4.26	0.25	0.00	0.00	4.26	0.25
Total	**3480**	**906.31**	**53.50**	**6.50**	**0.38**	**899.81**	**53.12**

5.2.3 INTER-ANNUAL TRENDS

Flights within the Snow Geese area during the moulting season have decreased over the last eight years, from 14.6% of transits and 5.59% of flight hours in 2015 down to 4.2% of transits and 1.28% of flight hours in 2022 (Figure 5-1, Table 5-8 and Table 5-9). The number of transits decreased by 2.6%, and flight hours decreased by 0.26% from 2021. The percent of disturbance hours, 48.68%, calculated as the total flight hours divided by the total hours of the active helicopter period (varies between years), was similar to the last four years (45.24% to 50.64%) with the exception of 2020 (26.90%).

Helicopter cruising altitude combined compliance within the Snow Geese area during the moulting season was 71% (41% compliant and 30% compliant with rationale) in 2022 (Table 5-4). Compliance, including compliance with rationale, for 2022 was higher than 2015 (49%) and 2016 (11%), similar to 2021 (72%), but still below combined compliance seen between 2017 and 2020, which ranged from 82% to 94% (Figure 5-1). However, 2022 had a lower number of flight hours than 2017, 2018 and 2019, which means a single non-compliant flight in 2022 would have a larger effect on the relative percentages. Helicopter cruising altitude combined compliance outside the Snow Geese area during the moulting season and in all areas during all other months for 2022 was 95.75%, similar to 2018 and 2020 (around 96%) and an increase over 2021 (93%; Figure 5-2).

The top pilot rationale for low-level flights 2022 was short distance compared to slinging in 2018, 2020 and 2021. However, 85% of the 2022 short-distance flights had slinging as a secondary reason. Slinging, survey, weather, and drop off/pick up were among the top pilot rationale for previous years, with the percentage of total flight hours ranging from 0.5 to 48.3% (Table 5-10).

Table 5-8. Number of transits flown per year with a breakdown of transits (№ and %) within the ≥1,100 magl and ≥650 magl cruising altitude requirements, 2015 to 2022.

Year	Total № of Transits	≥1,100 magl Cruising Altitude Requirement		≥650 magl Cruising Altitude Requirement	
		№ of Transits	% Transits	№ of Transits	% Transits
2015	919	134	14.6	785	85.4
2016	1,063	175	16.5	888	83.5
2017	1,345	205	15.2	1,140	84.8
2018	2,489	198	8.0	2,291	92.0
2019	3,110	207	7.0	2,903	93.0
2020	1,863	77	4.0	1,786	96.0
2021	2,560	175	6.8	2,385	93.2
2022	2,691	112	4.2	2,579	95.8

Table 5-9. Number of flight hours per year with a breakdown of flight time (hours and %) within the ≥1,100 magl and ≥650 magl cruising altitude requirements, 2015 to 2022.

Year	Total Hours	Total Flight Hours	% Disturbance Hours	≥1,100 magl Cruising Altitude Requirement		≥650 magl Cruising Altitude Requirement	
				Flight Hours	% Flight Hours	Flight Hours	% Flight Hours
2015	3,192	893.07	27.98	50.84	5.69	842.23	94.31
2016	2,616	589.52	22.54	34.05	5.78	555.47	94.22
2017	3,096	762.15	24.62	45.30	5.94	716.85	94.06
2018	3,360	1,701.60	50.64	35.31	2.07	1,666.30	97.93
2019	3,120	1,411.63	45.24	26.82	1.90	1,384.81	98.10
2020	3,168	852.34	26.90	15.05	1.77	837.29	98.23
2021	3,024	1,440.60	47.64	22.09	1.53	1,418.51	98.47
2022	3,480	1,693.93	48.68	21.64	1.28	1,672.30	98.72

Total flight hours increased in 2022 to numbers similar to 2018 (Table 5-11). The percentage of compliant flight hours increased to 42.2%, the highest percentage since 2016 (45.0%) before pilot rationale was included. The compliant with rationale percentage decreased to 53.5%, the second lowest next to 2017 (41.8%). The percentage of non-compliant flights also decreased, dropping from 7.8% in 2021 to 4.3% in 2022.

During the moulting season within the Snow Geese area, with a cruising altitude requirement of ≥1,100 magl, the percentage of compliant flight hours doubled from 20.1% to 40.8% from 2021 to 2022, the highest percentage since 2015 (49.1%; Table 5-12). This increase was accompanied by a comparable decrease in the percentage of compliant with rationale flights (21.9% decrease). The percentage of non-compliant flights was 1.3% higher in 2022 than 2021, but both years had approximately 6 hours of non-compliant flight time. The total number of hours flown within the 1,100 magl cruising altitude requirement in 2022 was similar to 2021, with both years close to 22 hours. The 2022 compliance to the ≥650 magl cruising altitude requirement followed a similar pattern as overall compliance, with an increase in the percentage of compliant flight hours and a decrease in the percentage of non-compliant flight hours.

Figure 5-1. Percent compliance and total flight hours for flights within the Snow Geese (SNGO) area during the moulting season, 2015 to 2022.

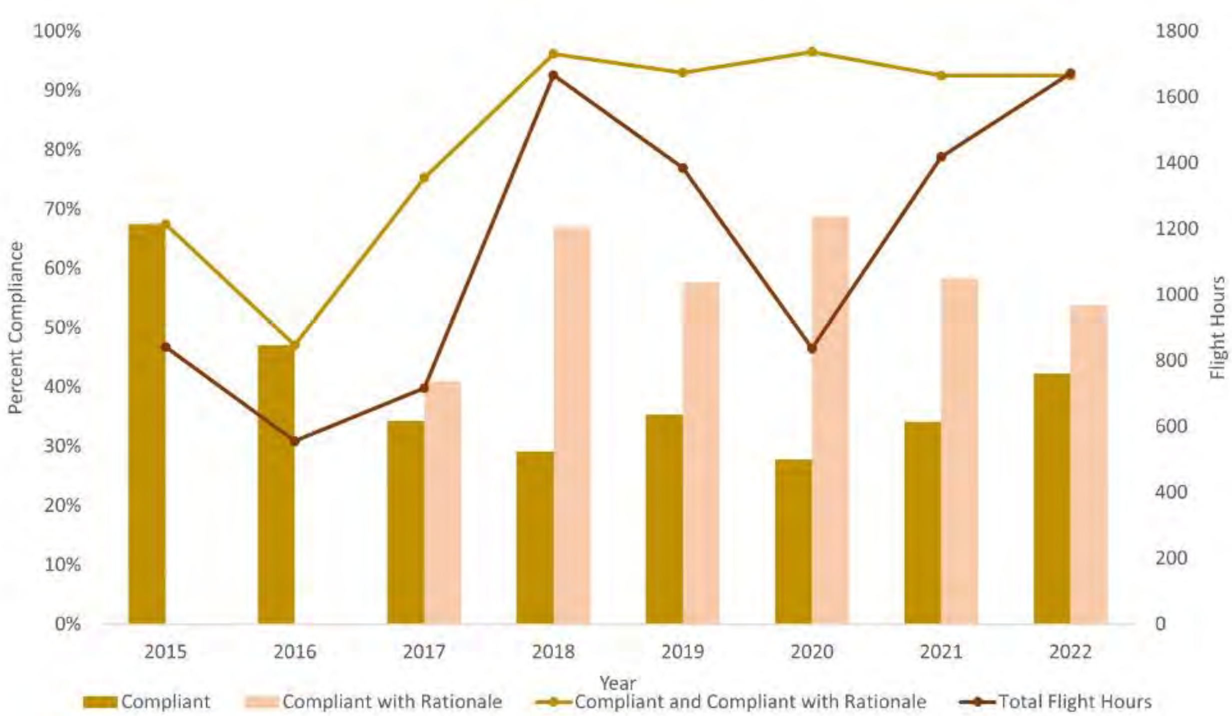


Figure 5-2. Percent compliance and total flight hours for flights outside the Snow Geese area during the moulting season and in all areas in all other months, 2015 to 2022.

Table 5-10. Flight hours and percentage of total flight hours for 'compliant with rationale' flights summarized by rationale category, 2017 to 2022.

Rationale	2017		2018		2019		2020		2021		2022	
	hrs	%[1]	hrs	%[1]	hrs	%[1]	hrs	%[1]	hrs	%[1]	hrs	%[1]
Drop off/pick up	63.20	8.29	277.22	16.29	326.26	23.11	132.26	15.52	73.30	5.09	8.99	0.53
Survey	36.12	4.74	288.85	16.98	176.21	12.48	67.55	7.93	27.13	1.88	19.78	1.17
Slinging	114.58	15.03	486.91	28.62	227.87	16.14	292.01	34.26	567.58	39.40	33.18	1.96
Short distance	0.35	0.05	0.00	0.00	0.07	0.00	48.87	5.73	33.12	2.30	818.86	48.34
Sampling	2.17	0.29	11.35	0.67	10.94	0.77	3.27	0.38	34.56	2.40	0.87	0.05
Staking	32.03	4.20	0.00	0.00	17.12	1.21	0.00	0.00	0.00	0.00	0.00	0.00
Weather	57.65	7.56	55.12	3.24	18.55	1.31	39.33	4.61	96.84	6.72	19.65	1.16
Mob/Demob2	12.65	1.66	0.00	0.00	21.22	1.50	0.00	0.00	0.27	0.02	0.73	0.04
Other	0.00	0.00	24.07	1.41	15.02	1.06	2.67	0.31	6.87	0.48	4.26	0.25
Total	318.74	41.82	1,143.52	67.20	813.25	57.61	585.96	68.75	839.67	58.29	906.31	53.50

[1] Percentages are calculated from the Rationale flight hours divided by the total annual flight hours.

[2] Mob/Demob stands for Mobilization/Demobilization.

Table 5-11. Total flight hours and overall cruising altitude compliance by flight hours and percentage, 2015 to 2022.

Year	Total Flight Hours	Compliant		Compliant with Rationale		Combined Compliance	Non-compliant	
		hr	%	hr	%	%	hr	%
2015	893.07	593.38	66.44	n/a	n/a	66.44	299.69	33.56
2016	589.52	265.18	44.98	n/a	n/a	44.98	324.33	55.02
2017	762.15	257.84	33.83	318.74	41.82	75.65	185.56	24.35
2018	1,701.60	490.22	28.81	1,143.52	67.20	96.01	67.86	3.99
2019	1,411.63	500.02	35.42	813.25	57.61	93.03	98.36	6.97
2020	852.34	235.52	27.63	585.96	68.75	96.38	30.86	3.62
2021	1,440.60	488.71	33.92	839.67	58.29	92.21	112.22	7.79
2022	1,693.93	715.20	42.22	906.31	53.50	95.73	72.42	4.28

Table 5-12. Flight hours and overall cruising altitude compliance by flight hours and percentage within the ≥1,100 magl and ≥650 magl cruising altitude requirements, 2015 to 2022.

Year	≥1,100 magl Cruising Altitude Requirement							≥650 magl Cruising Altitude Requirement						
	Flight Hours	Compliant		Compliant with Rationale		Non-compliant		Flight Hours	Compliant		Compliant with Rationale		Non-compliant	
		hr	%	hr	%	hr	%		hr	%	hr	%	hr	%
2015	50.84	24.98	49.13	n/a	n/a	25.86	50.87	842.23	568.40	67.49	n/a	n/a	273.83	32.51
2016	34.05	3.68	10.81	n/a	n/a	30.37	89.19	555.47	261.50	47.08	n/a	n/a	293.96	52.92
2017	45.30	11.89	26.24	25.27	55.78	8.15	17.98	716.85	245.96	34.31	293.47	40.94	177.42	24.75
2018	35.31	3.73	10.56	27.90	79.03	3.67	10.40	1,666.30	486.49	29.20	1,115.62	66.95	64.19	3.85
2019	26.82	10.31	38.45	14.84	55.35	1.66	6.20	1,384.81	489.71	35.36	798.40	57.65	96.70	6.98
2020	15.05	3.01	20.01	10.46	69.48	1.58	10.51	837.29	232.51	27.77	575.50	68.73	29.28	3.50
2021	22.09	4.45	20.12	11.48	51.97	6.17	27.91	1,418.51	484.26	34.14	828.19	58.38	106.06	7.48
2022	21.64	8.82	40.77	6.50	30.04	6.32	29.19	1,672.30	706.38	42.24	899.81	53.81	66.10	3.95

5.3 HELICOPTER OVERFLIGHT SUMMARY

The combined compliance for helicopter cruising altitude (i.e., combining compliant and compliant with rationale) for 2022 increased compared to 2021 and had the highest percentage of compliant flight hours since 2016. The combined compliance for cruising altitude within the Snow Geese area was similar to 2021 but lower than from 2017 to 2020. More specifically, in 2022, helicopter cruising altitude compliance within the Snow Geese area during the moulting season was 70.8%; the overall combined compliance in all areas during all months was 95.7%.

The 2022 overflight analysis was the sixth consecutive year in which additional analysis (i.e., accounting for pilot rationales) was included. Helicopter cruising altitude continues to be used to monitor avoidance of potential disturbance to birds and other wildlife within and outside the Snow Geese area.

Low-level flights are expected to continue at the Project due to operational circumstances; pilot rationale will continue to be logged to evaluate leading causes and context. The compliance descriptions will be modified in 2023 based on input from GN and TEWG.

6 TOTE ROAD TRAFFIC

Site Security at the Mary River Project (the Project) monitors and records traffic along the Tote Road. Site Security records non-haul vehicle traffic (e.g., transits related to personnel transfer, equipment, and fuel). At the same time, mine operations tracks ore haul traffic. Traffic data are then compared with the projected ore haul and non-haul vehicle transits. Not all vehicle travel on the Tote Road comprises return/round-trip travel between the Mine Site and Milne Port. Therefore, traffic is tracked in terms of 'vehicle transits' accounting for one-way trips (i.e., return/round-trip travel comprises two transits).

The mean number of ore haul transits from January 1 to December 31, 2022, was 243.6 transits per day (Table 6-1; Figure 6-1 and Figure 6-2). This slightly exceeds what was predicted in the Final Environmental Impact Statement (FEIS) Addendum for the Production Increase Proposal (i.e., 236 ore haul transits (Stantec Consulting Ltd. 2018)), but is consistent with 2019 and 2020. The mean number of non-haul vehicle transits in 2022 was 26.7 transits per day, below the FEIS Addendum (i.e., 40 non-haul vehicle transits (Stantec Consulting Ltd. 2018)). The mean number of all vehicle transits combined (i.e., haul and non-haul) in 2022 was 269.7 transits per day; the monthly mean number of all vehicle transits combined varied from a low of 194 transits in December to a high of 314 transits in January (Table 6-1; Table 6-2; Figure 6-1 and Figure 6-2).

Table 6-1. Mean and total vehicle transits along the Tote Road, including ore haul, non-haul, and all vehicles combined, from 2015 through 2022.

Sample Year	Ore Haul Transits		Non-Haul Vehicle Transits		Combined Vehicle Transits	
	Daily Mean	Total	Daily Mean	Total	Daily Mean	Total
2015	73.0	26,662	53.9	19,668	126.9	46,330
2016	151.2	55,354	27.7	10,150	179.0	65,504
2017	195.9	71,516	32.3	11,777	228.2	83,293
2018	219.5	80,118	37.3	13,616	256.8	93,734
2019	238.0	86,860	43.0	15,678	280.9	102,538
2020	243.3	88,807	28.4	10,361	271.7	99,168
2021	227.2	82,911	28.6	10,440	255.8	93,351
2022	243.6	88,908	26.7	9,749	269.7	98,443

Table 6-2. Mean ore haul and non-haul vehicle transits and total per month from January 1 to December 31, 2022.

Month	Daily Mean Ore Haul Transits	Daily Mean Non-Haul Transits	Daily Mean Total Transits
January	289	25	314
February	278	22	300
March	288	18	306
April	248	15	263
May	253	19	272
June	229	28	257
July	250	27	277
August	250	48	298
September	193	41	234
October	209	34	244
November	262	26	287
December	177	17	194

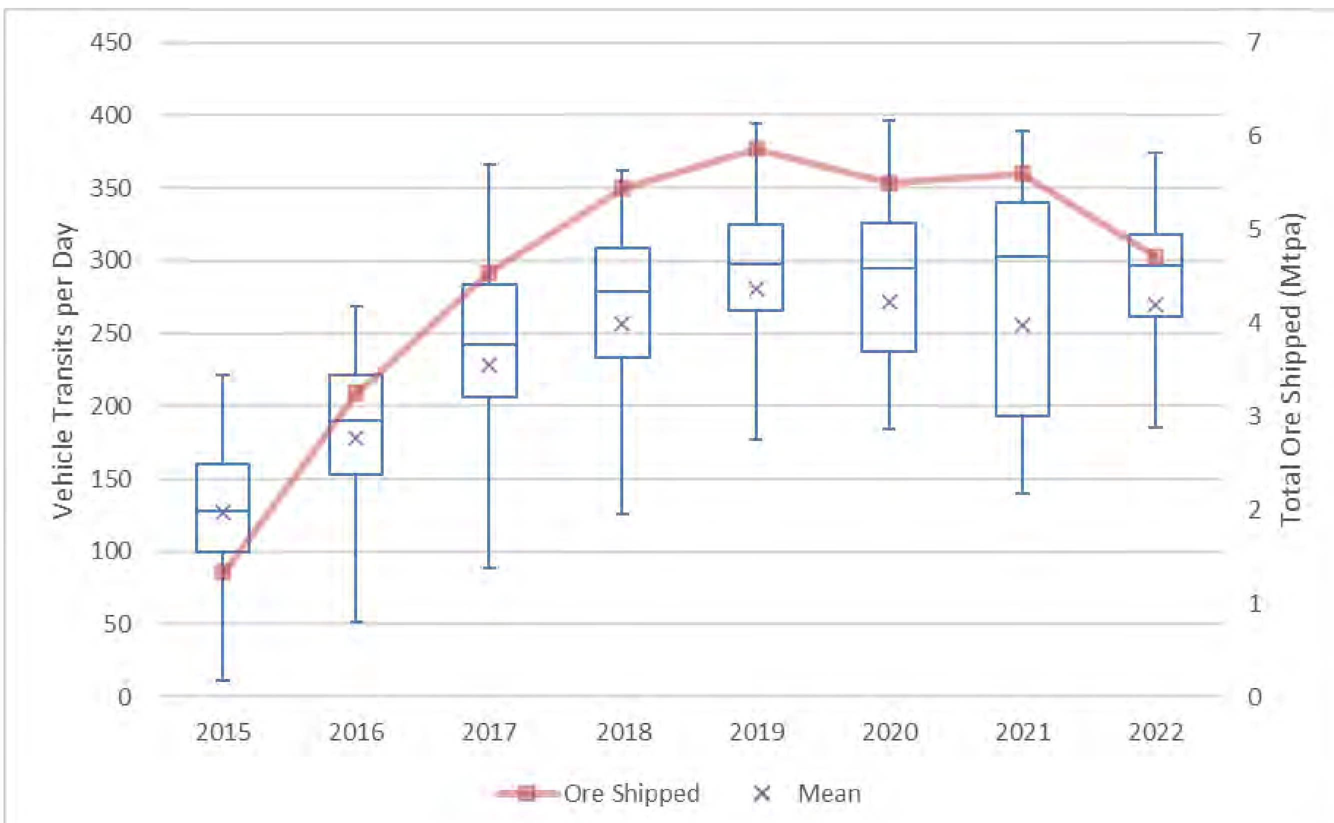


Figure 6-1. Mean ore haul and non-haul vehicle transits per day and total ore shipped between 2015 and 2022.

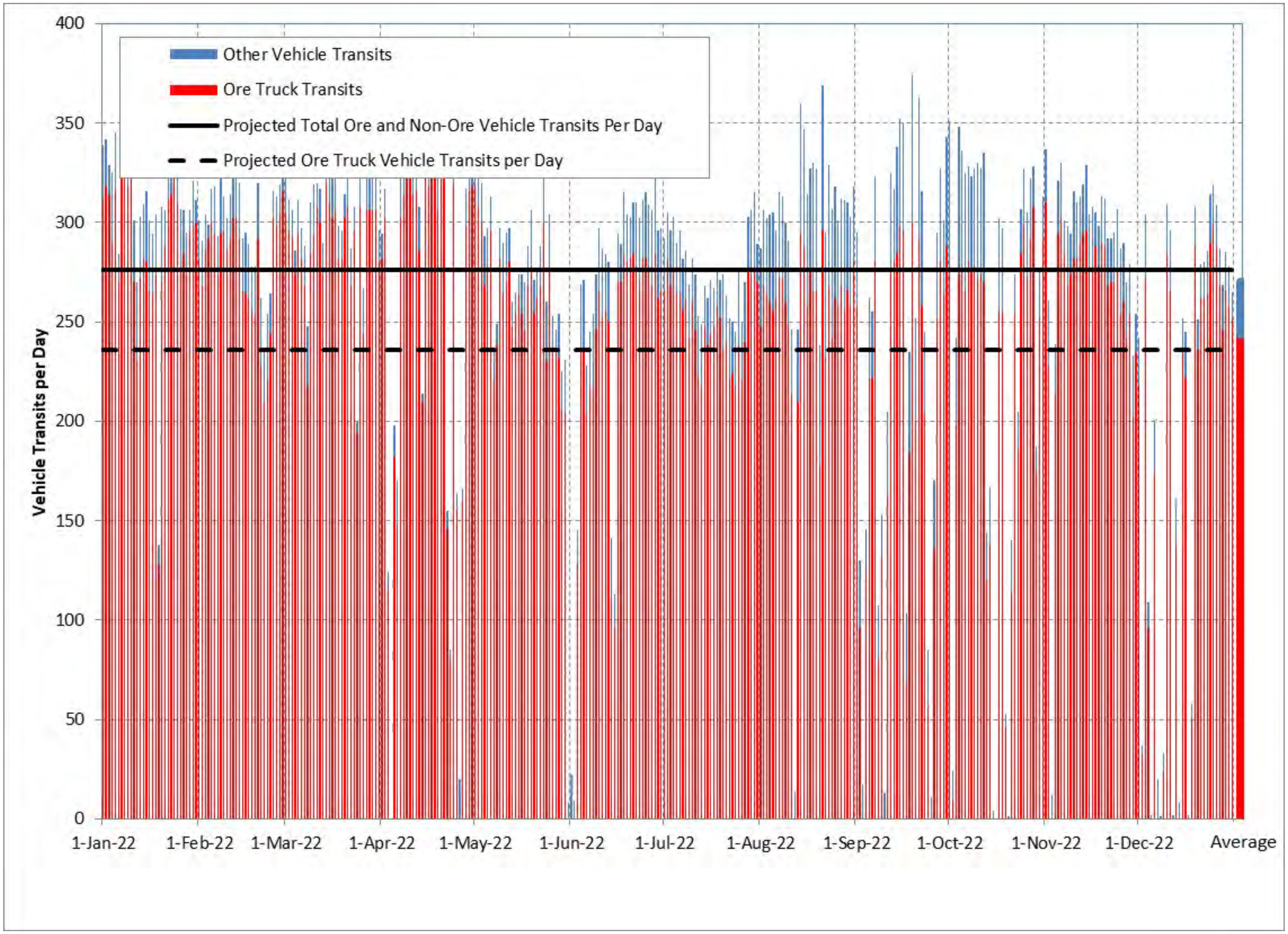


Figure 6-2. Vehicle transits per day on the Tote Road, including ore trucks (red) and all other traffic (blue), January 1 to December 31, 2022. *Also included are the projected maximum number of vehicle transits per day and the projected maximum number of ore haul trucks per day on the Tote Road.*

7 NOISE MONITORING

The 2022 Noise Monitoring programme contributes to the fulfillment of Nunavut Impact Review Board (NIRB) Project Certificate No. 005 Project Condition (PC) #14(b) (Nunavut Impact Review Board 2020):

- *"The Proponent, through coordination with the TEWG as may be appropriate, shall demonstrate appropriate adaptive management for project activities during operations which have the potential to produce noise and sensory disturbance to wildlife and other users of project areas."*

The programme was designed to address a knowledge gap in the current monitoring program for project-related effects on wildlife distribution and behaviour. Project-related noise monitoring has focused on human health (i.e., as part of occupational hygiene monitoring) but has not informed (more broadly) how Project noise might be perceived by wildlife and other users across the landscape. The 2020 noise monitoring study (EDI Environmental Dynamics Inc. 2021) was implemented to evaluate project-related effects on wildlife distribution and behaviour. Additional investigations were warranted based on preliminary study outcomes and dialogue and review comments from the Terrestrial Environment Working Group (TEWG).

RWDI was retained to conduct confirmatory noise measurements near the Mine Site, Milne Port and the Tote Road. The purpose of the measurements was to determine current noise levels associated with Baffinland operations and compare them with predicted noise levels modelled during the environmental assessment (Baffinland Iron Mines Corporation 2012a).

7.1 METHODS

7.1.1 APPLICABLE GUIDELINES

To determine the methods for taking the sound measurements, and in the absence of local noise monitoring requirements for Nunavut, sound level measurements were conducted in compliance with the Ontario Ministry of the Environment Publication NPC-103[5].

Sound level criteria were taken from Alberta Energy and Utilities Board Directive 038: Noise Control(D038) to interpret the significance of measured noise levels. Those were the same criteria used to assess predicted (modelled) noise levels in the Final Environmental Impact Statement (FEIS, Baffinland Iron Mines Corporation 2012b).

Directive 038 requires the evaluation of sound levels at a location 1.5 km from the facility “fence line”. In the case of Baffinland, the Potential Development Area (PDA) was used as a proxy for the “fence line”. The

[5] Ontario Ministry of the Environment, 1978, Model Municipal Noise Control Bylaw, which includes Publication NPC-103 – Procedures.

D038 sets out minimum permissible sound levels (PSLs) of 50 dBA[6] for the daytime and 40 dBA for the nighttime periods. If background levels are below these minima, then the facility needs to comply with the minima. Being situated north of the Arctic circle, the area around the Project does not experience a pronounced diurnal noise pattern, as seen further south. Therefore, the more conservative criteria (i.e., 40 dBA) is adopted for all periods.

7.1.2 HISTORY OF NOISE MODELLING AND MONITORING

As part of the work during the original environmental assessment, background sound levels were measured by RWDI in the summer of 2007 during the initial exploration phase. These measurements were intended to quantify the pre-development background sound levels. In 2007, noise was measured at locations far from the exploration activities to minimize the impacts of those activities on the measurements. Pre-development background noise levels ranged from 25 to 35 dBA. Background sound levels were attributed to wind, insect, small animals and birds. At the port sites, noises were also associated with flowing water and waves.

In 2020, EDI conducted a noise monitoring study to address PC 14b over two time periods: June 5 to 8, 2020, and July 17 to 26, 2020 (EDI Environmental Dynamics Inc. 2021). Nine locations were selected: three each for the Mine Site, Milne Port, and the Tote Road. At each site, a noise monitor was located near the PDA, 1.5 km from PDA, and 3 to 3.5 km from the PDA.

7.1.3 2022 NOISE MONITORING LOCATIONS AND EQUIPMENT

RWDI conducted updated noise monitoring during the summer of 2022, from July 14 to 24. The 2022 monitoring intended to measure sound levels 1.5 km from the PDA and to confirm current background levels.

At the Mine site and Milne Port, noise monitoring locations were chosen for two purposes:

- Monitoring was conducted at locations 1.5 km from the edge of the PDA, with the intent to be comparable to the predictions in the FEIS and criteria laid out in D038. Measurements were conducted several kilometres from the PDA to verify the present-day background sound levels[7]. Monitoring locations 1.5 km from the PDA were conservatively chosen to be in areas predicted in the FEIS to have the highest noise-related impacts.
- Background locations were selected to be in areas with little air traffic, and no audible noise from ground operations.

[6] dB (decibel) - A unit of measure of sound pressure that compresses a large range of numbers into a more meaningful scale. Hearing tests indicate that the lowest audible pressure is approximately 2 x 10-5 Pa (0 dB), while the sensation of pain is approximately 2 x 102 Pa (120 dB). Generally, an increase of 10 dB is perceived as twice as loud.

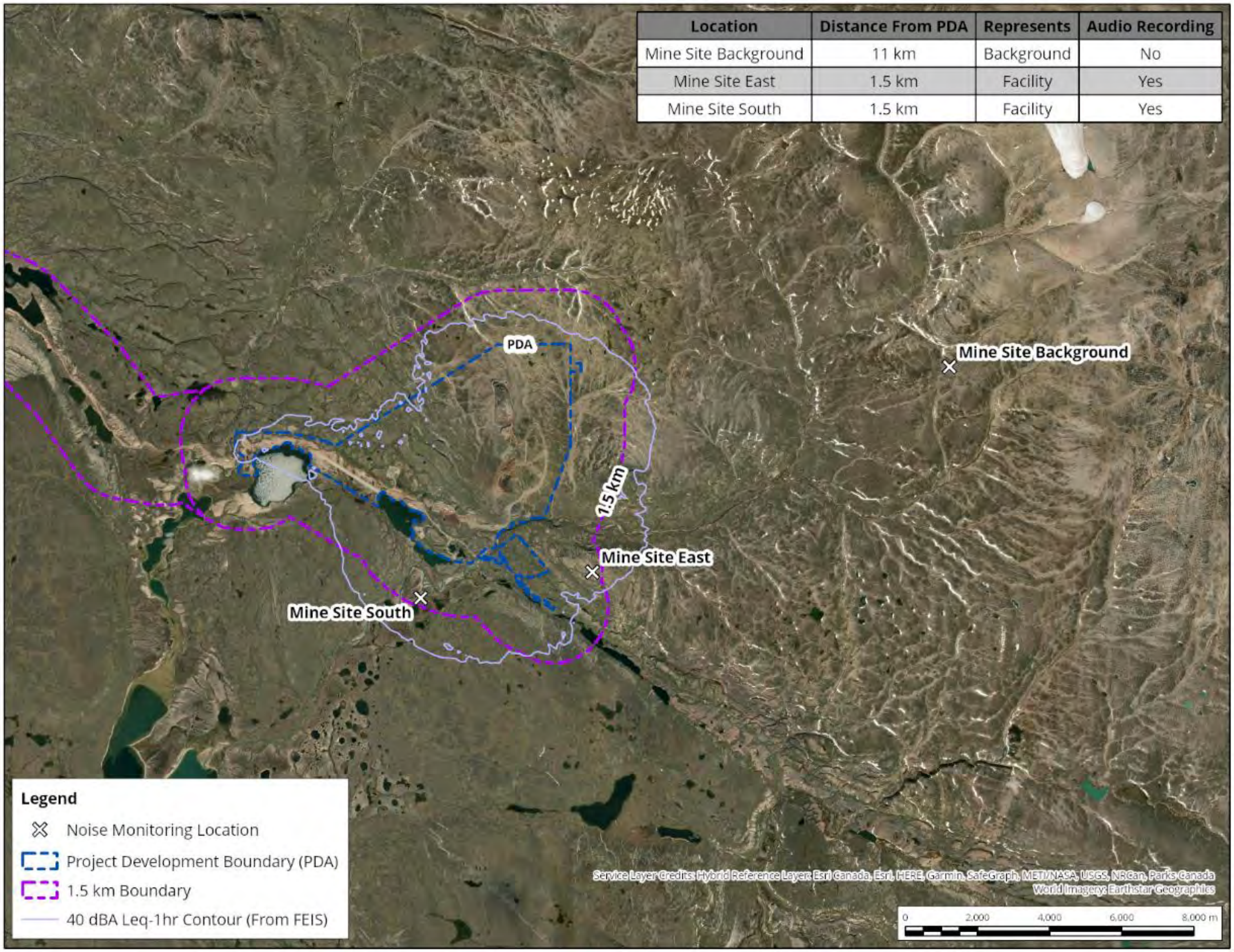
dBA - The decibel (dB) sound pressure level filtered through the A filtering network to approximate human hearing response at low frequencies

[7] Predicted noise levels were based on available design information and assumptions regarding the layout of Project infrastructure, equipment and operations at the time the FEIS was prepared. Hence, differences between the proposed and as-built Project are expected to highlight key differences in predicted versus actual noise levels.

Noise monitoring locations, the PDA, the 1.5 km boundary and the predicted 40 dBA Leq[8] 1hr contour for the Mine Site are shown in Map 7-1, and for Milne Port with the Tote Road are shown in Map 7-2.

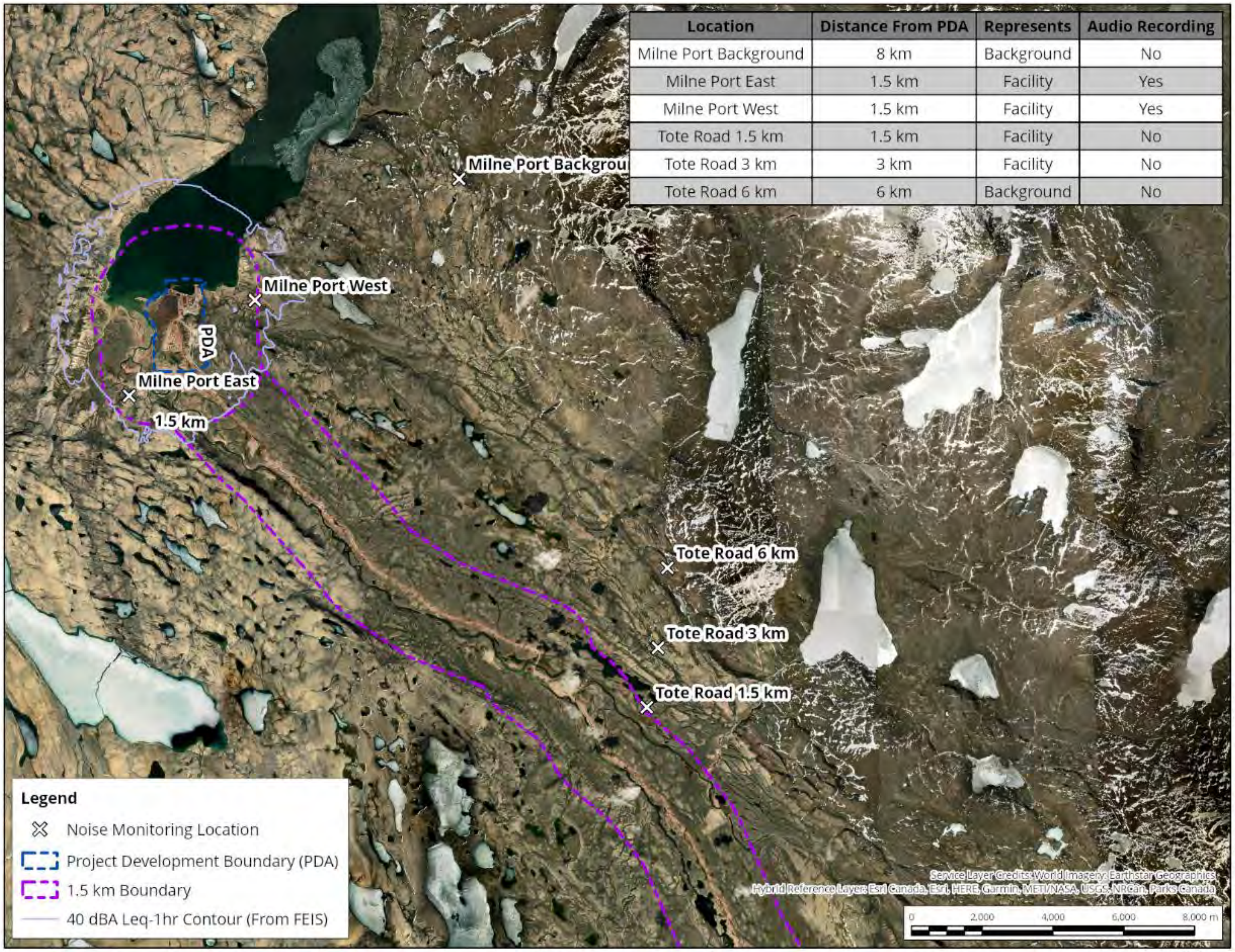
Two types of sound level meters (SLMs) were used for the measurements: Larson Davis 820 and Larson Davis 831c. The Larson Davis 820 SLMs are capable of recording sound level metrics and measuring low sound levels but do not save audio files. These were preferred for locations further from Project-related activities (i.e., 3 to 6 km away). The Larson Davis 831c SLMs are capable of recording sound level metrics and audio files but are not capable of recording sound levels as low as the Larson Davis 820s. These were preferred for the locations that were 1.5 km from the PDA.

[8] Leq – The energy equivalent sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval.



Location	Distance From PDA	Represents	Audio Recording
Mine Site Background	11 km	Background	No
Mine Site East	1.5 km	Facility	Yes
Mine Site South	1.5 km	Facility	Yes

Map 7-1. Mine Site noise monitoring locations.



Location	Distance From PDA	Represents	Audio Recording
Milne Port Background	8 km	Background	No
Milne Port East	1.5 km	Facility	Yes
Milne Port West	1.5 km	Facility	Yes
Tote Road 1.5 km	1.5 km	Facility	No
Tote Road 3 km	3 km	Facility	No
Tote Road 6 km	6 km	Background	No

Map 7-2. Milne Port and Tote Road noise monitoring locations.

7.1.4 REPRESENTATIVE DATA AND DATA EXCLUDED FROM MEASUREMENTS

When working with noise monitoring data, it is typical to exclude instances of measured noise that are not associated with the operations of interest. In this case, the operations of interest are the ground-level operations of the Project. Directive 038 provides guidance on excluding data not representative of the facility. This can include periods with unacceptable meteorological conditions and noise events associated with airborne aircraft and animals.

The effects of noise generated from wind hitting the measurement equipment are accounted for by excluding times when winds exceeded 20 km/h, based on data from nearby weather stations. The exclusion of data during wind events of ≥20 km/h is typical in other Canadian jurisdictions. This is conservative in the northern context of Baffin Island because lower wind speeds may still generate sound of comparable levels to the local background sound levels.

While the presence of aircraft in the Project area may result from mining operations, the guidance in D038 provides criteria for industrial sound. It does not include sounds associated with aircraft in flight, which is federally regulated. The FEIS modelling did not include aircraft. Data periods with aircraft overpasses were excluded from this analysis to provide a fair comparison to the FEIS predictions.

7.2 RESULTS AND DISCUSSION

For background sound levels, the minimum Leq-1hr is reported. This is the same metric presented in the results of the 2007 monitoring and is representative of the environment at its quietest.

Sound levels associated with the facility varied significantly over time. Data measured 1.5 km from the PDA are presented as both the highest Leq-1hr, and the average Leq over the entire monitoring program. The average Leq over the entire monitoring period is useful for comparison to the FEIS predictions because the FEIS modelling also presented data as an average over time.

The locations selected for monitoring consisted of worst-case locations along the 1.5 km boundary. Because noise from the Project varies significantly by direction, these levels do not indicate noise levels at every point along the boundary.

7.2.1 BACKGROUND NOISE MEASUREMENTS

The intent of the background level monitoring was to verify that the criteria adopted and used in the FEIS remain applicable. If the background sound levels were greater than the minima described in D038, then permissible sound levels increased accordingly. The quietest hour recorded at each location, to verify present-day background levels, is presented in Table 7-1.

The measured background levels were below 40 dBA, the nighttime minima per D038; therefore, this minimum PSL is applicable for all ground activities associated with the Project.

Table 7-1. Measured background sound levels.

Location	Distance from PDA	Lowest Valid Leq-1hr (dBA)
Mine Site Background	11 km	20[1]
Milne Port Background	8 km	29
Tote Road	6km	30[1]

[1] Noise floor (lowest measurable level) of the meter is reached.

7.2.2 MINE SITE

Sound levels measured 1.5 km from PDA boundary at the Mine Site are summarized in Table 7-2. Sound levels at Mine Site South were recorded above the predictions of the FEIS by up to 5 dB. Over the entire measurement period, the equivalent level matched the FEIS modelling. The Mine Site South location was directly south of the crusher pad. Activities associated with the crusher pad were audible at the measurement location.

The Mine Site East location has a line of sight to the working face of the mine, but mining activities were not audible during visits to the monitoring location. Levels measured at this site were consistently below the FEIS predictions.

Sound levels and weather data at Mine Site are plotted in Figure 7-1. At the Mine Site South location, the 1-hour Leq fluctuated between 30 and 48 dBA. The extended exclusion from July 15 to 17 resulted from animals tampering with the microphone cable. At the Mine Site East location, the 1-hour Leq generally remained below 40 dBA.

Table 7-2. Measured sound levels 1.5 km from the Mine Site Potential Development Area (PDA).

Location	Distance from PDA	Measured 2022			FEIS Modelling Leq-1hr (dBA)
		Leq (dBA) All Valid Data	Number of Valid Hours	Highest Valid Leq-1hr (dBA)	
Mine Site South	1.5 km	43	50	48	43
Mine Site East	1.5 km	30	25	43	44

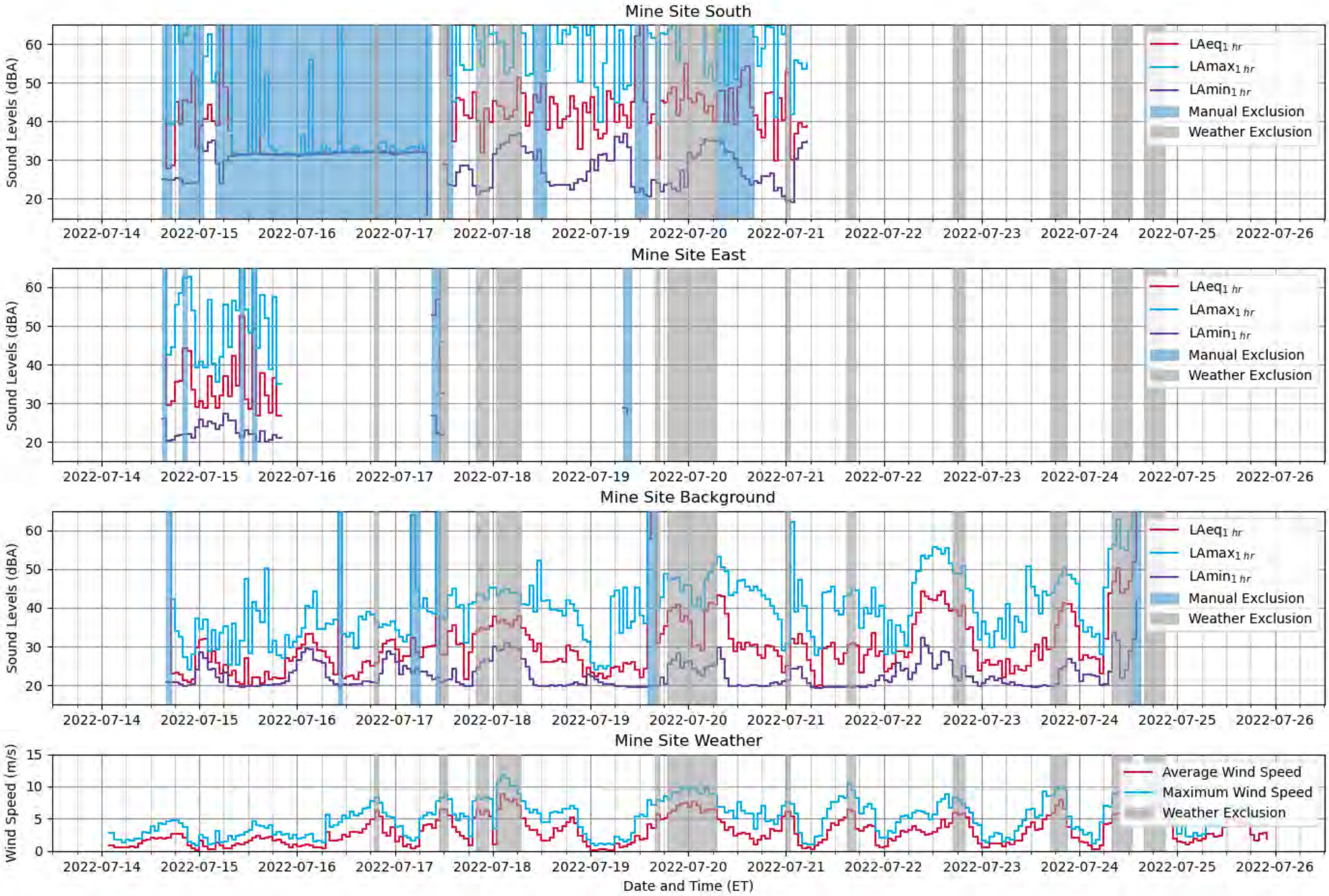


Figure 7-1. **Mine Site sound levels and weather data plots.**

7.2.3 MILNE PORT

Sound levels measured on the boundary 1.5 km from the PDA at Milne Port are summarized in Table 7-3. The activities at Milne Port were typical ore stockpiling activities and camp operations. Due to sea ice around the north end of Baffin Island, ships where not present during the noise monitoring. Sound emissions specific to ship-loading activities were not captured in 2022 because there was no ship load during the sampling period.

The FEIS modelling considered rail operations, including rail car unloading at the Milne Port site. This activity does not occur in the current operation.

The Milne Port West location has a direct line of sight to the port camp and the ore pile. Sound from the Project was not audible at this location during the site visits. Levels measured at this site were consistently below the FEIS predictions. Over the entire measurement period, the equivalent level was below the 40 dBA criteria.

The Milne Port East location also has a direct line of sight to the port camp and the ore pile. Sound from the Project was barely audible at this location during the site visits. The measured levels indicated there were hours where sound levels were recorded above the FEIS predictions. However, the equivalent level over the entire measurement period matched the FEIS predictions and was below the 40 dBA criteria.

Sound levels and weather data at Milne Port are plotted in Figure 7-2. The locations around Milne Port experienced more consistent wind than the Mine Site locations due to their proximity to the coast. Sound levels associated with Milne Port fluctuate throughout the day, with both locations generally maintaining levels below 40 dBA. The extended exclusion at the Milne Port West location from July 15 to 17 resulted from damage to the tripod holding the microphone, believed to be caused by animals.

Table 7-3. Measured sound levels 1.5 km from the Milne Port Potential Development Area (PDA).

Location	Distance from PDA	Measured 2022			FEIS Modeling Leq-1hr (dBA)
		Leq (dBA) All Valid Data	Number of Valid Hours	Highest Valid Leq-1hr (dBA)	
Milne Port West	1.5 km	35	99	41	42
Milne Port East	1.5 km	38	83	45	38

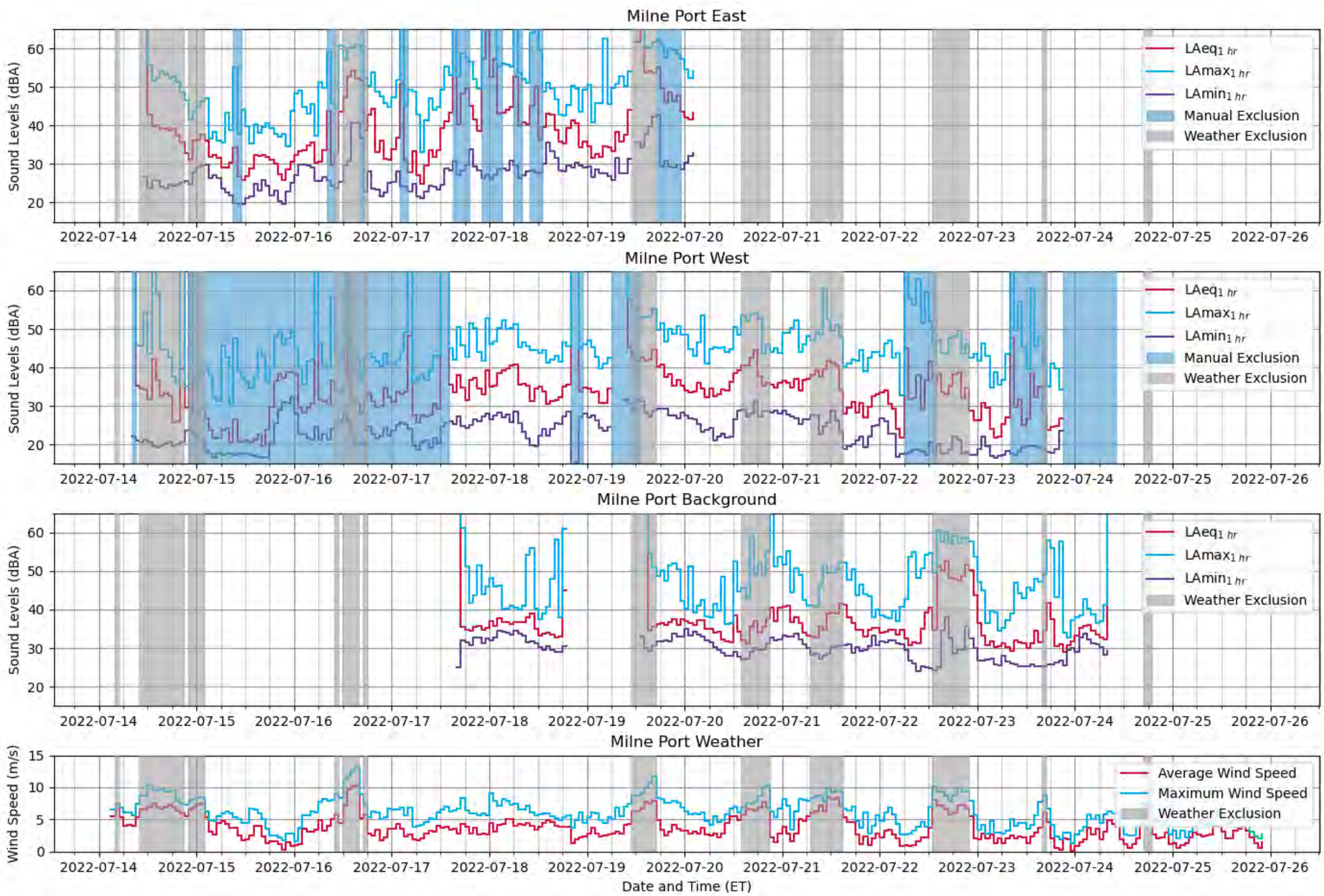


Figure 7-2. Milne Port sound levels and weather data plots.

7.2.4 TOTE ROAD

Sound levels from locations nearest the Tote Road are summarized in Table 7-4. The noise levels along the Tote Road were measured to be higher than the FEIS predicted. Operational differences between the FEIS modelling scenario and the actual operations on the ground were the likely cause. The measured levels at 1.5 km from the road's centre line were, on average, below the limits adopted from D038, although they exceeded these limits by up to 3 dB at some times. Sound levels measured perpendicular to the Tote Road are plotted in Figure 7-3. The weather from Milne Port was used to generate weather exclusions given it is the closest weather station.

In addition to the measurement location at 1.5 km from the centre line, a measurement was conducted at 3 km from the road's centre line. These data were collected to show a reduction in sound level over distance and are helpful for validating the FEIS model results.

Qualitative observations made on site were that at 1.5 km the road was audible at times, at 3 km the road was just audible, and at 6 km the road was not audible. At all locations for the Tote Road, the road was visible, and traffic could be seen moving along the road.

Table 7-4. Measured sound levels 1.5 km from the Tote Road.

Location	Distance from PDA	Measured 2022			FEIS Modeling Leq-1hr (dBA)
		Leq (dBA) All Valid Data	Number of Valid Hours	Highest Valid Leq-1hr (dBA)	
Milne Port West	1.5 km	37	122	43	29
Milne Port East	1.5 km	35	104	42	-

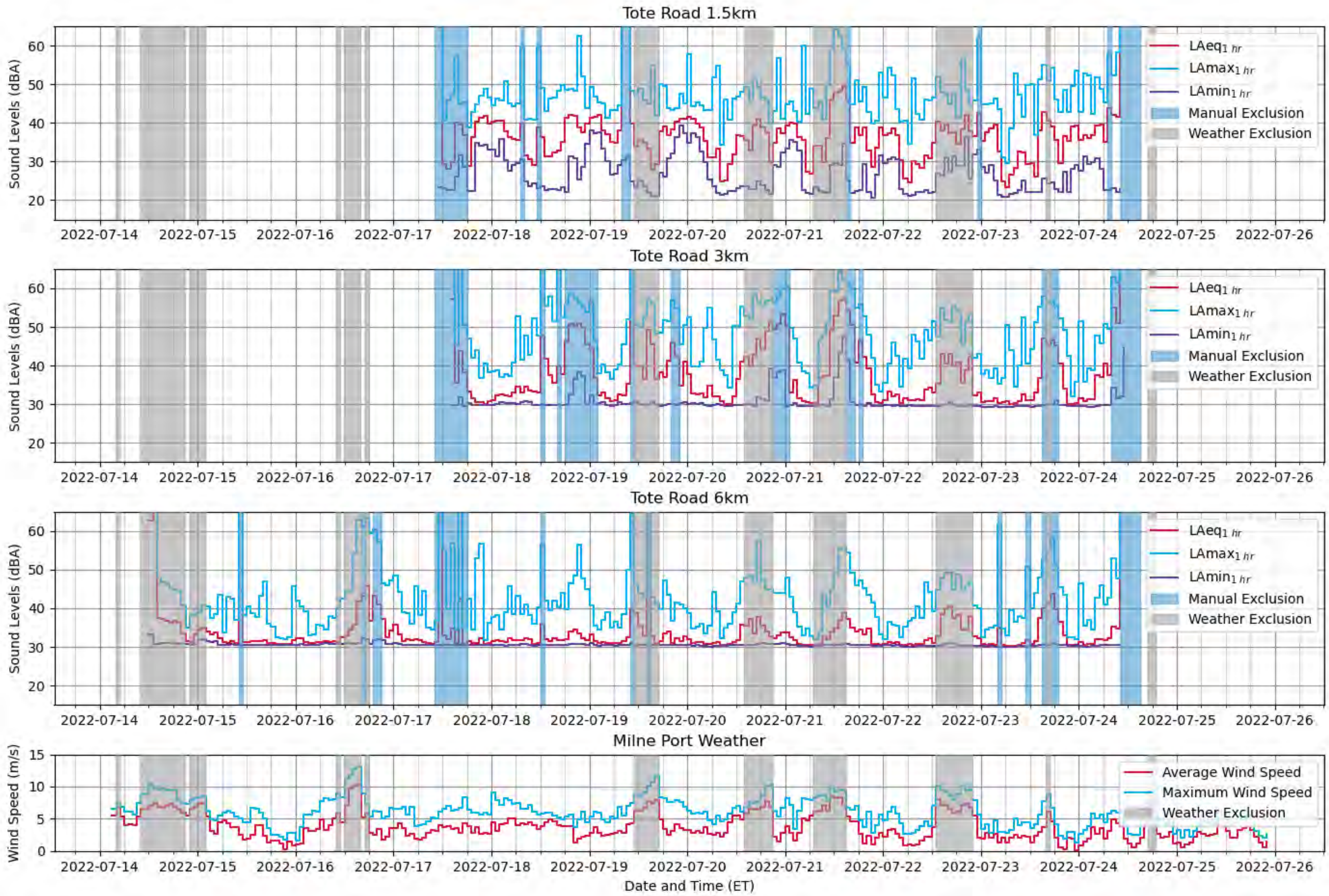


Figure 7-3. Tote Road sound levels and weather data plots.

7.3 SUMMARY

Noise monitoring was conducted in the summer of 2022 to verify background sound levels and sound associated with the Project's ground operations, for comparison with the analysis presented in the FEIS and the guideline criteria adopted from Directive 038. The monitoring focused on the three main areas of the Project that produce noise: the Mine Site, the Tote Road, and Milne Port.

At the Mine Site and Milne Port, average sound levels at 1.5 km from the PDA were at or below the levels predicted in the FEIS. In the FEIS modelling, the distribution of sound levels around the Project throughout the day was necessarily simplified due to the complex and unpredictable nature of the operations. The average sound level from the entire monitoring period is a useful comparator to the FEIS modelling because it similarly averages the noise from Project operations. The highest one-hour levels ranged from 1 dB below the FEIS modelled levels to 7 dB above the modelled FEIS levels.

Monitoring locations were chosen where sound levels were expected to be highest. Considering the sound levels measured in this program, and the FEIS modelling, it was likely that sound levels at other locations 1.5 km from the PDA comply with the 40 dBA criterion.

Along the Tote Road, sound levels were consistently higher than modelled in the FEIS. This is likely due to the higher truck traffic levels than initially considered. However, the average sound levels remained below the 40 dBA criterion, with maximum hourly sound levels exceeding by up to 3 dB. For context, in the field of acoustics, 3 dB is considered a "just noticeable" difference in sound level.

Overall, it is likely that in most areas, the impacts of noise by the Project have complied with the criteria presented in the FEIS. Exceedances of those criteria and the FEIS predictions were observed, but did not occur continuously and are not expected to occur in all directions from the Project.

8 DUSTFALL

Several Project Conditions (PCs; e.g., PC# 36, 50, 54d, 58c, 187 and 188) relate to the effects of dustfall and dustfall monitoring at the Mary River Project (the Project; (Nunavut Impact Review Board 2020)). Since summer 2013, the Project has implemented a dustfall monitoring program intended to meet these conditions, the objectives of which are to:

- quantify the volume and extent of dustfall generated by Project activities;
- determine seasonal variations in dustfall; and,
- determine if annual dustfall volume and extent exceed ranges predicted with the dustfall dispersion models (Baffinland Iron Mines Corporation 2013b).

The following subsections summarize the study design, methods, results, and discussion for the dustfall monitoring program.

Note: PC# 57g—referring to the requirements for "*an assessment and presentation of annual environmental conditions including timing of snowmelt, green-up and standard weather summaries*"—is considered ancillary to the dustfall monitoring program. Supporting information about these topics is presented in the Climate section.

8.1 HISTORY OF DUSTFALL MONITORING AT THE PROJECT

Over time, changes have been made to the dustfall monitoring program based on data analysis, interpretation, and input from the Terrestrial Environment Working Group (TEWG). The following summarizes key milestones and responses to TEWG comments leading to the 2021 Dustfall Monitoring:

2013 — The dustfall monitoring program was initiated in August 2013. A total of 26 monitoring stations were established near Project infrastructure at the Mine Site, Milne Port, along the Tote Road, and reference sites (located 14 km from the Project).

2014 — First full year of monitoring, which includes Project activities during the Construction Phase. Based on preliminary analysis, the program was expanded in September 2014 to increase the number of monitoring stations at the Mine Site and Milne Port; three sites were added at the Mine Site and four were added at Milne Port. Additional stations were intended to improve understanding of 'how dustfall pattern may change with distance from Project infrastructure'. One site at Milne Port was removed because project infrastructure rendered it inaccessible. The total number of monitoring stations at the end of 2014 was 32.

2015 — First full year of monitoring during Mine Operations. One additional monitoring site was added at the Mine Site to address a gap in the program associated with dustfall at distances greater than 1,000 m; site DF-M-08 was established 4,000 m from the PDA. The total number of monitoring stations at the end of 2015 was 33.

2019 — Data collection at 1,000 m distant from the Tote Road was increased in response to a request from the Qikiqtani Inuit Organization (QIA) and the Mittimatalik Hunters and Trappers Organization (MHTO).

Six additional dustfall monitors were installed (three paired monitoring stations, one of each on the east and west sides of the Tote Road at KM25, KM56, and KM75). Additionally, dustfall data collection at other 1,000 m distant sites was changed to year-round, where data were only collected during the summer months from 2013 to 2018. This brought the total number of dustfall monitors at the 1,000 m Potential Development Area (PDA) boundary to 12.

One monitor at Milne Port (DF-P-01) was relocated and was renamed (DF-P-08) to allow for the expansion of an ore stockpile. The total number of monitoring stations at the end of 2019 was 39.

2020 — Satellite imagery analysis of dustfall extent was conducted to address concerns from the MHTO that the past dustfall monitoring data and analyses did not reflect what hunters saw on the ground. The analysis included Landsat and Sentinel-2 imagery from 2004 to 2020 between March 15 and May 15.

2021 — Reported quantitative measurements from the dustfall satellite imagery analysis as requested from the Nunavut Impact Review Board (NIRB), including dustfall concentrations and area using the Snow Darkening Index (SDI), a measure of mineral dust on snow. Included data from Steensby Inlet as a reference area for comparison.

A total of 14 new dustfall monitoring stations were installed, including:

- four additional monitors at Milne Port to better characterize dustfall moving off the Milne Port site;
- four new monitors along the section of the proposed Phase 2 railway that departs from the Tote Road right-of-way to define baseline conditions; and,
- six dustfall monitors installed to collect dust at the height of 0.5 m. These 'short' monitors are part of a pilot study to investigate the variability between dustfall sampling at the standardized height of 2.0 m and closer to ground level. This program was implemented in response to specific requests from the QIA.

As of the end-of-year 2021, a total of 53 dustfall monitors (including the six 'short' monitors as part of the trial) have been installed at defined/pre-existing monitoring locations.

2022 — Following one year of data collection intended for baseline data capture, sampling at the four dustfall monitors along the section of the proposed Phase 2 railway that departs from the Tote Road right-of-way were discontinued in October 2022 (i.e., following the Ministerial decision that Phase 2 expansion would not proceed at this time). There are presently 49 monitors located across 43 monitoring stations.

8.2 DUSTFALL SUPPRESSION AND MITIGATION

Baffinland Iron Mines Corporation (Baffinland) implemented dustfall suppression measures throughout the 2022 calendar year to mitigate dustfall from all Project areas. They include:

Dustfall Suppression along the Tote Road — DUST/BLOKR®, a product by Cypher Environmental, was used for dust suppression along 60 km of the Tote Road. The 2022 application was completed between approximately KM0 to KM60 from July 6 to July 21 as soon as ambient air temperatures permitted. In total, approximately 324,000 L of DUST/BLOKR® was applied along the Tote Road at a rate of approximately 1,000 L/km with up to six applications in areas for 2022. The final application of DUST/BLOKR® occurred on July 24.

Other methods of dust suppression were also used, including water and a combination of water and calcium chloride; these dust suppression measures ended when temperatures fell below zero (final date of application, September 15). The road maintenance team also applied 183,200 kg of calcium chloride along the Tote Road in various locations.

Other Initiatives — Other ongoing studies and initiatives at the Project are intended to characterize dustfall and dustfall suppression better; these include the following:

At Milne Port:

- Ore handling added longer strips on the stackers and have programmed the stackers to hug the stockpiles as closely as possible to limit exposure to wind.
- Ongoing application of DusTreat to ore stockpiles at Milne Port.
- Rubber bellows have been installed on all discharge stackers. Repair/replacement has been incorporated into the maintenance planning process.

At the Mine Site:

- The Crusher has had multiple dust hoods installed along the conveyor (previously), which are routinely replaced and maintained (dust covers also cover the jaw discharge conveyors). Installation of dust hoods on the Crusher A cone discharge conveyor is complete. Also, rubber bellows on the fine ore stackers (previously installed) are routinely replaced as needed. Dust hood inspection and maintenance are part of routine work.
- Ongoing installation of hoods and shrouds on Crusher Facility equipment (stackers and conveyors) to minimize dust generation during crushing operations. As part of regular operations, damaged or missing hoods are replaced as they are discovered. A hood/shroud for Crusher A cone feed will be scheduled into a maintenance shutdown as materials become available.

8.3 PASSIVE DUSTFALL MONITORING

8.3.1 METHODS

8.3.1.1 Supporting Data Review

The dustfall monitoring program incorporates a review of supporting data to characterize the Project setting and identify factors that could influence the volume and extent of dustfall during 2022. These supporting data comprise an overview of weather conditions at the Mine Site and Milne Port meteorological stations and vehicle traffic on the Tote Road:

- climate data (including a summary of air temperature and precipitation data) are presented in Section 4 – Climate; and,
- traffic data (including the number of ore haul truck transits and other vehicle transits on the Tote Road) are presented in Section 6 – Tote Road Traffic.

8.3.1.2 Passive Dustfall Sampling

The 2022 dustfall monitoring program comprises deploying passive dustfall sampling across the Project area for collecting and measuring dustfall following standard test methods (ASTM International 2010). Each dustfall sampler comprises a dust collection canister within a bowl-shaped terminal holder affixed to an approximately 2 m tall post that is anchored to solid ground. The terminal bowl is crowned with 'bird spikes' to prevent birds from perching and contaminating samples with feces (Photo 8-1). Dust collection canisters were pre-charged with 250 mL of algaecide in summer and 250 mL of isopropyl alcohol in winter; the percentage of isopropyl alcohol in the canisters was increased from 40% to 75% solution in 2021 in effort to prevent freezing of the liquid media. Collection vessels were changed once per month and shipped to ALS Environmental Laboratory in Waterloo, Ontario, to analyze Total Suspended Particulates (TSP; units of $mg/dm^2 \cdot day$) and a suite of metals. Dustfall samples were also analyzed for total metal concentrations to characterize potential contaminants of potential concern (CoPCs) and inform other monitoring endpoints (refer to Section 8.4 – Vegetation).

Photo 8-1. Dustfall monitoring station DF-P-01.

As summarized in Table 8-1, the Regional Study Area (RSA) was divided into four areas to review dustfall data:

- Mine Site;
- Milne Port;
- Tote Road North crossing (KM28); and,
- Tote Road South crossing (KM78).

In 2022, the study design comprised 53 dustfall monitors over 47 monitoring locations distributed across the Project area (Map 8-1).

- Nine dustfall monitors located at the Mine Site: three within the Mine Site, four outside the mine footprint within low to moderate isopleth areas, and two reference sites (one to the northeast and one to the south) located at least 14,000 m from any Project infrastructure, outside of the extent of expected dustfall.
- Ten dustfall monitors located at Milne Port: four active sites on the Port Site footprint, five located at the PDA boundary, and one reference site situated on a ridge approximately 3,000 m northeast (upwind) of the Port Site outside of the predicted extent of dustfall.
- Sixteen dustfall monitors divided between two sites along the Tote Road (North sites and South sites). These two sites are organized into transects, each composed of eight dustfall monitors distributed perpendicular to the Tote Road centreline at distance of 30 m, 100 m, 1,000 m, and 5,000 m on either side of the road.
    - Six additional Tote Road monitors are organized as three pairs, all located at a 1,000 m distance from the Tote Road.
- Two reference dustfall monitors located 14,000 m southwest of the Tote Road (one at the North and one at the South sites).
- Four dustfall monitors located along the section of the proposed Phase 2 railway between the Mine Site and Milne Port. These stations were discontinued in October 2022 following the Ministerial decision indicating that Phase 2 not proceed at this time; data are presented in this report, but not included in any analyses.

Over the year, passive dustfall sampling was conducted monthly by Baffinland personnel at 36 of the 43 monitoring locations in 2022 (four stations along the proposed Phase 2 railway were omitted). These sites are all distributed within 1,000 m of the PDA and tend to experience higher dustfall levels. The remaining 11 monitoring stations are situated at, or greater than, 1,000 m from the PDA and historically experienced lower dustfall levels. For these 11 sites, monthly sampling was only conducted from May to October and was paused during winter (e.g., November to April) due to their remote locations and inaccessibility without helicopter support. These sampling categories were delineated for data analysis as 'year-round' and 'summer.'

The 2022 dustfall monitoring program includes data collected for a full calendar year from late December 2021 through late December 2022 (Table 8-2).

Table 8-1. 2022 summary of dustfall monitoring stations (locations and sampling period).

Site ID	Monitor Height (m)	Location	Sample Period	Distance to PDA [1] (m)	Expected Dustfall Exposure [2]	Latitude	Longitude
DF-M-01	2.0	Mine Site	year-round	Within PDA	High	71.3243	-79.3747
DF-M-01-S	0.5	Mine Site	year-round	Within PDA	High	71.3243	-79.3747
DF-M-02	2.0	Mine Site	year-round	Within PDA	High	71.3085	-79.2906
DF-M-03	2.0	Mine Site	year-round	Within PDA	High	71.3072	-79.2433
DF-M-04	2.0	Mine Site	summer [3]	9,000	Nil	71.2197	-79.3277
DF-M-05	2.0	Mine Site	summer [3]	9,000	Nil	71.3731	-78.923
DF-M-06	2.0	Mine Site	summer [3]	1,000	Moderate	71.3196	-79.156
DF-M-07	2.0	Mine Site	summer [3]	1,000	Moderate	71.3	-79.1953
DF-M-08	2.0	Mine Site	summer [3]	4,000	Moderate	71.2945	-79.1002
DF-M-09	2.0	Mine Site	summer [3]	2,500	Low	71.2936	-79.4127
DF-RS-01	2.0	Tote Road – south, KM78	summer [3]	5,000	Nil	71.3275	-79.8001
DF-RS-02	2.0	Tote Road – south, KM78	year-round	1,000	Low	71.3893	-79.8324
DF-RS-03	2.0	Tote Road – south, KM78	year-round	Within PDA, 100 m from Tote Road	Moderate	71.3967	-79.8228
DF-RS-03-S	0.5	Tote Road – south, KM78	year-round	Within PDA, 100 m from Tote Road	Moderate	71.3967	-79.8228
DF-RS-04	2.0	Tote Road – south, KM78	year-round	Within PDA, 30 m from Tote Road	Moderate	71.3975	-79.8222
DF-RS-05	2.0	Tote Road – south, KM78	year-round	Within PDA, 30 m from Tote Road	Moderate	71.398	-79.8228
DF-RS-06	2.0	Tote Road – south, KM78	year-round	Within PDA, 100 m from Tote Road	Moderate	71.3986	-79.8234
DF-RS-06-S	0.5	Tote Road – south, KM78	year-round	Within PDA, 100 m from Tote Road	Moderate	71.3986	-79.8234
DF-RS-07	2.0	Tote Road – south, KM78	year-round	1,000	Nil	71.4077	-79.8182
DF-RS-08	2.0	Tote Road – south, KM78	summer [3]	5,000	Nil	71.4489	-79.7106
DF-RN-01	2.0	Tote Road – north, KM27	summer [3]	5,000	Nil	71.6883	-80.5363
DF-RN-02	2.0	Tote Road – north, KM27	year-round	1,000	Low	71.7145	-80.4704
DF-RN-03	2.0	Tote Road – north, KM27	year-round	Within PDA, 100 m from Tote Road	Moderate	71.7186	-80.4473
DF-RN-03-S	0.5	Tote Road – north, KM27	year-round	Within PDA, 100 m from Tote Road	Moderate	71.7186	-80.4473
DF-RN-04	2.0	Tote Road – north, KM27	year-round	Within PDA, 30 m from Tote Road	Moderate	71.7189	-80.4456

Table 8-1. 2022 summary of dustfall monitoring stations (locations and sampling period).

Site ID	Monitor Height (m)	Location	Sample Period	Distance to PDA [1] (m)	Expected Dustfall Exposure [2]	Latitude	Longitude
DF-RN-05	2.0	Tote Road – north, KM27	year-round	Within PDA, 30 m from Tote Road	Moderate	71.7185	-80.4414
DF-RN-06	2.0	Tote Road – north, KM27	year-round	Within PDA, 100 m from Tote Road	Moderate	71.7189	-80.4397
DF-RN-06-S	0.5	Tote Road – north, KM27	year-round	Within PDA, 100 m from Tote Road	Moderate	71.7189	-80.4397
DF-RN-07	2.0	Tote Road – north, KM27	year-round	1,000	Nil	71.7226	-80.4165
DF-RN-08	2.0	Tote Road – north, KM27	summer [3]	5,000	Nil	71.7435	-80.2898
DF-P-03	2.0	Milne Port	summer [3]	3,000	Nil	71.8996	-80.7884
DF-P-04	2.0	Milne Port	year-round	Within PDA	Low	71.871	-80.8828
DF-P-05	2.0	Milne Port	year-round	Within PDA	Moderate	71.8843	-80.8945
DF-P-06	2.0	Milne Port	year-round	Within PDA	Low	71.8858	-80.879
DF-P-07	2.0	Milne Port	year-round	Within PDA	Moderate	71.8838	-80.916
DF-P-08	2.0	Milne Port	year-round	1,000	Moderate	71.8722	-80.9126
DF-P-08-S	0.5	Milne Port	year-round	1,000	Moderate	71.8722	-80.9126
DF-P-09	2.0	Milne Port	year-round	1,000	Moderate	71.855286	-80.893269
DF-P-10	2.0	Milne Port	year-round	Within PDA	Moderate	71.876033	-80.919739
DF-P-11	2.0	Milne Port	year-round	1,000	Moderate	71.875471	-80.95393
DF-P-12	2.0	Milne Port	year-round	1,000	Moderate	71.86558	-80.951059
DF-RR-01	2.0	Reference – Road	summer [3]	14,000	Nil	71.2805	-80.245
DF-RR-02	2.0	Reference – Road	summer [3]	14,000	Nil	71.5189	-80.6923
DF-TR-25E	2.0	Tote Road	year-round	1,000	Nil	71.7425	-80.4394
DF-TR-25W	2.0	Tote Road	year-round	1,000	Low	71.7395	-80.5068
DF-TR-56E	2.0	Tote Road	year-round	1,000	Nil	71.5097	-80.2109
DF-TR-56W	2.0	Tote Road	year-round	1,000	Low	71.4944	-80.2685
DF-TR-75E	2.0	Tote Road	year-round	1,000	Nil	71.3902	-79.9917
DF-TR-75W	2.0	Tote Road	year-round	1,000	Low	71.3709	-80.0007

[1] PDA = Potential development area

[2] Low (1 to 4.5 $g/m^2/year$), Moderate (4.6 to 50 $g/m^2/year$), and High ($\geq$50 $g/m^2/year$).

[3] Summer sampling includes data collection from June, July, August, and September.

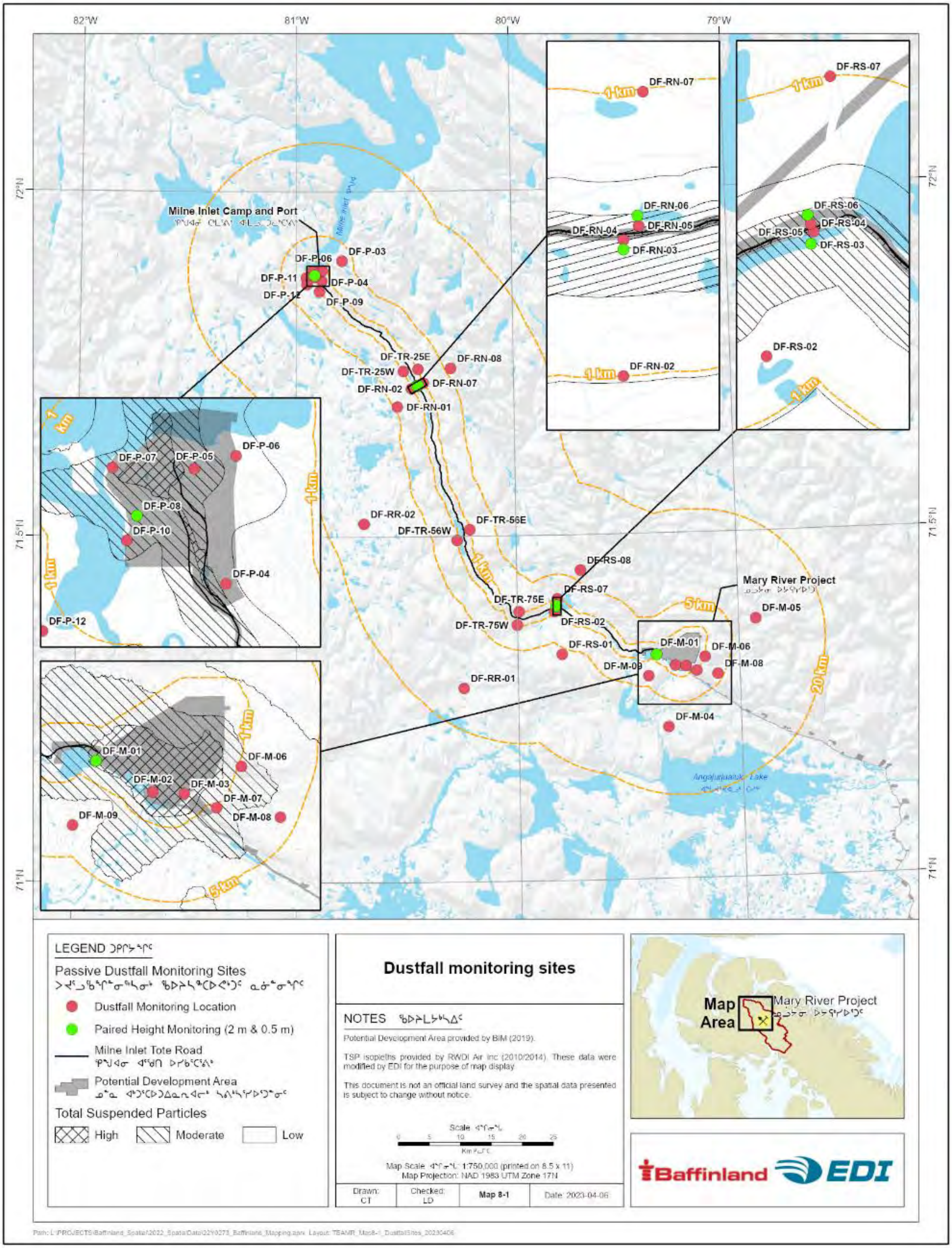

Milne Inlet Camp and Port
DF-P-03
DF-P-06
DF-P-11
DF-P-04
DF-P-12
DF-P-09
DF-TR-25E
DF-TR-25W
DF-RN-08
DF-RN-02
DF-RN-07
DF-RN-01
DF-RR-02
DF-TR-56E
DF-TR-56W
DF-RS-08
DF-RS-07
DF-TR-75E
DF-TR-75W
DF-RS-02
DF-RS-01
Mary River Project
DF-M-05
DF-M-01
DF-M-06
DF-M-09
DF-M-08
DF-RR-01
DF-M-04
Angajurjualuk Lake
DF-RN-06
DF-RN-05
DF-RN-04
DF-RN-03
DF-RS-06
DF-RS-04
DF-RS-05
DF-RS-03
DF-P-07
DF-P-05
DF-P-08
DF-P-10
DF-M-02
DF-M-03
DF-M-07
1 km
5 km
20 km
82°W
81°W
80°W
79°W
72°N
71.5°N
71°N
LEGEND
Passive Dustfall Monitoring Sites
Dustfall Monitoring Location
Paired Height Monitoring (2 m & 0.5 m)
Milne Inlet Tote Road
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Dustfall monitoring sites
NOTES
Potential Development Area provided by BIM (2019).
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
Map Scale: 1:750,000 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N
Drawn: CT
Checked: LD
Map 8-1
Date: 2023-04-06
Map Area
Mary River Project
Baffinland
EDI

Table 8-2. 2022 dustfall monitoring — sampling record.

Sampling Session	Sample Collection Date [1]	No. of Sample Days	No. of Canisters Deployed	No. of Canisters Analyzed	Sampling Solution
1	15-Jan-2022	29–31	40	25 [2]	Alcohol
2	15-Feb-2022	29–90	40	40	Alcohol
3	16-Mar-2022	28–35	40	40	Alcohol
4	13-Apr-2022	29–37	40	40	Alcohol
5	12-May-2022	28–29	40	40	Alcohol
6	11-Jun-2022	28–31	53	53	Alcohol
7	8-Jul-2022	27–31	53	53	Algaecide
8	7-Aug-2022	28–31	53	53	Algaecide
9	4-Sept-2022	28–35	53	53	Algaecide
10	3-Oct-2022	28–30	36	36	Alcohol
11	16-Nov-2022	16–45	36	34	Alcohol
12	15-Dec-2022	29–78	34	36	Alcohol

[1] Sample collection and jar changeout can take more than one day for all sites to be collected; the first date of monthly sampler changeout is presented here.

[2] Samples from 15 sites could not be accessed in mid-January due to poor snow conditions for snowmobiling. These samples were all collected in mid-February and had 60-day sampling intervals rather than 30. These sites include DF-P-09, DF-P-11, DF-P-12, DF-RS-02, DF-RS-03-S, DF-RS-07, DF-RN-02, DF-RN-06-S, DF-TR-07, DF-TR-25W, DF-TR-25E, DF-TR-56W, DF-TR-56E, DF-TR-75W, and DF-TR-75E.

8.3.1.3 Sampling Height Pilot Study

Through previous engagements at the TEWG and in comments on Baffinland's annual reports, the QIA—citing concerns that ground-level dustfall deposition could be underestimated—raised questions regarding applying the standard 2.0 m height of dustfall monitors (described in Section 8.3.1.2). To investigate potential sampling variability at the 2.0 m height versus ground level, paired dustfall monitors (standard 2.0 m height and 'ground-level' 0.5 m height) were installed at six sites in October 2021. Sites close to Project infrastructure (i.e., commonly having higher dustfall exposure) were selected: DF-M-01, DF-RS-03, DF-RS-06, DF-RN-03, DF-RN-06, and DF-P-08. Data collection at these sites began in September 2021. A full year of data comparing results collected at both heights is presented as part of this report.

The shorter dustfall height was chosen based on discussions in the TEWG beginning in 2018, culminating in a request by NIRB during the Phase 2 hearing, and Baffinland committing to the installation of six 0.5 m dustfall collectors in the fall of 2021 to address the non-standard dustfall sampling approach.

8.3.1.4 Data Trends and Statistical Analysis

Extent and Magnitude of Dustfall at Various Sites — Dustfall deposition rates (as TSP) for each site were compiled for the 2022 monitoring season; data were grouped according to the four study areas within the RSA. Data were reviewed to determine which sites in each sampling area were most affected by dustfall relative to reference sites.

Daily dustfall from summer sampling periods (June, July, August, and September) were used to evaluate the potential relationship between dustfall and distance from the road for the Mine Site and the Tote Road. Mixed effects models were used to test for a relationship between distance from Project infrastructure and daily dustfall.

- Sites were treated as the random effect.
- Distance from the Mine Site was treated as a categorical variable with three classes: Near (within footprint), Far (1,000 m to 5,000 m), and Reference (>5,000 m).
- Distance from the road was treated as a categorical variable with four classes: 30 m, 100 m, 1,000 m, and 5,000 m.

Data for daily dustfall as a function of distance from Project infrastructure did not always meet the assumptions of normality (Shapiro-Wilk test) or equality of variance (Levene's test) in the residuals required for a linear model. In such cases, differences in the distribution of dustfall by distance class were tested for using nonparametric Kruskall-Wallis tests, with data stratified by sampling month. Pairwise Wilcoxon tests were performed to determine which distance classes were different. Ninety-five percent bias-corrected and accelerated confidence intervals were calculated for each estimate by bootstrapping datasets and testing mixed effects models 1,000 times. Holm's p-value correction was applied when conducting pairwise comparisons. Medians and inter-quartile ranges were reported to summarize dustfall within distance classes. Statistical analyses were conducted using R version 4.2.1 (R Core Team 2022).

Seasonal Variation in Dustfall — Daily dustfall was assessed at year-round sites within all Project areas (i.e., Mine Site, Milne Port, and the Tote Road crossings) to determine whether there were either discrete seasonal/monthly patterns or continuous temporal patterns. The month of dustfall collection was identified from the time period between consecutive sample dates (e.g., samples collected early [<15] in December were associated with dustfall in November whereas samples collected later [>15] in December were associated with dustfall in December). Generalized least-squares regression were used to test for effects of season (summer and winter) or time (month time series) and sample site on daily dustfall accumulation. Seasonal models were used to test the main effects of season and sample site, as well as the interaction between them. Time-series models were used to test the main effects of sample site and cosinusoidal functions of month, as well as the interaction between them. All dustfall data were $\log_e$ 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 dustfall in one sampling period was most similar to samples from the preceding period (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 period time (Zuur et al. 2009). Model selection procedures followed an information theoretic approach using corrected Akaike's Information Criterion (AICc; Burnham and Anderson 2002). Models with the lowest scores were identified as the best trade-off between parsimony and explained variance.

Residual diagnostic plots were examined, and formal tests (Shapiro-Wilk and Levene's tests) were conducted to confirm assumptions of normality and homogeneity of variance in the residuals. If these assumptions were violated, bootstrap resampling (1,000 times) was conducted to develop 95% bias-corrected and accelerated confidence intervals for each estimate. If there was evidence of an effect of season or month on daily dustfall, estimated marginal means were used to determine the geometric mean effect after accounting for the effect of the sample site (Lenth et al. 2018). Statistical analyses were conducted using R version 4.2.1 (R Core Team 2022).

Annual Dustfall — Within the Early Revenue Phase (ERP) Final Environmental Impact Statement, annual TSP rate 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 (Doetzel and Bajina 2023). Values for these annual TSP rate predictions are as follows:

- Low — 1 to 4.5 $g/m^2/year$;
- Moderate — 4.6 to 50 $g/m^2/year$; and,
- High — ≥50 $g/m^2/year$.

The results of the 2022 dustfall sampling program for monitoring sites with year-round data collection were converted from units of $mg/dm^2 \cdot day$ to $g/m^2/year$. They were compared with the modelled dust deposition isopleths for the Project to determine if deposition rates exceeded the predicted range. Data for each month were converted to $g/m^2/day$, and then summed to add up to one year.

Note 1: Sites in the nil and low isopleth zones were not sampled during winter, so annual accumulation was not calculated for those sites. Very low dustfall accumulation, often below laboratory detection, was observed at these sites during summer.

Note 2: The laboratory detection limit for dustfall sampling is 0.10 $mg/dm^2 \cdot day$, which converts to an annual dustfall of 3.6 $g/m^2/year$ and is a substantial proportion of the low dustfall threshold of 4.5 $g/m^2/year$. Therefore, total annual dustfall may be overestimated at some sites where data collected each month had dustfall below the laboratory detection limit.

Inter-annual Trends — Linear mixed effects models were used to test for effects of year and season (summer and winter), month, or time (month time-series) on daily dustfall accumulation for each Project area (Mine Site, Milne Port, and the Tote Road crossings). Only sites that were sampled throughout the year were included in analyses. The month of dustfall collection was identified from the time period between consecutive sample dates (e.g., samples collected early [<15] in December were associated with dustfall in November whereas samples collected later [>15] in December were associated with dustfall in December). Monthly models were used to test the main effects of month and year, as well as the interaction between them. Time-series models were used to test the main effects of year and sine/cosine functions of month, as well as the interaction between them. 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 dustfall data were $\log_e$ transformed before analysis and results were back transformed to the original scale. A variance structure was parameterized on the number of sampling days per month in a given year for all models (Zuur et al. 2009).

Residual diagnostic plots were examined, and formal tests (Shapiro-Wilk and Leven's tests) were conducted to confirm assumptions of normality and equality of variance in the residuals. If these assumptions were violated, pairwise Wilcoxon tests were performed for factorial (categorical) designs and bootstrap resampling (1,000 times) was used to develop 95% bias-corrected and accelerated confidence intervals for each estimate. If there was evidence of an effect of month on daily dustfall, estimate marginal means were used to determine the geometric mean effect (Lenth et al. 2018). Model selection procedures followed an information theoretic approach using AICc (Burnham and Anderson 2002). Models with the lowest scores were identified as the best trade-off between parsimony and explained variance. Statistical analyses were conducted using R version 4.2.1 (R Core Team 2022).

Sampling Height Pilot Study — Results from paired tall (2 m) versus short (0.5 m) dustfall collectors were assessed to see if their daily dustfall accumulation differed. In total, there were 70 samples across six paired collectors (i.e., DF-M-01 = 12, DF-P-08 = 12, DF-RN-03 = 12, DF-RN-06 = 11, DF-RS-03 = 11, and DF-RS-06 = 12). Two simple analyses were conducted to determine if these collectors yielded similar data. First, a paired t-test was conducted between paired collectors to determine whether the mean difference in dustfall among short and tall collectors differed from zero. Second, a standardized major axis (type II) regression was used, due to sampling error in both axes, to determine whether the linear relationship between daily dustfall in tall and short collectors differed significantly from unity (i.e., a 1:1 relationship based on an intercept = 0 and a slope = 1). Residual diagnostic plots were examined, and formal tests (e.g., Shapiro–Wilk) were conducted to confirm assumptions of normality and equality of variance in the residuals.

8.3.2 RESULTS AND DISCUSSION

8.3.2.1 Magnitude and Extent of 2022 Dustfall

Mine Site — The 2022 monitoring program included nine dustfall monitors at the Mine Site: three within the Mine footprint (Near sites), four outside the Mine footprint but within the 5,000 m buffer (Far sites), and two Reference sites located more than 5,000 m from the Mine Site (Table 8-1).

Within the Mine footprint, dustfall deposition rates at DF-M-01, located near the airstrip, ranged from 0.51 to 13.3 mg/dm²·day, with the highest dustfall recorded in May 2022 (Table 8-3). At DF-M-02, located nearest to the crusher, the dust deposition rates ranged from 0.60 mg/dm²·day in December 2022 to 18.60 mg/dm²·day in February 2022. At DF-M-03, located just south of the Mine haul road near the ore deposit, the dustfall deposition rates ranged from 0.49 mg/dm²·day in November 2022 to a high of 7.56 mg/dm²·day in May 2022.

Outside the PDA but within a 5,000 m radius, sites DF-M-06, -07, -08, and -09 were sampled during the summer months (i.e., mid-May through mid-October). Dustfall sampled at these stations was low, generally ranging from below detection (<0.10 mg/dm²·day) to a high of 0.53 mg/dm²·day in July at DF-M-09 (Table 8-3).

Dustfall was significantly higher at the Near sites versus the Far and Reference sites ($\chi^2_2 = 50.28$, $P < 0.0001$; Figure 8-1). Geometric mean daily dustfall was highest in the Near distance class at 2.44 (Confidence Interval [CI] = 1.82–3.35) mg/dm²·day, which was significantly higher than the other two distance classes (all $P < 0.0001$). Ten samples (50%) in the Far distance class were above the detection limit (0.1 mg/dm²·day); the geometric mean daily dustfall recorded at the Far distance class was 0.15 (CI = 0.13–0.20) mg/dm²·day. No samples in the Reference distance class were above the detection limit (0.1 mg/dm²·day).

Table 8-3. 2022 summary of Total Suspended Particulates (mg/dm²·day).

Site ID	January	February	March	April	May	June	July	August	September	October	November	December
DF-M-01	5.04	5.63	0.91	3.77	13.30	3.27	2.50	1.74	0.51	1.19	0.57	2.31
DF-M-01-S	3.37	3.42	2.01	0.94	9.46	1.68	3.36	1.88	0.49	1.11	2.96	0.98
DF-M-02	1.96	18.60	3.39	5.92	4.54	1.50	4.65	1.62	1.03	0.99	5.19	0.60
DF-M-03	4.79	7.13	3.00	1.70	7.56	4.35	5.95	4.42	1.50	0.59	0.49	0.52
DF-M-04	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
DF-M-05	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
DF-M-06	-	-	-	-	-	<0.10	0.37	0.27	<0.10	<0.10	-	-
DF-M-07	-	-	-	-	-	<0.10	0.18	0.28	<0.10	<0.10	-	-
DF-M-08	-	-	-	-	-	<0.10	0.22	0.20	<0.10	<0.10	-	-
DF-M-09	-	-	-	-	-	0.18	0.53	0.20	<0.10	0.13	-	-
DF-P-03	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
DF-P-04	<0.10	0.17	0.11	0.21	0.98	1.33	0.31	0.35	0.63	0.18	0.28	0.10
DF-P-05	1.05	2.37	1.67	1.46	4.32	2.85	0.61	2.25	1.93	1.10	1.82	0.62
DF-P-06	0.27	0.50	0.31	0.27	0.69	0.46	0.10	0.15	0.26	0.14	0.34	0.11
DF-P-07	0.12	1.08	0.28	0.31	0.65	0.40	<0.10	0.38	0.24	0.25	0.38	0.25
DF-P-08	1.04	3.11	0.41	2.82	2.84	0.90	0.80	3.53	2.11	0.74	0.86	1.18
DF-P-08-S	1.50	2.54	0.47	3.70	2.62	0.98	0.95	3.25	1.93	0.76	0.75	1.85
DF-P-09	-	0.21	0.21	0.40	1.05	<0.10	0.42	0.68	0.24	-	-	0.17
DF-P-10	1.13	2.45	0.24	2.53	1.39	0.56	0.72	3.45	1.60	0.47	0.53	1.20
DF-P-11	-	<0.10	0.11	0.18	0.14	<0.10	0.10	0.11	0.11	-	-	0.11
DF-P-12	-	0.18	0.28	0.55	<0.10	<0.10	0.36	0.41	0.10	-	0.26	0.24
DF-RS-01	-	-	-	-	-	0.13	0.15	<0.10	<0.10	<0.10	-	-
DF-RS-02	-	<0.10	0.90	0.25	1.60	0.70	0.91	0.54	0.17	-	0.22	0.10
DF-RS-03	0.50	0.78	0.73	1.08	5.38	6.01	6.19	4.93	1.73	0.94	0.47	0.29
DF-RS-03-S	-	1.32	0.71	1.09	5.96	7.42	6.68	4.26	1.72	1.01	0.45	0.35
DF-RS-04	2.51	1.82	3.07	4.63	22.40	35.80	50.90	24.90	10.90	5.81	0.99	1.71
DF-RS-05	1.83	1.67	1.93	3.80	17.00	24.50	20.90	14.50	6.99	1.24	1.03	0.66
DF-RS-06	0.63	0.56	0.59	0.92	5.00	4.29	2.55	3.49	1.01	0.40	0.24	0.40

Table 8-3. 2022 summary of Total Suspended Particulates (mg/dm²·day).

Site ID	January	February	March	April	May	June	July	August	September	October	November	December
DF-RS-06-S	0.62	0.36	0.47	1.13	5.60	4.46	2.50	2.38	1.20	0.48	0.42	0.28
DF-RS-07	-	<0.10	<0.10	0.14	0.28	0.21	0.23	<0.10	<0.10	-	0.18	0.10
DF-RS-08	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
DF-RN-01	-	-	-	-	-	<0.10	0.13	0.24	<0.10	<0.10	-	-
DF-RN-02	-	<0.10	<0.10	<0.10	0.37	<0.10	0.23	0.11	<0.10	-	0.28	0.10
DF-RN-03	0.64	0.50	0.97	0.87	3.91	2.97	2.98	3.00	2.50	0.90	1.34	0.36
DF-RN-03-S	0.93	0.88	0.91	1.33	4.61	2.22	2.54	2.55	2.51	0.80	1.10	0.37
DF-RN-04	1.17	1.57	1.17	2.41	9.32	6.42	7.62	5.42	5.36	1.79	2.16	0.54
DF-RN-05	2.16	1.76	1.70	2.65	17.30	12.50	13.60	4.77	8.58	1.91	2.00	0.94
DF-RN-06	1.07	1.06	0.93	1.40	8.51	6.11	3.86	1.96	2.80	0.83	1.04	0.78
DF-RN-06-S	-	0.74	1.33	1.90	9.58	6.50	2.45	4.82	5.93	1.08	1.22	0.95
DF-RN-07	-	<0.10	<0.10	0.17	1.08	0.27	0.27	0.45	0.12	-	0.22	0.10
DF-RN-08	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
DF-RR-01	-	-	-	-	-	0.12	<0.10	<0.10	<0.10	<0.10	-	-
DF-RR-02	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
DF-TR-25W	-	<0.10	<0.10	0.22	0.73	0.32	0.33	0.60	0.18	-	0.49	0.10
DF-TR-25E	-	<0.10	<0.10	0.28	1.08	0.14	0.48	0.44	0.20	-	0.44	0.10
DF-TR-56W	-	<0.10	<0.10	0.17	0.30	0.12	0.42	0.33	<0.10	-	0.21	0.10
DF-TR-56E	-	<0.10	<0.10	0.13	0.32	<0.10	0.21	0.30	0.13	-	0.18	0.10
DF-TR-75W	-	0.24	0.25	0.57	1.37	0.18	0.70	1.11	<0.10	-	0.54	0.10
DF-TR-75E	-	<0.10	<0.10	0.17	0.28	0.20	0.34	0.24	0.17	-	0.18	0.10
DF-RW-01	-	<0.10	<0.10	<0.10	0.30	<0.10	0.10	<0.10	<0.10	-	-	-
DF-RW-02	-	<0.10	<0.10	<0.10	0.37	<0.10	0.12	<0.10	<0.10	-	-	-
DF-RW-03	-	<0.10	<0.10	<0.10	0.32	<0.10	0.18	0.14	<0.10	-	-	-
DF-RW-04	-	<0.10	<0.10	<0.10	0.33	<0.10	0.15	0.12	<0.10	-	-	-

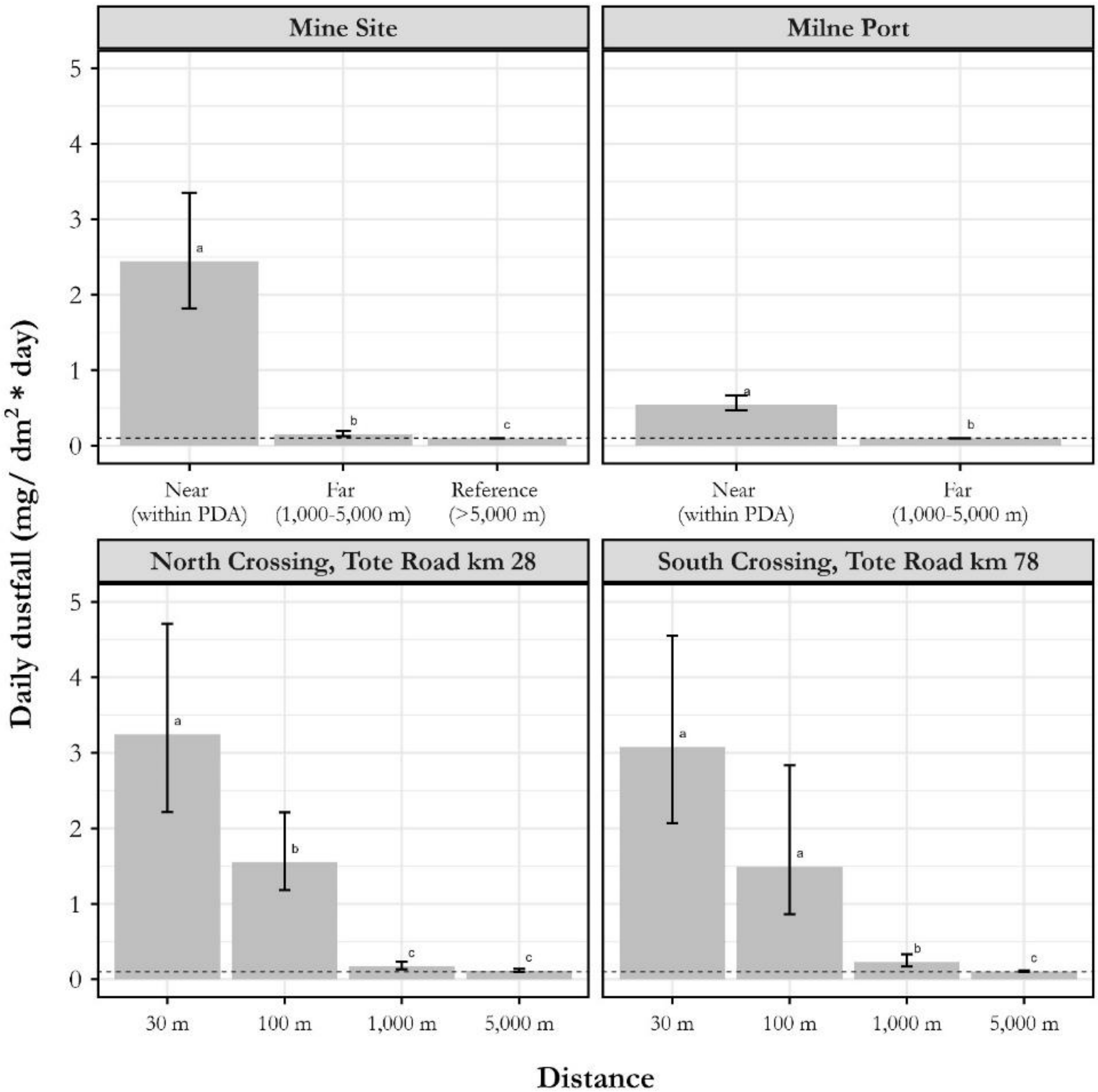


Figure 8-1. 2022 mean daily dustfall (mg/dm²·day) for the Mine Site, Milne Port, and the Tote Road crossings (KM28 and KM78) — fixed y-axis; PDA is the Potential Development Area.

The Tote Road sites are measured as a function of distance from the Tote Road. Scales are different for each area to allow a review of differences between the sites at each area. Bar heights show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the log_e scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

Milne Port — Ten dustfall monitors were associated with Milne Port in 2022 (Table 8-1; Map 8-1): five active sites on the Milne Port footprint and five outside the PDA boundary. The two main sources of dustfall at Milne Port are the sealift staging area and the ore stockpile area.

Dustfall deposition rates at Milne Port were highest at DF-P-05, located centrally in the camp area and east of the sealift staging pad, where dustfall ranged from 0.61 mg/dm²·day in July 2022 to 4.32 mg/dm²·day in May 2022 (Table 8-3). Dustfall deposition rates at DF-P-06, nearest to the sealift staging pad on the west side, ranged from 0.10 mg/dm²·day to a high of 0.69 mg/dm²·day (Table 8-3). Dustfall deposition at DF-P-08, nearest the ore pad, ranged from 0.41 to 3.53 mg/dm²·day in August 2022, while dustfall at DF-P-10, which is the same direction but further out near the PDA boundary, ranged from 0.24 to 3.45 mg/dm²·day. Dustfall at DF-P-07, near the ore pad but further to the north, had dustfall ranging from below laboratory detection (0.10 mg/dm²·day) to 1.08 mg/dm²·day in February 2022. Dustfall at DF-P-04, primarily associated with the Tote Road and quarry operations, ranged from below laboratory detection to 1.33 mg/dm²·day. Sites DF-P-11 and DF-P-12 are located west of the PDA, at approximately 1,000 m distant; dustfall ranged from below detection to a high of 0.18 mg/dm²·day and 0.55 mg/dm²·day, respectively. Dustfall deposition rates at DF-P-03, sampled only in summer months, were below detection during all sampling events (June to October).

Evidence showed that Near and Far classes differed in their geometric mean daily dustfall ($\chi^2_1 = 11.91$, $P = 0.0006$; Figure 8-1). Geometric mean daily dustfall was highest in the Near distance class at 0.54 (CI = 0.47–0.67), followed by the Far distance class at 0.10 (CI = 0.10–0.10). Fifty-six samples (93%) in the Near distance class and no samples in the Reference distance class were above the detection limit (0.1 mg/dm²·day).

Tote Road Dustfall — Twenty-four dustfall monitors were associated with the Tote Road in 2022: eight at each of two transects perpendicular to the road (the North crossing site at KM28 of the Tote Road, and South Crossing site at KM78 of the Tote Road), two Reference monitors located approximately 14,000 m from the road, and three pairs of two sites located 1,000 m from each side of the road at KM25, KM56, and KM75 of the Tote Road.

North Crossing, Tote Road KM28 — Dustfall was highest at the monitors nearest the centerline on both sides of the Tote Road (DF-RN-04 and -05), with dustfall ranging from 0.54 to 9.32 mg/dm²·day at DF-RN-04 and from 0.94 to 17.30 mg/dm²·day at DF-RN-05. Dustfall decreased with distance from the centerline, and dustfall at DF-RN-03 and DF-RN-06 ranged from 0.36 to 3.91 mg/dm²·day, and from 0.78 to 8.51 mg/dm²·day, respectively. Dustfall in two monitors located 1,000 m from the PDA (DF-RN-02 and -07) ranged from below detection to 0.37 mg/dm²·day, and below detection to 1.08 mg/dm²·day, respectively. Dustfall deposition data collected during the summer season at the farthest sites (DF-RN-01 and -08) ranged from below laboratory detection to 0.24 mg/dm²·day, and were below detection in all samples, respectively (Table 8-3).

There was evidence of an effect of distance from the north road on daily dustfall ($\chi^2 3 = 56.18$, $P < 0.0001$; Figure 8-1). Geometric mean daily dustfall was highest in the 30 m distance class, 3.25 (CI = 2.21–4.71) mg/dm²·day, compared to all others (all $P < 0.02$). Geometric mean daily dustfall in the 100 m distance class was 1.55 (CI = 1.18–2.21) mg/dm²·day, which was significantly higher than the two farther distance classes (all $P < 0.0001$). There was suggestive evidence of a difference in dustfall between the 1,000 m and 5,000 m distance classes ($P = 0.06$). The geometric mean daily dustfall in the 1,000 m distance class was 0.17 (CI = 0.13–0.23) mg/dm²·day, and 55% of all samples were above the detection limit. One-fifth (20%) of the samples in the 5,000 m distance class were above the detection limit of 0.1 mg/dm²·day.

South Crossing, Tote Road KM78 — Dustfall was highest at monitors nearest the centerline on the south side of the Tote Road (DF-RS-04), where dustfall ranged from 0.99 to 50.90 mg/dm²·day. On the north side of the road (DF-RS-05), dustfall ranged from 0.66 to 24.50 mg/dm²·day. Dustfall decreased with distance from the centerline, and dustfall at DF-RS-03 and DF-RS-06 ranged from 0.29 to 6.19 mg/dm²·day and from 0.24 to 5.00 mg/dm²·day, respectively. Dustfall in collectors at 1,000 m from the PDA (DF-RS-02 and -07) ranged from below detection to 1.60 mg/dm²·day, and below detection to 0.28 mg/dm²·day, respectively. Dustfall deposition data collected during the summer season at the farthest sites (DF-RN-01 and -08) ranged from below detection to 0.15 mg/dm²·day, and below detection in all samples, respectively (Table 8-3). The South Crossing monitors are in a wide valley where high winds are common, generally travelling north to south; these sites are also just north of a bridge crossing. As vehicles exit the bridge, they accelerate, increasing dust production. The winds then blow towards the south of the Tote Road. Dustfall at the South Crossing generally represents the 'worst-case scenario' for dustfall along the Tote Road.

There was evidence of an effect of distance from the south road on daily dustfall ($\chi^2 3 = 48.93$, $P < 0.0001$; Figure 8-1). Geometric mean daily dustfall was highest in the 30 m distance class at 3.06 (CI = 2.07–4.55) mg/dm²·day, which was significantly higher than the 1,000 m and 5,000 m distance classes (all $P < 0.0005$) but no different than the 100 m distance class ($P = 0.15$). The geometric mean dustfall in the 100 m distance class was 1.49 (CI = 0.86–2.84) mg/dm²·day; there was evidence that this was higher than the 1,000 m and 5,000 m distance classes (all $P < 0.0005$). There was also suggestive evidence of a difference in geometric mean dustfall between the 1,000 m (0.23 [CI = 0.17–0.33] mg/dm²·day) and 5,000 m (0.11 [CI = 0.10–0.12] mg/dm²·day) distances classes ($P = 0.02$). Twelve samples (60%) in the 1,000 m distance class and two samples (20%) in the 5,000 m distance class were above the detection limit.

Reference Sites — Dustfall deposition rates at the two Tote Road reference sites (DF-RR-01 and DF-RR 02), which are sampled only during summer months, were below lab detection in all samples except for one (i.e., DF-RR-02 in June with a dustfall of 0.12 mg/dm²·day, just above the detection limit) (Table 8-3).

Dustfall at Sites 1,000 m from the PDA — Twelve dustfall monitoring sites were located 1,000 m from the PDA; two were located at the Mine Site, and the other ten were in various locations along the Tote Road. The two Mine Site collectors were sampled only during the summer, whereas the road sites were sampled throughout the year.

There were significant differences in dustfall among the sites located 1,000 m from the PDA during summer ($\chi^2 11 = 61.94$, $P < 0.0001$; Figure 8-2). Geometric mean daily dustfall was highest for DF-RS-02 (0.46 [CI = 0.45–0.47)] mg/dm²·day) and lowest for DF-RN-02 (0.11 [CI = 0.11–0.12)] mg/dm²·day) (Difference = 0.35 mg/dm²·day, $P = 0.0004$). There was suggestive evidence of differences in dustfall among sites located 1,000 m from the PDA based on year-round data ($\chi^2 11 = 19.31$, $P = 0.06$; Figure 8-3). Pairwise comparisons between sites revealed no significant differences after accounting for multiple tests (i.e., 'Holm' p-value correction).

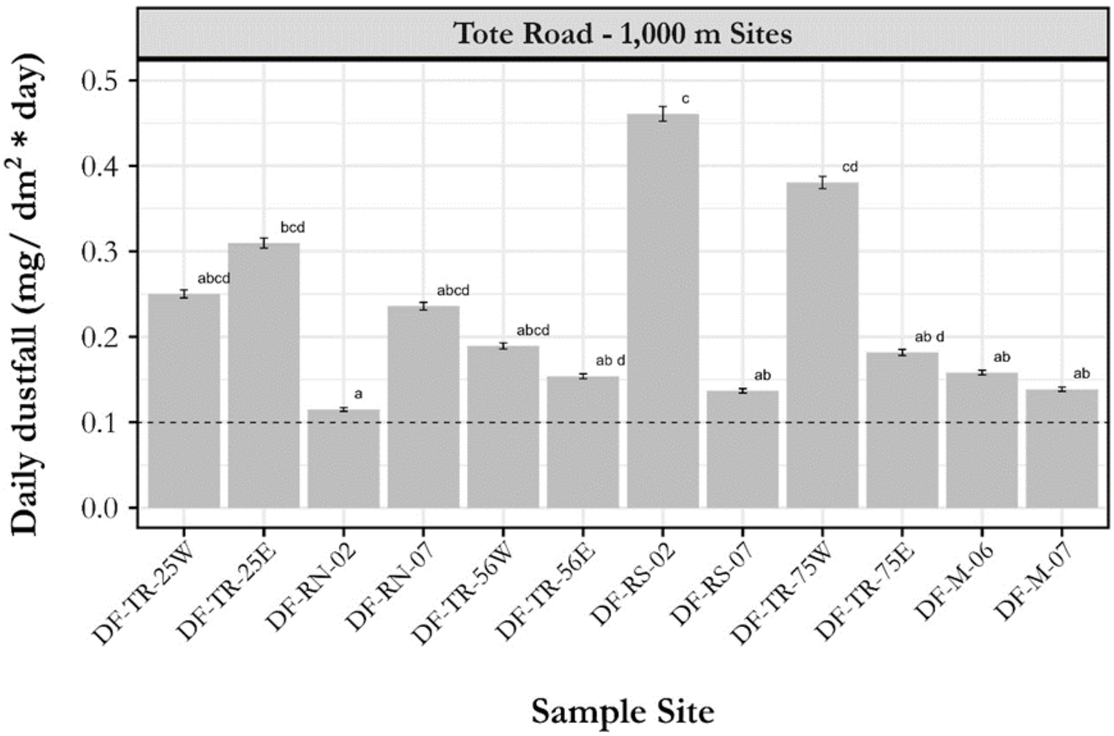


Figure 8-2. 2022 mean daily dustfall (mg/dm²·day) at 1,000 m from the Potential Development Area (summer sampling).

Bar heights show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the $\log_e$ scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

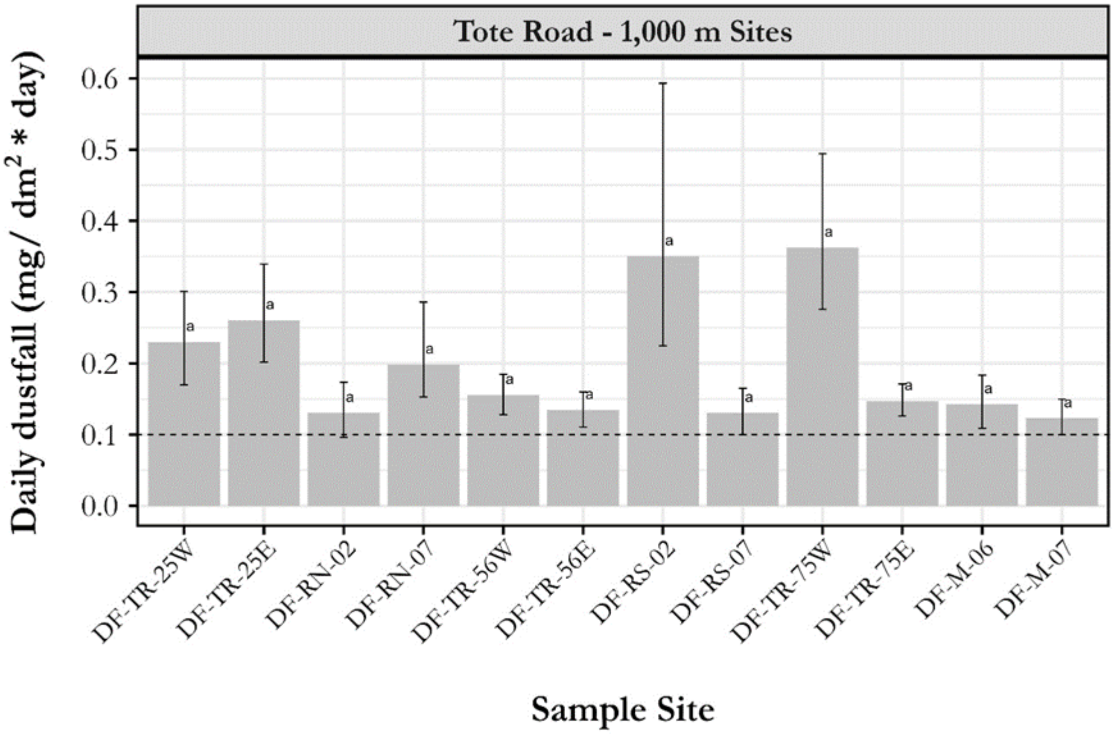


Figure 8-3. 2022 mean daily dustfall (mg/dm²·day) at 1,000 m from the Potential Development Area (year-round sampling).

Bar heights show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the $\log_e$ scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

8.3.2.2 Seasonal Comparisons of 2022 Dustfall

Seasonal variations in dustfall were investigated as per the dustfall monitoring objectives. Dustfall deposition across the PDA indicated different seasonal trends depending on location. For example, dustfall at the Mine Site and Milne Port was elevated in late winter/early spring (February to April/May), whereas dustfall deposition along the Tote Road seemed to be elevated through the early summer months with a peak in May/June.

Mine Site — Patterns across time were best represented by an effect of month, with peaks in February, April, and May (F_{10} = 12.06, P < 0.0001; Figure 8-4). This model better explained variation in the data than a model with sinusoidal fluctuations across months (AICc = 95.00 versus 97.67, respectively). The highest daily dustfall occurred in February (10.23 [CI = 6.15–17.00] mg/dm²·day), and the lowest daily dustfall occurred in December (0.88 [CI = 0.53–1.46] mg/dm²·day).

Milne Port — Patterns across time were best represented by an effect of month (F_{10} = 8.34, P < 0.0001) and site (F_4 = 33.57, P < 0.0001), with peaks in February, April, and May (Figure 8-4). This model better explained variation in the data than a model with sinusoidal fluctuations across months per site (AICc = 119.09 versus 135.51, respectively). The highest daily dustfall occurred in April at site DF-P-05 (3.92 [CI = 2.46–6.26] mg/dm²·day), and the lowest daily dustfall occurred in June at site DF-P-06 (0.13 [CI = 0.08–0.20] mg/dm²·day).

North Crossing, Tote Road KM28 — Patterns across time were best represented by differences in sites only (F_3 = 32.02, P < 0.0001). The effects of season (F_1 = 1.28, P = 0.26) and a sinusoidal function (F_1 = 1.16, P = 0.29; Figure 8-4) did not explain any additional variation. Differences in months were identified (F_{10} = 5.63, P < 0.0001; Figure 8-5) but were not a parsimonious model. Ultimately, the site-only model was the most parsimonious and had the lowest AICc score (76.96 versus 78.26 [with season], 78.93 [with sine function], and 87.60 [with month]). Geometric mean daily dustfall was greatest at site DF-RN-05 in May (10.73 [CI = 7.15–14.86] mg/dm²·day) and June (10.29 [CI = 6.32–13.64] mg/dm²·day) of 2022. Geometric mean daily dustfall was least in December at sites DF RN-03 (0.37 [CI = 0.26–0.57] mg/dm²·day) and DF-RN-06 (0.50 [CI = 0.31–0.73] mg/dm²·day.

South Crossing, Tote Road KM78 — Patterns across time were best represented by fluctuating patterns across time (interaction term with eight-month cycle; F_3 = 4.06, P = 0.01; Figure 8-4) rather than monthly (Figure 8-5) or seasonal (Figure 8-6) differences (AICc = 80.66 versus 99.12 and 96.63, respectively). The sinusoidal function explained more variation even though it had a relatively weak fit to the data. The strongest effect was that of site (F_3 = 107.84, P < 0.0001). Geometric mean daily dustfall was consistently highest at site DF-RS-04 across several months (Figure 8-4 and Figure 8-5); the highest values were associated with May (33.18 [CI = 21.47–45.69] mg/dm²·day) and June (31.17 [CI = 16.07–46.75] mg/dm²·day). This same pattern was evident across all sites, even those with relatively low dustfall overall (e.g., highest rates for site DF-RS-06 were 5.12 [CI = 3.92–8.11] mg/dm²·day in May and 4.85 [CI = 3.12–10.03] mg/dm²·day in June).

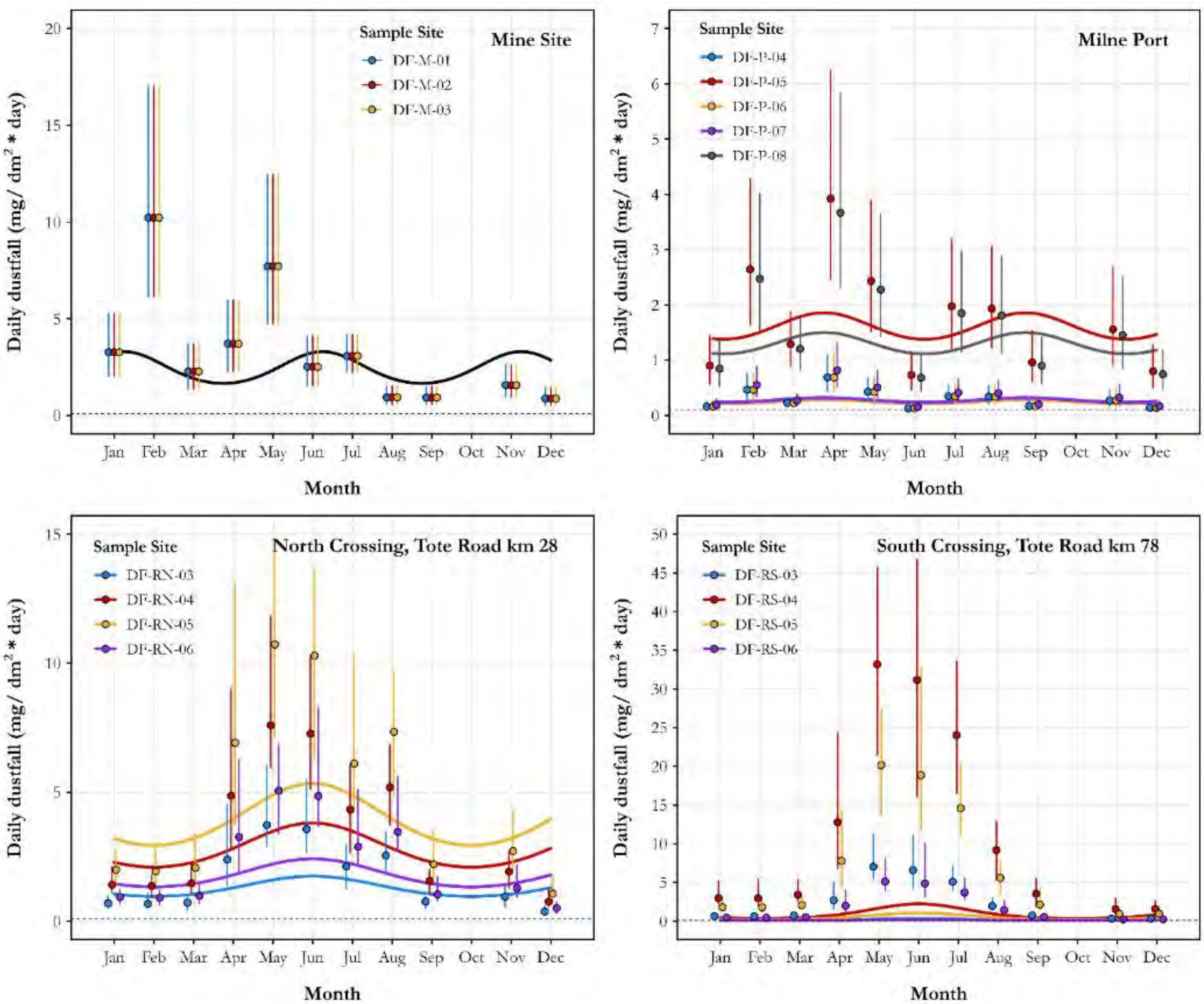


Figure 8-4. 2022 mean daily dustfall (mg/dm²·day) by site and month (time series or category) or season (category) across the Project.

Scales are different for each area to allow a review of differences between the sites at each area. Bar heights show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the $\log_e$ scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

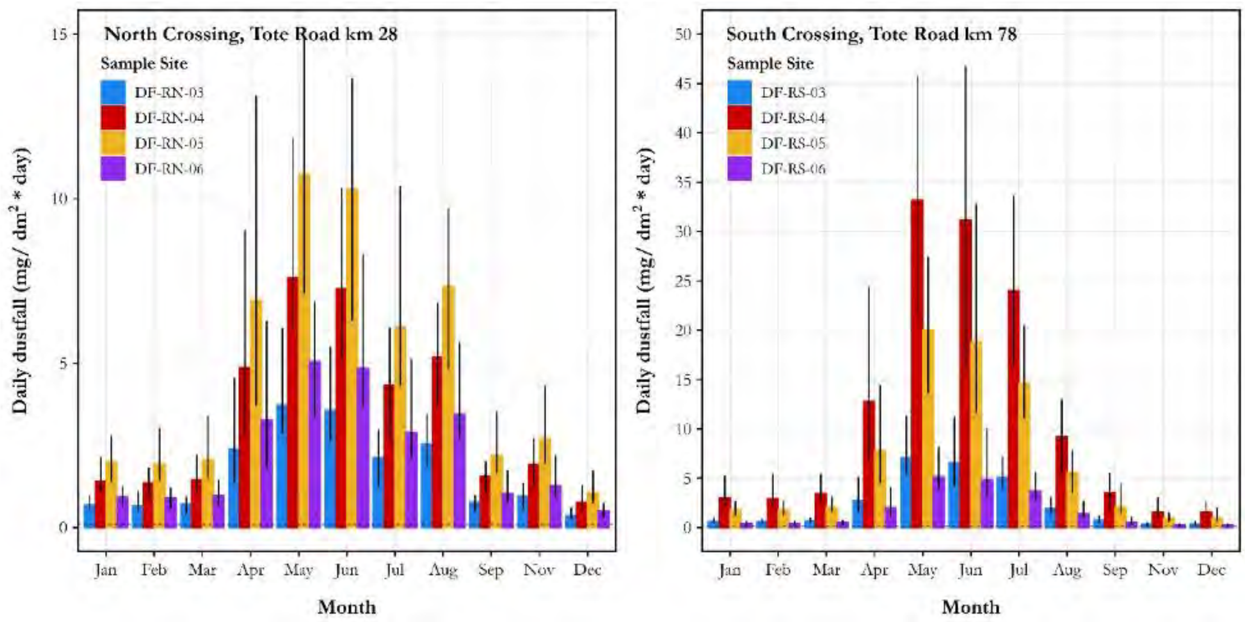


Figure 8-5. 2022 mean daily dustfall (mg/dm²·day) by site and month at the Tote Road crossings (KM28, KM78).

Scales are different for each area to allow a review of differences between the sites at each area. Bar heights show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the log_e scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

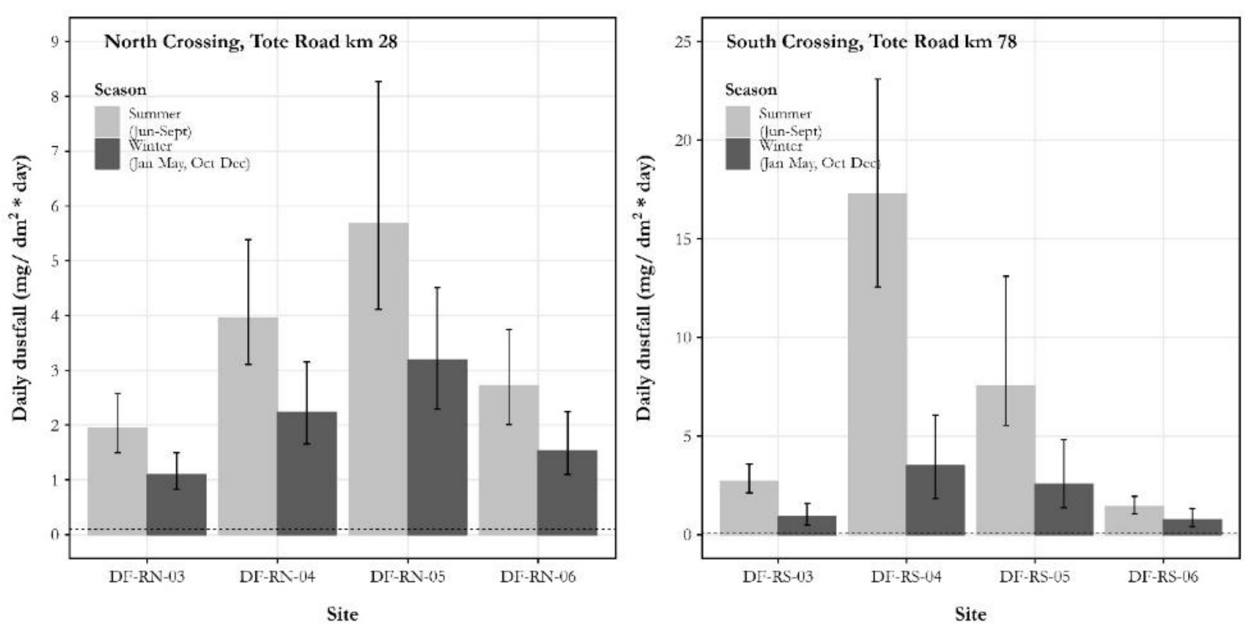


Figure 8-6. 2022 mean daily dustfall (mg/dm²·day) by site and season (summer and winter) at the Tote Road Crossings (KM28, KM78).

Bar heights show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the log_e scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

8.3.2.3 2022 Annual Dustfall

Total annual dustfall for the 2022 calendar year was calculated for all sites and each area in the Project RSA (Table 8-4; Figure 8-7; Figure 8-8). Annual dustfall quantities were based on those observed during monitoring and included predicted amounts (*) for sites that were sampled partially during the year (i.e., less than 365 days). For the latter sites, the total observed dustfall quantity was summed with the predicted dustfall during winter months when sampling did not occur. Those predictions were developed using a model-based approach that estimated the quantity of dustfall during winter at sites at various distances from the Mine Site, Milne Port, and the Tote Road (Doetzel and Bajina 2023). The predicted quantities added to observed dustfall quantities depended on each site's temporal coverage during 2022. The following equation was used to calculate annual dustfall (g/m²/year) in Table 8-4:

$$Annual.Dust_{Total} = Annual.Dust_{Observed} + (Daily.Dust_{Predicted} \times [365 - Days.Sampled])$$

Table 8-4. Annual dustfall accumulation for sites sampled throughout 2022.

Site	Area	Distance from PDA	Predicted Range [1]	Isopleth Upper Limit	Annual Dustfall (g/m²/year)	EIS Prediction Comparison
DF-M-01	Mine Site	0.00	High	N/A [2]	121.98	Within prediction
DF-M-02	Mine Site	0.00	High	N/A [2]	154.90	Within prediction
DF-M-03	Mine Site	0.00	High	N/A [2]	127.77	Within prediction
DF-M-04	Mine Site	9.23	Low	4.5	4.44*	Within prediction
DF-M-05	Mine Site	9.23	Low	4.5	4.43*	Within prediction
DF-M-06	Mine Site	1.18	Moderate	50	17.87*	Within prediction
DF-M-07	Mine Site	1.23	Moderate	50	17.23*	Within prediction
DF-M-08	Mine Site	4.09	Moderate	50	10.45*	Within prediction
DF-M-09	Mine Site	3.35	Moderate	50	13.11*	Within prediction
DF-P-03	Milne Port	3.27	Low	4.5	3.32*	Within prediction
DF-P-04	Milne Port	0.00	Low	4.5	14.41	Above prediction
DF-P-05	Milne Port	0.00	Moderate	50	67.65	Above prediction
DF-P-06	Milne Port	0.00	Low	4.5	11.37	Above prediction
DF-P-07	Milne Port	0.00	Moderate	50	13.91	Within prediction
DF-P-08	Milne Port	0.08	Moderate	50	60.93	Above prediction
DF-P-09	Milne Port	1.00	Moderate	50	13.96	Within prediction
DF-P-10	Milne Port	0.00	Moderate	50	48.86	Within prediction
DF-P-11	Milne Port	1.17	Moderate	50	4.53	Within prediction
DF-P-12	Milne Port	1.35	Moderate	50	10.02	Within prediction
DF-RN-01	Road North	4.54	Low	4.5	4.86*	Above prediction
DF-RN-02	Road North	1.00	Low	4.5	5.61	Above prediction
DF-RN-03	Road North	0.07	Moderate	50	61.40	Above prediction

Table 8-4. Annual dustfall accumulation for sites sampled throughout 2022.

Site	Area	Distance from PDA	Predicted Range [1]	Isopleth Upper Limit	Annual Dustfall (g/m²/year)	EIS Prediction Comparison
DF-RN-04	Road North	0.00	Moderate	50	131.64	Above prediction
DF-RN-05	Road North	0.01	Moderate	50	201.77	Above prediction
DF-RN-06	Road North	0.09	Moderate	50	88.51	Above prediction
DF-RN-07	Road North	0.98	Low	4.5	9.48	Above prediction
DF-RN-08	Road North	5.92	Low	4.5	3.59*	Within prediction
DF-RS-01	Road South	6.02	Low	4.5	3.78*	Within prediction
DF-RS-02	Road South	0.63	Low	4.5	17.88	Above prediction
DF-RS-03	Road South	0.07	Moderate	50	83.70	Above prediction
DF-RS-04	Road South	0.00	Moderate	50	472.59	Above prediction
DF-RS-05	Road South	0.00	Moderate	50	275.49	Above prediction
DF-RS-06	Road South	0.00	Moderate	50	58.26	Above prediction
DF-RS-07	Road South	0.95	Low	4.5	5.81*	Above prediction
DF-RS-08	Road South	6.67	Low	4.5	3.26*	Within prediction
DF-RR-01	Tote Road	13.99	Low	4.5	1.88*	Within prediction
DF-RR-02	Tote Road	14.00	Low	4.5	1.81*	Within prediction
DF-TR-25E	Tote Road	1.19	Low	4.5	11.17	Above prediction
DF-TR-25W	Tote Road	1.01	Low	4.5	9.61	Above prediction
DF-TR-56E	Tote Road	0.90	Low	4.5	5.96	Above prediction
DF-TR-56W	Tote Road	1.14	Low	4.5	6.85	Above prediction
DF-TR-75E	Tote Road	1.00	Low	4.5	6.48	Above prediction
DF-TR-75W	Tote Road	1.07	Low	4.5	16.81	Above prediction

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/m²/year of total suspended particulate matter (dustfall).

* Extrapolated (winter) dustfall prediction was added to the observed dustfall amount. The amount added to the observed quantity was inversely proportional to the number of sampling days (i.e., lower total sampling days resulted in greater amounts added to observed dustfall quantities).

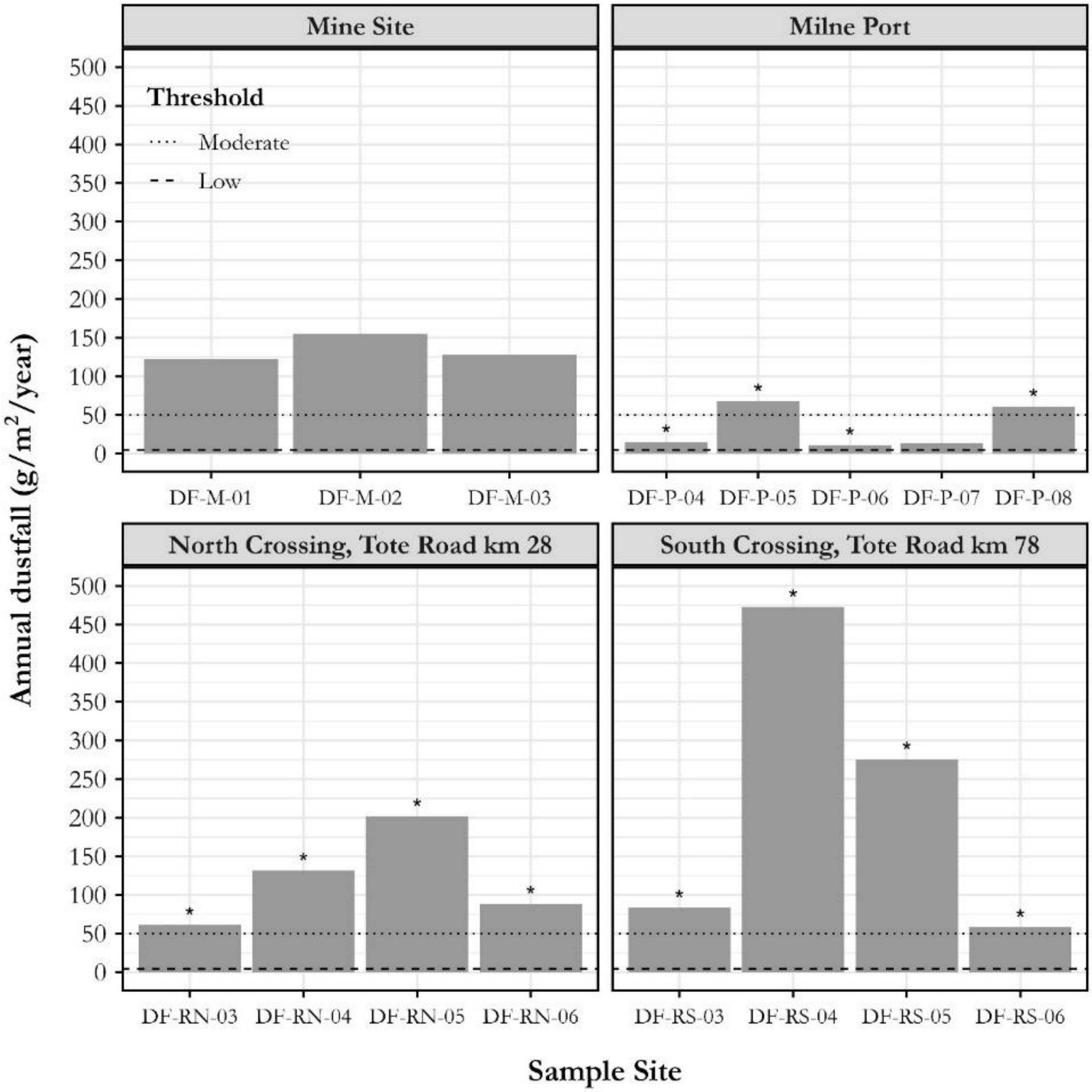


Figure 8-7. **2022 annual dustfall (g/m²/year) for stations sampled year round.**
Dashed horizontal lines show low and moderate dust isopleth upper limits. The asterisk (*) denotes that the annual dustfall was greater than projected by the predicted isopleth.

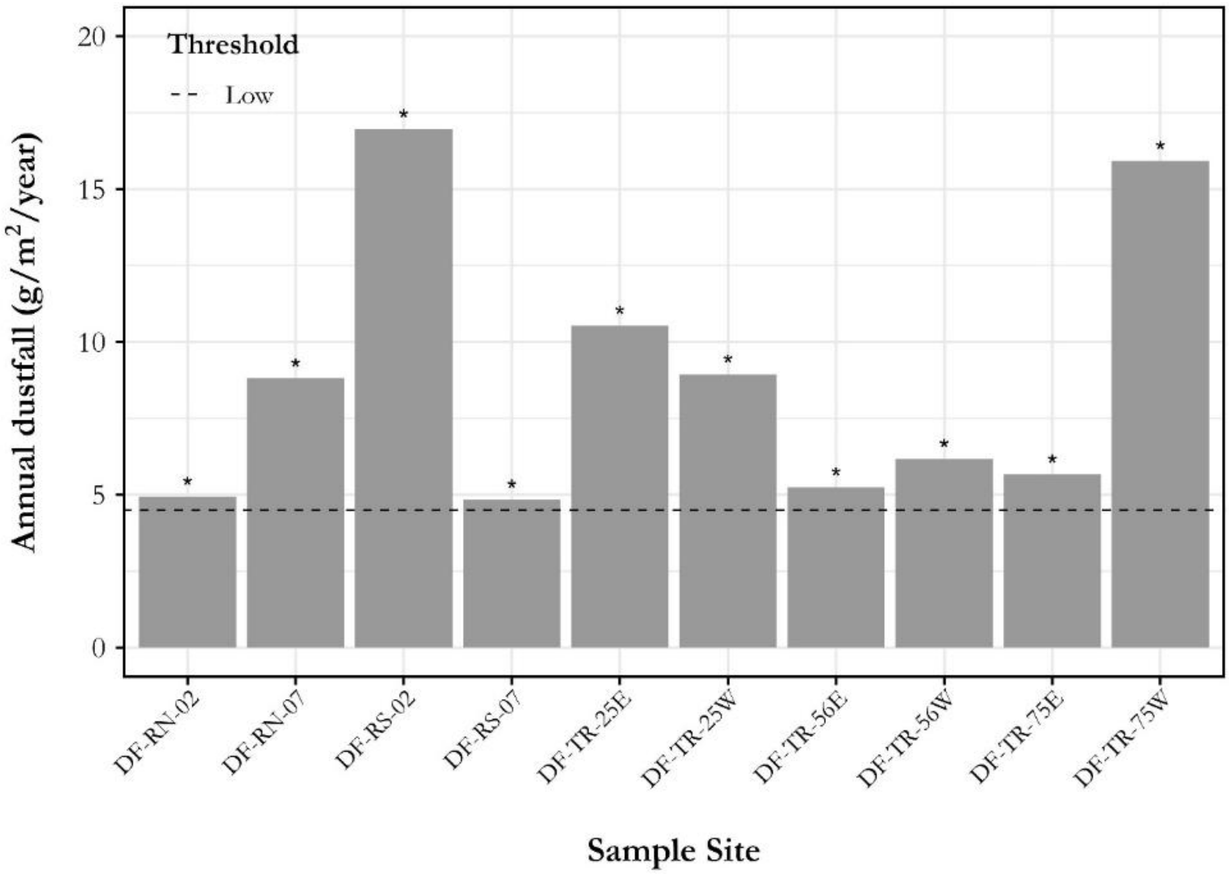


Figure 8-8. 2022 total annual dustfall (g/m²/year) at 1,000 m from the Tote Road.
Dashed horizontal line shows the low dust isopleth upper limit. The asterisk (*) denotes that the annual dustfall was greater than projected by the predicted isopleth.

8.3.3 INTER-ANNUAL TRENDS

8.3.3.1 Seasonal Dustfall

Mine Site — No multi-year seasonal trends in increasing dustfall were identified; however, 2022 was among the highest measured since 2016. The 2022 trend was driven by increases at DF-M-02 and DF-M-03 (located near the crusher and the haul road, respectively). Inter-annual patterns across time were best represented by differences in months rather than year-specific fluctuations or a common fluctuation across time (AICc = 838.20 versus 859.33 and 850.27, respectively). The strongest evidence was for the effect of month (F_{11} = 5.37, P < 0.0001; Figure 8-9). There was also evidence of a year effect (F_7 = 2.57, P = 0.01). The highest dustfall repeatedly occurred in March, April, and May, while lower dustfall around the Mine Site was noted during winter (December through February) and summer (June through August). The greatest geometric mean daily dustfall rates were in May (5.25 [CI = 1.84–15.04] mg/dm²·day) and April (5.14 [CI = 1.88–14.07] mg/dm²·day) of 2022. The least geometric mean daily dustfall rates were in December (0.70 [CI = 0.25–1.95] mg/dm²·day) and August (0.73 [CI = 0.26–2.02] mg/dm²·day) of 2015. Most activities around the Mine Site, including ore mining and air strip use, are constant year-round and do not change with seasons. Therefore, these trends suggest elevated dustfall around the Mine Site during spring and fall may be associated with reduced implementation/effectiveness of dustfall mitigations during times of freeze/thaw conditions.

Milne Port — Inter-annual patterns in dustfall at Milne Port were best represented by year-specific sinusoidal functions rather than a common fluctuation or month effect (AICc = 878.54 versus 898.93 and 887.58, respectively). Fluctuations in geometric mean daily dustfall seemed to follow a six-month cyclic pattern that varied in magnitude by year, with peaks occurring in April and October ($F_7 = 5.24$, $P < 0.0001$; Figure 8-10). The April peak comes as stockpiles grow, following a winter season of stockpiling and no shipping. The October peak comes as the shipping season is ending, with dustfall associated with ore handling, and when the onset of freezing conditions hampers dustfall mitigations. Highs and lows across months were most pronounced in 2018 (e.g., high of 1.35 [CI = 1.1–1.69] mg/dm²·day in April and low of 0.39 [CI = 0.31–0.49] mg/dm²·day in December) (Figure 8-10). Fluctuations in 2022 were lower than most years but higher than 2021, with highs in April (0.92 [CI = 0.80–1.09] mg/dm²·day) and lows in December (0.26 [CI = 0.22–0.32] mg/dm²·day). The relatively flat curve in 2015 is because those data did not conform well with an approximate six-month period, unlike other years, and because the standard error of the monthly estimates for 2015 were greater than the corresponding mean values.

Tote Road — Dustfall along the Tote Road has been consistently elevated from April through October. This corresponds with early spring melt, summer, and early fall freeze-up. During the winter season, when conditions are consistently frozen, dustfall is significantly less.

North Crossing, Tote Road KM28 — Similar to the Mine Site, inter-annual patterns across time were best represented by differences in months and years rather than year-specific fluctuations or a common fluctuation across time (AICc = 853.53 versus 993.61 and 984.63, respectively). There was strong evidence for an effect of month ($F_{11} = 8.98$, $P < 0.0001$; Figure 8-11) and year ($F_7 = 4.16$, $P = 0.0002$) with a two-way Analyses of Variance (ANOVA), but normality and homoscedasticity assumptions were violated. Pairwise Wilcoxon tests revealed that the greatest differences in dustfall were between February and May, June, and July (all $P < 0.0001$). Geometric mean daily dustfall was highest in June 2020 (7.34 [CI = 6.07–8.87] mg/dm²·day) and lowest in February 2019 (0.40 [CI = 0.34–0.48] mg/dm²·day).

South Crossing, Tote Road KM78 — Inter-annual patterns across time were best represented by differences in months and years rather than year-specific fluctuations or a common fluctuation across time (AICc = 924.04 versus 1,127.59 and 1,129.50, respectively). The greatest geometric mean daily dustfall occurred in May, June, and July for all years (Figure 8-12); the greatest values were associated with 2020 (15.49 [CI = 12.67–18.74] mg/dm²·day in June and 14.77 [CI = 12.73–17.13] mg/dm²·day in May). The least geometric mean daily dustfall occurred in February for most years; the lowest values were associated with February 2017 (0.27 [CI = 0.22–0.33] mg/dm²·day). There was strong evidence for an effect of month ($F_{11} = 90.80$, $P < 0.0001$) and year ($F_7 = 10.53$, $P < 0.0001$) with a two-way ANOVA, but normality and homoscedasticity assumptions were violated. Pairwise Wilcoxon tests revealed that the greatest differences in dustfall were between June and January, February, March, and December (all $P < 0.0001$).

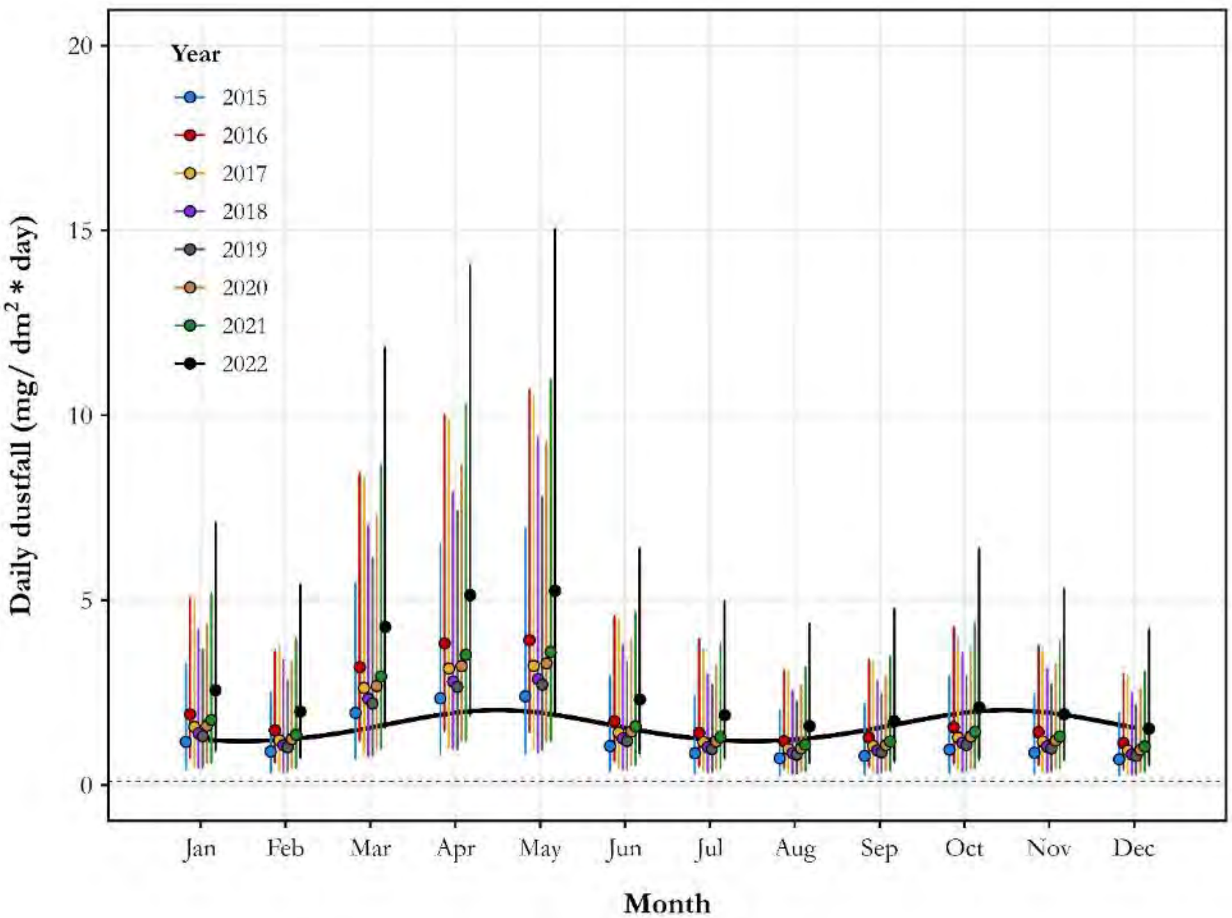


Figure 8-9. Inter-annual mean daily dustfall (mg/dm²·day) at the Mine Site (2015 to 2022).
Points show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the log_e scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

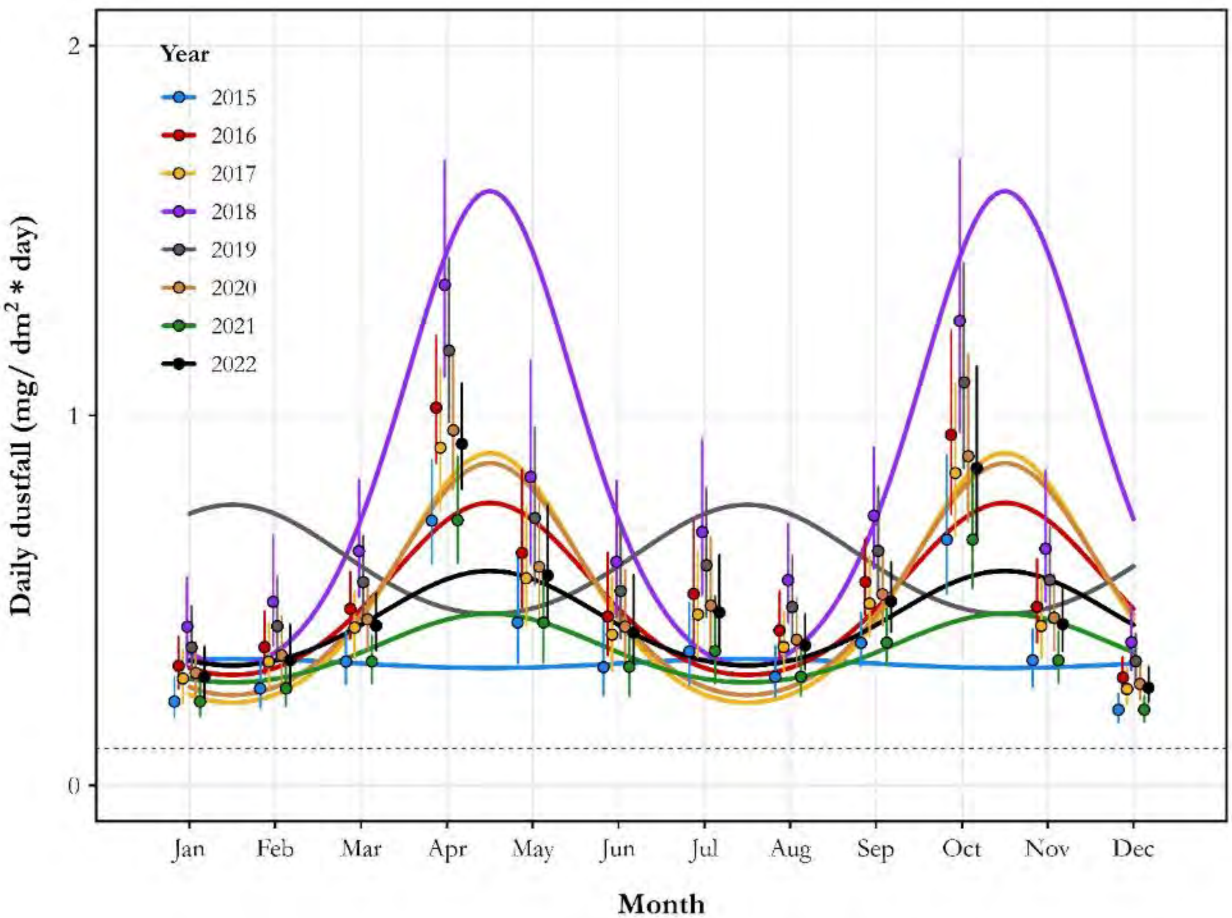


Figure 8-10. Inter-annual mean daily dustfall (mg/dm²·day) at Milne Port (2015 to 2022).

Points show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the log$_e$ scale and back-transformed to the natural scale. Lines correspond with sinusoidal functions relative to each year. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

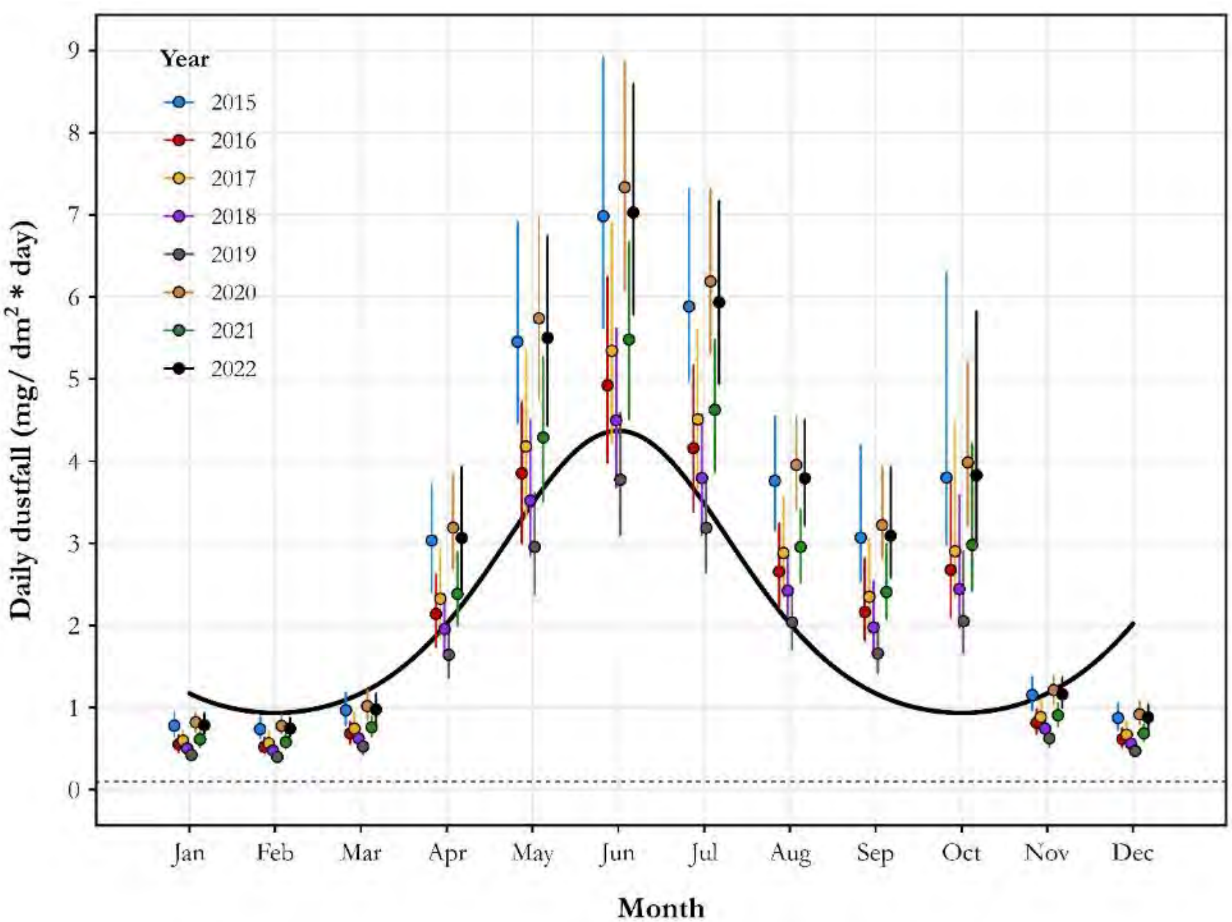


Figure 8-11. Inter-annual mean daily dustfall (mg/dm²·day) at the North Crossing, the Tote Road KM28 (2015 to 2022).

Points show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the $\log_e$ scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

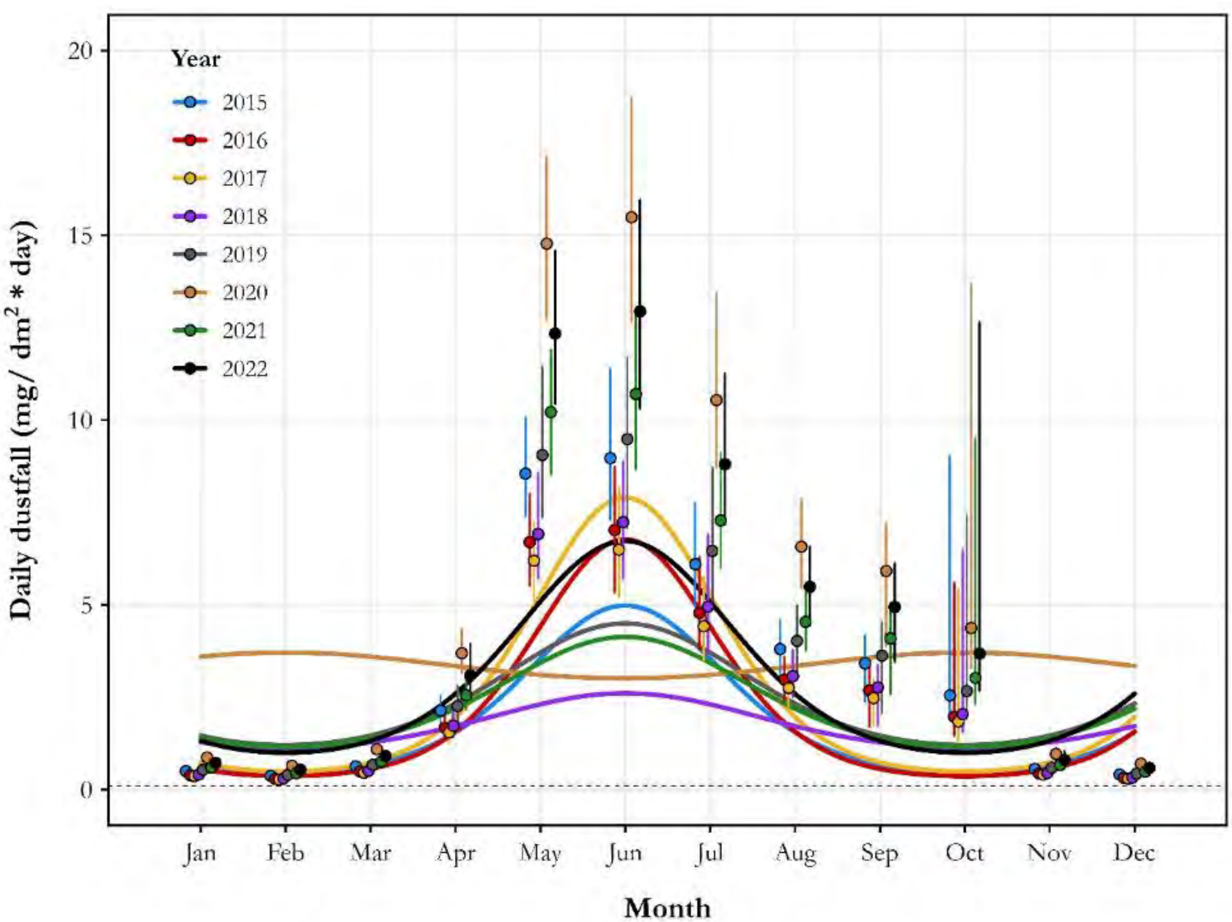


Figure 8-12. Inter-annual mean daily dustfall (mg/dm²·day) at the South Crossing, the Tote Road KM78 (2015 to 2022).

Points show geometric mean daily dustfall with 95% confidence intervals. Confidence intervals are asymmetrical because dust data were analyzed on the loge scale and back-transformed to the natural scale. The dashed horizontal line indicates the minimum detection limit for dust samples and the maximum dustfall rate at reference sites unaffected by the Project.

8.3.3.2 Total Annual Dustfall

From 2014 to 2016, dustfall across the PDA increased, corresponding with the increase in Mine production. In 2016, production increased from 0.5 MTPA to 2.5 MTPA, corresponding with increased dustfall; however, from 2016 to 2020, dustfall generally plateaued with only modest increases in some Project areas. Post-2016 decreases in dustfall appear to correspond with the implementation of additional dustfall mitigation strategies. Dustfall deposition in 2022 was within the ranges observed in previous years across the Project area (Figure 8-13).

The Mine Site dustfall monitoring station DF-M-01 has recorded variable dustfall throughout all monitoring years. An increasing trend that was observed from 2019 to 2021 was followed by a decrease in 2022. Dustfall at DF-M-02 and DF-M-03 has remained relatively consistent from 2018 to 2021 but has shown an increasing trend in 2022. May, June, and July 2022 were comparatively dry at the Mine Site, each with roughly two-thirds fewer rain day occurrences (refer to Section 4 – Climate); this likely contributed to conditions conducive to increased dust and dustfall.

Dustfall at DF-P-05 decreased since 2018, whereas dustfall has remained consistent at DF-P-04, DF-P-06 and DF-P-07. There was a slight increase in dustfall at DF-P-08 from 2021 to 2022. As with the Mine Site, September was the most unusually rainy month, while July had the greatest dry weather anomaly (Section 4 – Climate).

Dustfall along the Tote Road remained constant at the North Crossings (KM28) and increased slightly at the South Crossings (KM78).

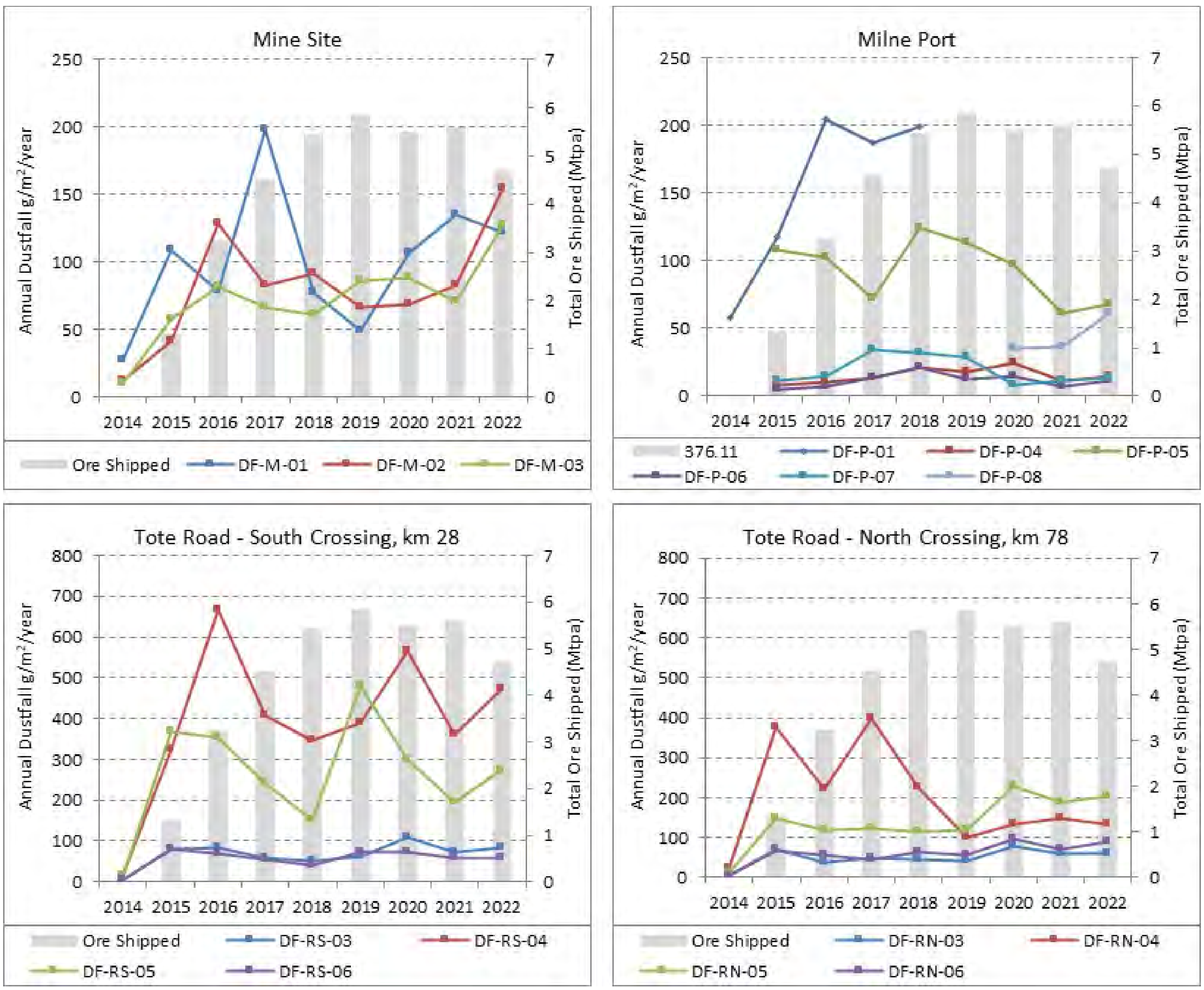


Figure 8-13. Year-over-year annual dustfall (g/m²/year) in relation to total ore mined and hauled to Milne Port.

8.3.4 SAMPLING HEIGHT PILOT STUDY

No statistically significant difference was found in the dustfall measured at the standardized height of 2.0 m and the QIA-requested monitoring stations closer to the ground (0.5 m).

To meet the assumptions of normality, one sample was dropped from the analysis (DF-M-01: short dustfall collector = 2.96 mg/dm²·day, tall dustfall collector = 0.57 mg/dm²·day; sample collected on November 18, 2022). Note, however, that the excluded data point was retained and outlined in red in Figure 8-14. The paired t-test determined that the mean difference between tall and short dustfall collectors was no different than zero (mean difference = 0.03 [CIs = -0.10–0.04]; t_{68} = 0.82, P = 0.41). Similarly, there was a strong correlation between dustfall at tall and short collectors (r_{cor} = 0.94, P < 0.0001), and the standardized major axis regression model demonstrated a very strong fit (intercept = -0.05, slope = 1.05, R^2 = 0.89). Tests of the regression parameters identified that neither the intercept (r_{67} = 0.15, P = 0.24) nor slope (t_{67} = -1.33, P = 0.19) differed from the expectation of unity (i.e., intercept = 0 and slope = 1).

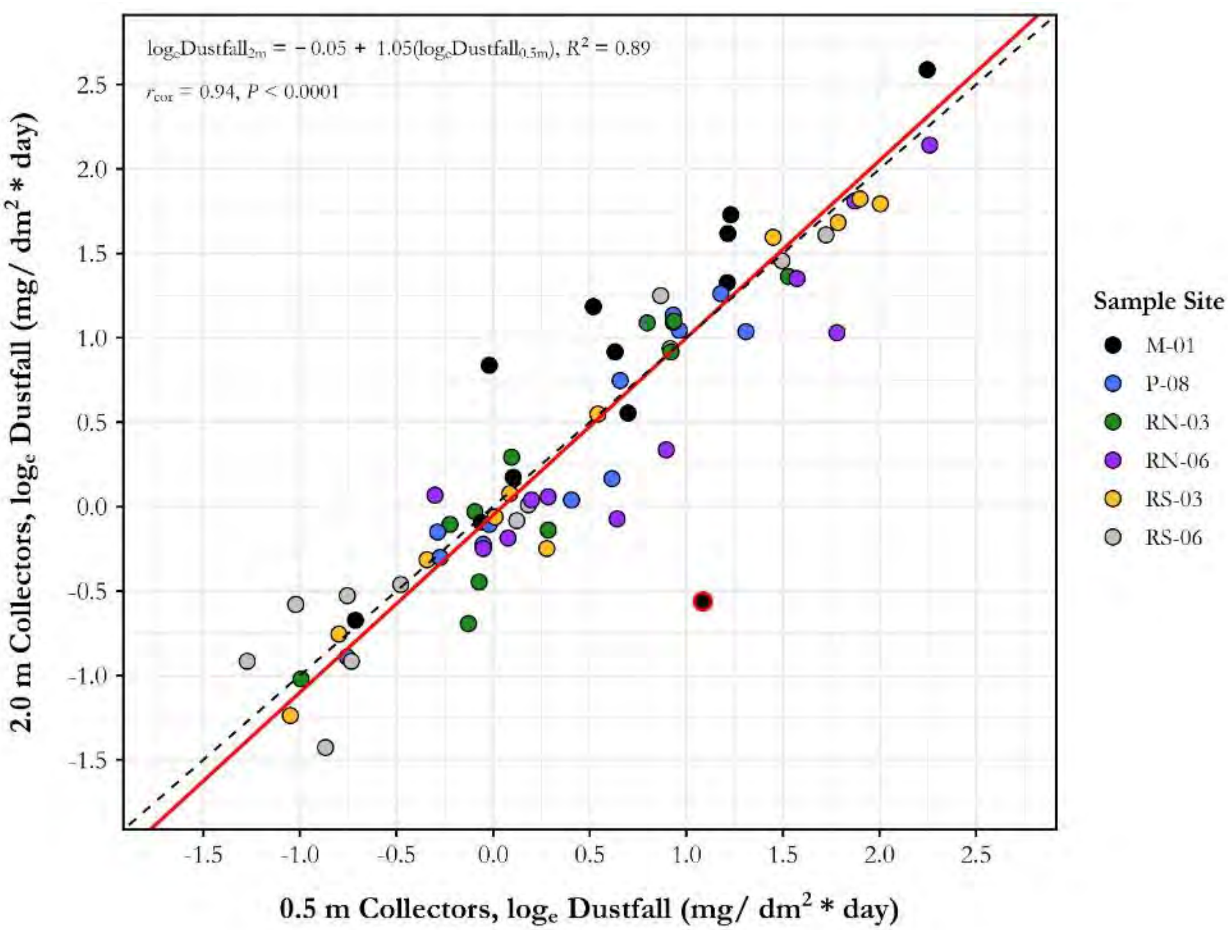


Figure 8-14. Standardized major axis regression of the relationship between tall and short collector daily dustfall (mg/dm²·day).

Points show paired daily dustfall values between tall and short dustfall collectors; point outlined in red is an outlier excluded from analysis. Dustfall analyzed on the loge scale. Paired short and tall dustfall collectors at each site have are identified with unique colours (see Legend). Red line depicts the regression (intercept and slope) estimate and the dashed line indicates the line of unity (intercept = 0, slope = 1).

8.4 DUSTFALL IMAGERY ANALYSIS

8.4.1 METHODS

Remote sensing and imagery analysis were deemed both appropriate and beneficial for estimating spatial extents of dustfall at the Project, given (1) the high contrast and visibility of dust on the landscape[9] and (2) the detectability of dust using multispectral analysis. Dust and snow have different spectral characteristics affecting light absorption/reflection in different wavelengths. Multispectral bands (e.g., visible, near-infrared, and shortwave) of satellite imagery can differentiate reflectance values of dust and snow, allowing for automated extraction of pixels representing dust coverage using comparisons of the various multispectral bands (i.e., band ratios).

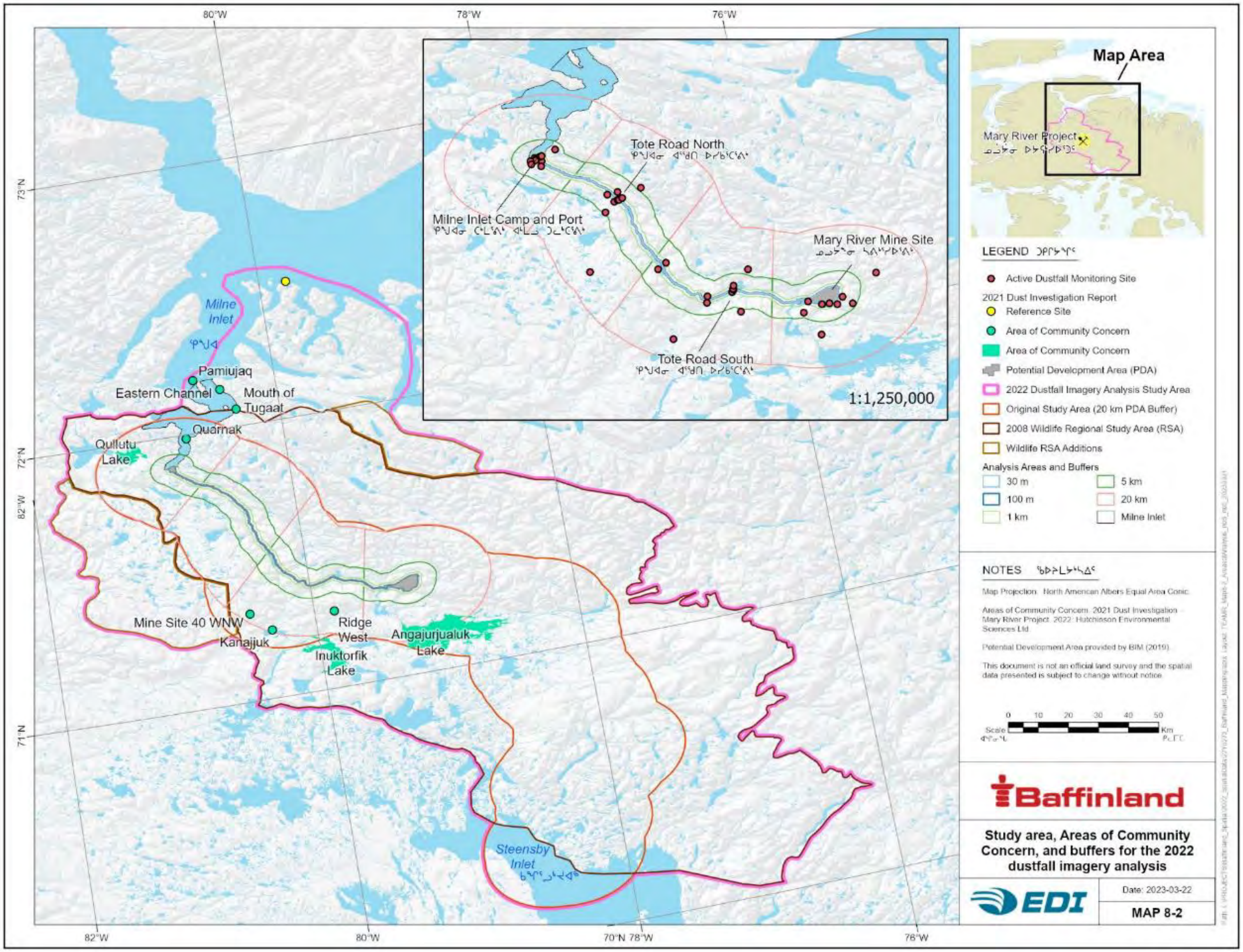
8.4.1.1 Study Area

Dustfall imagery analysis has been used to estimate dustfall extent at the Project since 2020. For the 2022 analysis, the study area was increased to account for additional areas of interest (i.e., beyond the original 20 km buffer of the PDA) identified in consultation with the TEWG or highlighted in supplementary information requests (cf. Response to QIA in 2022 Production Increase Proposal Renewal (QIA-09; Baffinland Iron Mines Corporation 2022) and ancillary reports (cf. 2021 Dust Investigation; Hutchinson Environmental Sciences Ltd. 2022).

Additional analysis areas include the PDA and 30 m, 100 m, 1 km, 5 km, and 20 km buffers. The expanded study area includes the 2008 RSA and identified Areas of Community Concern[10] in the 2021 Dust Investigation report (Hutchinson Environmental Sciences Ltd. 2022). The buffer zones were divided into four component areas: Mine Site, Milne Port, Tote Road North, and Tote Road South. Analysis was also conducted within Milne Inlet, from Milne Port to the north end of Stephens Island (Map 8-2).

[9] At ground level, dust on snow can be visible at dustfall deposition as low as 0.1 to 0.2 g/m² (Li et al. 2013a).

[10] Areas of Community Concern were digitized from Figure 11 in Hutchinson (2022) as no coordinates were listed.


Map Area
Mary River Project
LEGEND
Active Dustfall Monitoring Site
2021 Dust Investigation Report
Reference Site
Area of Community Concern
Area of Community Concern
Potential Development Area (PDA)
2022 Dustfall Imagery Analysis Study Area
Original Study Area (20 km PDA Buffer)
2008 Wildlife Regional Study Area (RSA)
Wildlife RSA Additions
Analysis Areas and Buffers
30 m
100 m
1 km
5 km
20 km
Milne Inlet
NOTES
Map Projection: North American Albers Equal Area Conic
Potential Development Area provided by BIM (2019).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Tote Road North
Milne Inlet Camp and Port
Mary River Mine Site
Tote Road South
1:1,250,000
Milne Inlet
Pamiujaq
Eastern Channel
Mouth of Tugaat
Quarnak
Qullutu Lake
Mine Site 40 WNW
Kanajjuk
Ridge West
Inuktorfik Lake
Angajurjualuk Lake
Steensby Inlet
Baffinland
Study area, Areas of Community Concern, and buffers for the 2022 dustfall imagery analysis
EDI
Date: 2023-03-22
MAP 8-2

8.4.1.2 Imagery Acquisition

Imagery from Landsat 8 Operational Land Imager (OLI), Landsat 9 Operational Land Imager-2 (OLI-2), and Sentinel-2 Multispectral Instrument (MSI) sensors were used in the dustfall extent image analysis (Table 8-5). Landsat data are available from the United States Geological Survey and have a revisit time of eight days with the combined satellites (U.S. Geological Survey 2022). Sentinel-2 data are available from the European Space Agency and have a revisit time of five days (European Space Agency 2020a). Images between March 15 and May 15, 2022, were selected for the dustfall imagery analysis. This period was chosen for extensive snow cover and available light. Where available, multiple images covering the same area were chosen to account for dustfall extent variability due to snowfall events that can regularly bury dust, and snowmelt that can cause dust to accumulate on the snow surface (Li et al. 2013b).

Surface reflectance products were downloaded from the United States Geological Survey EarthExplorer website (U.S. Geological Survey 2023) and the Copernicus Open Access Hub (European Space Agency 2023). The surface reflectance product contains georeferenced images corrected for topography and atmospheric conditions, giving reflectance values for each pixel as they appear at the Earth's surface (Jenkerson 2019, European Space Agency 2020b). Landsat images came with pixel quality masks identifying pixels representing clouds, cloud shadows, snow, and saturated pixels. Sentinel-2 images came with a classification mask, including categories for saturated/defective pixels, clouds and cloud shadows, water, vegetation, non-vegetated areas, and snow.

Table 8-5. Summary of satellite imagery used for dustfall extent image analysis.

Mission	Analysis Years	Sensor	Image Tiles	Bands[2]	Resolution
Landsat 5	2004–2011 (baseline)	Thematic Mapper (TM)	26-11[1], 27-10, 27-11, 28-10, 28-11, 29-10, 30-09, 30-10, 31-09, 31-10, 32-09, 32-10, 33-09, and 34-09[1]	Band 2: G 0.52–0.60 µm Band 3: R 0.63–0.69 µm	30 m 30 m
Landsat 8	2013 (baseline) 2014–2022	Operational Land Imager (OLI)	26-11[1], 27-10, 27-11, 28-10, 28-11, 29-10, 30-09, 30-10, 31-09, 31-10, 32-09, 32-10, 33-09, and 34-09[1]	Band 3: G 0.53–0.59 µm Band 4: R 0.64–0.67 µm	30 m 30 m
Landsat 9	2022	Operational Land Imager-2 (OLI-2)	26-11[1], 27-10, 27-11, 28-10, 28-11, 29-10, 30-09, 30-10, 31-09, 31-10, 32-09, 32-10, 33-09, and 34-09[1]	Band 3: G 0.53–0.59 µm Band 4: R 0.64–0.67 µm	30 m 30 m
Sentinel-2	2019–2022	Multispectral Instrument (MSI)	16WFE[1], 16XFF[1], 17WMV, 17WNT, 17WNU, 17WNV, 17WPT, 17WPU, 17WPV, 17XMA[1], 17XNA[1], 18WVC[1], 18WVD[1], 18WVE[1]	Band 3: G 0.54–0.58 µm Band 4: R 0.65–0.68 µm	20 m 20 m

[1] Only baseline and 2022 imagery.

[2] G = Green and R = Red.

8.4.1.3 Image Preprocessing

R version 4.2.2 (R Development Core Team 2023), ArcMap 10.8, and ArcGIS Pro 3.0 (ESRI 2020, 2022) were used to process and analyze the images. Saturated pixels were excluded from the analysis using masks. Saturated pixels occur when the high reflectance of the surface (e.g., fresh snow) is beyond the sensor's range, causing sensor saturation. For Landsat images, saturated pixel masks were derived from the radiation saturation quality band using the Landsat Quality Assessment ArcGIS Toolbox (U.S. Geological Survey 2017) and cloud masks were generated from the pixel quality band. For Sentinel-2 images, the provided classification masks were used to remove all pixels not classified as snow. Cloud masks were generally not adequate to completely remove clouds. A visual check was conducted to remove images with identifiable clouds (i.e., that could skew data analysis); images with thin clouds or fog that were not distinguishable from the snow cover may not have been identified and removed from the analysis. The resulting image database represented a selection of high-quality satellite images within the study area from mid-March to mid-May for 2022, when dust should be detectable against a snow-covered landscape with minimal spectral or atmospheric interference.

8.4.1.4 Image Analysis

The 2022 dustfall imagery analysis focused on identifying, extracting, and quantifying mineral dust produced from mining activities at the Project. The image bands used for the analysis represent ranges of wavelengths on the electromagnetic spectrum. Features such as snow, rock, and vegetation absorb and reflect at different wavelengths. These distinct absorption and reflection characteristics can be used to identify and extract features from the imagery using combinations of bands. The SDI, (Red−Green)/(Red+Green), was used in the analysis as it was explicitly created to extract mineral dust on snow from imagery and can provide a relative estimation of mineral dust magnitude (Mauro et al. 2015). The SDI values ranged from -1 to 1.

An SDI layer was calculated for each image and the maximum pixel value of all the SDI layers was used to create a composite SDI dataset for 2022. The composite SDI dataset represented the maximum dustfall extent and relative magnitude within the study area between March 17 and May 14, 2022. Composite datasets and subsequent analysis were conducted using the North American Albers Equal Area Conic spatial reference.

A new baseline SDI dataset was created for the expanded study area from Landsat imagery collected between 2004 and 2013. Additional imagery was downloaded and processed with the original baseline imagery. The maximum pixel value of all the SDI layers within a single year was used to create a composite SDI dataset for each year. The new baseline used the mean SDI value of composite SDI datasets from 2004 to 2011 and 2013, representing the mean background dust extent and relative magnitude before the construction of the Project.

Post-baseline datasets include the years 2014 to 2022, and were used in the interannual analysis.

8.4.1.5 Dustfall Extent and Magnitude

Satellite-derived dustfall concentration was estimated from a relationship between dustfall accumulation calculated from the dustfall deposition rates measured by the passive dustfall monitors and the SDI values from the imagery analysis. For each satellite image, a period of dustfall was determined, where the start date was the last snowfall event, and the end date was the date of the image. Snowfall events were determined from recorded weather events or as days where precipitation was recorded at the Mine Site or Milne Port weather stations and the temperature was below freezing. Dustfall accumulation (g/m²) was calculated as the sum of the daily dustfall over each individual image period. Snow Darkening Index values were extracted from each image at the year round dustfall monitor sites (Map 8-2) and compared with the calculated dustfall accumulation.

Landsat and Sentinel-2 images were processed separately and a linear regression model was developed for each dataset. To justify the separate processing, a paired t-test was first conducted between overlapping Landsat and Sentinel-2 images acquired on the same day to determine whether mean difference in SDI values between Landsat and Sentinel-2 differed from zero. The linear regression models were applied to the baseline and composite SDI datasets from 2014 to 2022 to produce estimated dustfall concentration datasets.

The baseline was subtracted from the 2022 Landsat and Sentinel-2 dustfall concentration datasets to convey the spatial extent and estimated dustfall concentrations possibly produced by Project activities. For years with Sentinel-2 data (i.e., since 2019), the Sentinel-2 and Landsat dustfall concentration datasets were combined, using the maximum value and 30 m resolution, to provide better spatial and temporal coverage over the image acquisition period. To provide representation of annual variability in the baseline dataset, dustfall concentration datasets were created for a high concentration and extent year and a low concentration and extent year. Mean baseline was removed to allow for comparison with the post-baseline datasets.

Mean dustfall concentration was calculated within the PDA and the 30 m, 100 m, 1 km, 5 km, and 20 km buffers for the Mine Site, Milne Port, Tote Road North, and Tote Road South areas (Map 8-2). For the Areas of Community Concern, mean dustfall concentration was calculated within the lake boundaries or within a 100 m buffer around a point feature to sample multiple pixels in the area.

Dustfall concentrations were classified into six classes (i.e., <1, 1–4.5, 4.5–10, 10–20, 20–40, and >40 g/m^2) and differentiated for each component of the study area (i.e., Mine Site, Milne Port, Milne Inlet, Tote Road North, and Tote Road South). The area was calculated by multiplying the number of pixels within each class by the area of the pixel (i.e., 900 m² for a 30 m pixel).

8.4.1.6 Surface Snow Sampling Pilot Study

Calculated dustfall accumulation from the passive dustfall monitor deposition rates can provide an estimate of dustfall concentration to apply to the SDI values. This approach assumes no redistribution of dust after deposition and relies on estimating a period over which accumulation occurs. However, the SDI is a measure of the magnitude of mineral dust concentration on the snow surface at the time of image acquisition, which is the result of dust deposition and redistribution.

To provide a more representative estimate of the dust concentration visible in the imagery, surface snow samples were collected based on the methods of Mauro et al. (2015). In 2022, surface snow samples were collected on May 1, 2, 6, and 9. The following procedures were conducted during field sampling to provide quality assurance and quality control (Baffinland Iron Mines Corporation 2022b).

- The 2.5-gallon high-density polyethylene pails used for sample collection were rinsed with deionized water three times.
- New nitrile gloves were worn during each sample collection and sample set collections.
- A 1.4 m x 1.4 m (2 m^2) square was measured on the snow surface, and the top 5 cm of the snowpack was transferred to a plastic pail using a plastic shovel.
- Samples were melted under cool conditions (≤4°C).
- Samples were stirred and agitated using a clean spatula.
- Bottles were rinsed three times with melt water before being filled, and a new syringe (no filter) was used for each site to fill the bottles.
- Field duplicates, field blanks, travel blanks, and equipment blanks were collected.

Sample bottles, duplicates, and blanks were sent to the ALS Environmental Laboratory in Waterloo, Ontario, to analyze Total Suspended Solids (units of mg/L) and a suite of metals. Only Total Suspended Solids was used for comparison with SDI values.

SDI values were extracted from Landsat and Sentinel-2 images acquired on the same date as the surface snow samples. A non-linear regression was created using R version 4.2.2 (R Development Core Team 2023) and the rational function from Mauro et al. (2015) for mineral dust versus SDI measured from hyperspectral data collected from a spectroradiometer.

$$f(x) = \frac{p_1 x + p_2}{x + q_1}$$

A range of starting values were used for *p1* (0.05 to 0.5), *p2* (-10.5 to -0.5), and *q1* (0 to 1,000), and the mean of the resulting coefficients was used as the final starting value for the model. Residual diagnostic plots were examined to confirm assumptions of normality and equality of variance in the residuals.

8.4.2 RESULTS AND DISCUSSION

8.4.2.1 Scene Distribution

The number of suitable Sentinel-2 images in 2022 was 60 images, and the number of suitable Landsat images in 2022 was 31 images (Table 8-6). The increase from 2021 was due to the expanded study area and the inclusion of images from Landsat 9, which became operational at the end of October 2021. Landsat 9 increased image coverage and reduced the revisit time to eight days, putting it on par with Sentinel-2 image acquisition (five-day revisit time). For 2022, most Sentinel-2 images were from early April and May, while early March and late April provided the least images (Figure 8-15A). The number of suitable Landsat images was highest in May. Both satellite image datasets had good spatial coverage and multiple images for all areas within the study area (Figure 8-15B).

Table 8-6. Remote sensing sources used for dustfall imagery analysis.

Satellite	Baseline (2004 to 2013)[1]	2014	2015	2016	2017	2018	2019	2020	2021	2022[1]
Landsat 5	64	–	–	–	–	–	–	–	–	–
Landsat 8	9	22	33	16	14	17	12	13	12	16
Landsat 9	–	–	–	–	–	–	–	–	–	10
Sentinel-2	–	–	–	–	–	–	26	87	36	60

[1] Expanded study area.

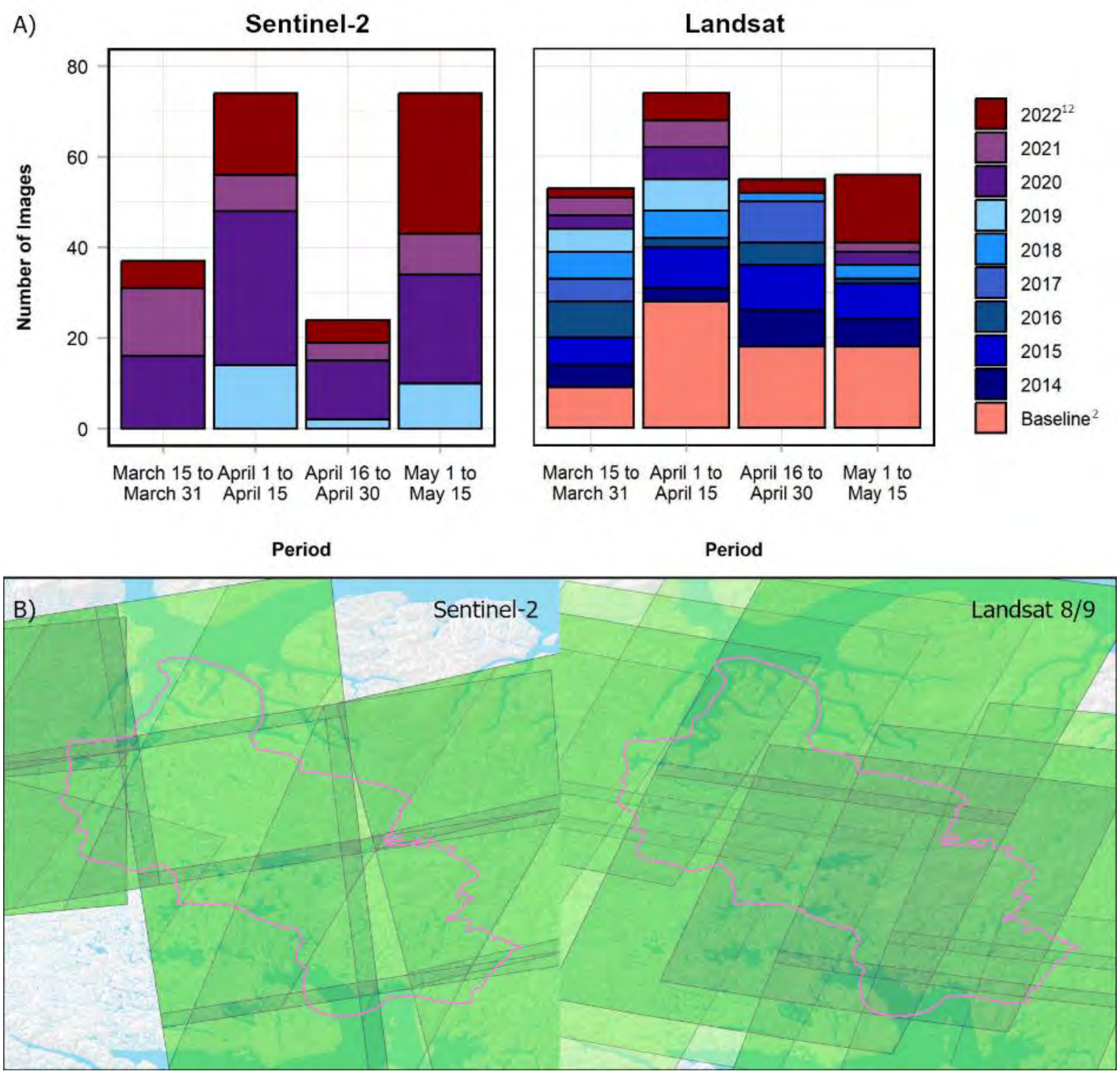


Figure 8-15. A) Sentinel-2 and Landsat images per year for dustfall imagery analysis (March 15 to May 15) and B) the spatial coverage of the 2022 imagery.

[1] *2022 Landsat imagery included Landsat 9 data.*

[2] *Expanded study area.*

8.4.2.2 Dustfall Concentration Estimation

Differences in Landsat and Sentinel-2 band wavelengths and resolution can affect the surface reflectance values used to calculate the SDI (Table 8-5). To determine if there was a significant difference between the two datasets, SDI values of overlapping Landsat and Sentinel-2 images from 11 dates ranging from March 22 to May 11, 2022, were sampled at 1,000 random points throughout the study area. Not all points were sampled for each date due to varying image coverage. The number of samples ranged from 22 to 687, with a total sample size of 2,162. The paired t-test determined that the mean difference between Landsat and Sentinel-2 SDI values was different than zero (mean difference = 0.0099 [CIs = 0.0096–0.0102]; t2161 = 57.65, *P* = <0.0001). Therefore, separate linear regression models were developed for each satellite image dataset.

The linear regression models used dustfall accumulation between the image acquisition data and the last snowfall event using the deposition rates from the year-round passive dustfall monitoring sites. The 2021 data were excluded due to issues with the precipitation measurements. The relationship between the dustfall accumulation Df and the SDI values from Landsat imagery SDI_L is presented in Figure 8-16; the equation is provided below (F_{709} = 97.72, P <0.0001, R^2 = 0.12).

$$SDI_L = 0.00118 \times Df \ + 0.00757$$

The relationship between the dustfall accumulation Df and the SDI values from Sentinel-2 imagery SDI_{S2} is presented in Figure 8-17; the equation is provided below (F_{319} = 189.1, P <0.0001, R^2 = 0.37).

$$SDI_{s2} = 0.00348 \times Df \ + 0.01333$$

The Sentinel-2 linear model had a higher R^2 value than the Landsat linear model but was limited to lower dustfall accumulation values. The weak relationships may indicate other factors involved such as dust dispersion. However, the linear models can provide an estimate of dust concentration from the SDI values derived from the satellite imagery to identify general spatial variability and temporal trends.

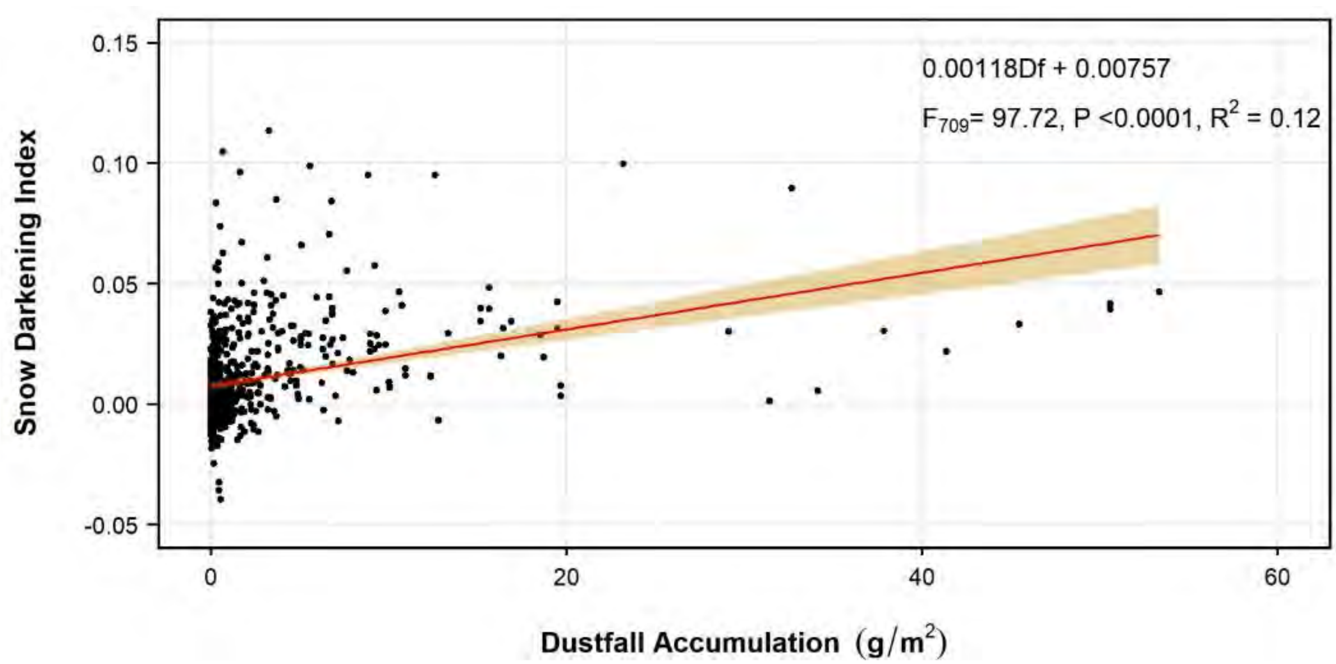


Figure 8-16. Relationship between calculated dustfall accumulation from passive dustfall deposition rates and Landsat 8/9 Snow Darkening Index.

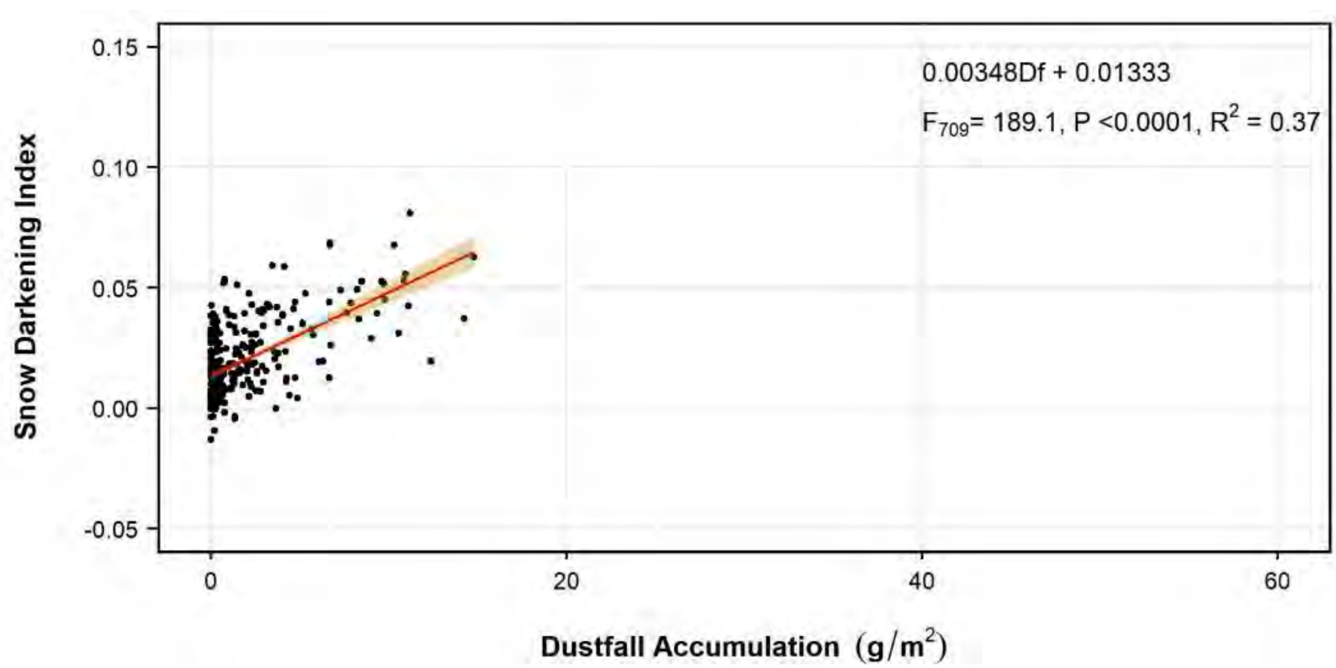


Figure 8-17. Relationship between calculated dustfall accumulation from passive dustfall deposition rates and Sentinel-2 Snow Darkening Index.

8.4.2.3 Interpretive Considerations

The following factors are considered when interpreting the results of the dustfall imagery analysis:

- Dust concentrations from remote sensing are estimates and represent the total dustfall accumulation over the satellite image capture period (i.e., mid-March to mid-May). These values are not equivalent to annual dustfall deposition.
- Clouds, snowfall events, early snow melt, and timing of image acquisition affect the availability of suitable images. Consequently, the dustfall captured in these images will vary year-to-year and may not indicate the maximum dust extent and concentration.
- The baseline dustfall data holds variability between assessment years. Mean dust concentration was used for the analysis; some baseline assessment years may have recorded higher dust concentrations (Figure 8-18A and B). The resulting dustfall extents and concentrations for post-baseline years may have a component of natural dust occurrence for years with higher natural dust. Examples of natural dust sources are presented in Figure 8-18C and D. To represent the baseline variability, data from 2004 (high concentration and extent) and 2013 (low concentration and extent) are presented with the post-baseline results.
- South-facing slopes and bare ground may inadvertently contribute to the dust extent and concentration (Figure 8-18E and F). The baseline dataset accounts (to a limited extent) for this effect, but these circumstances may still affect data interpretations.

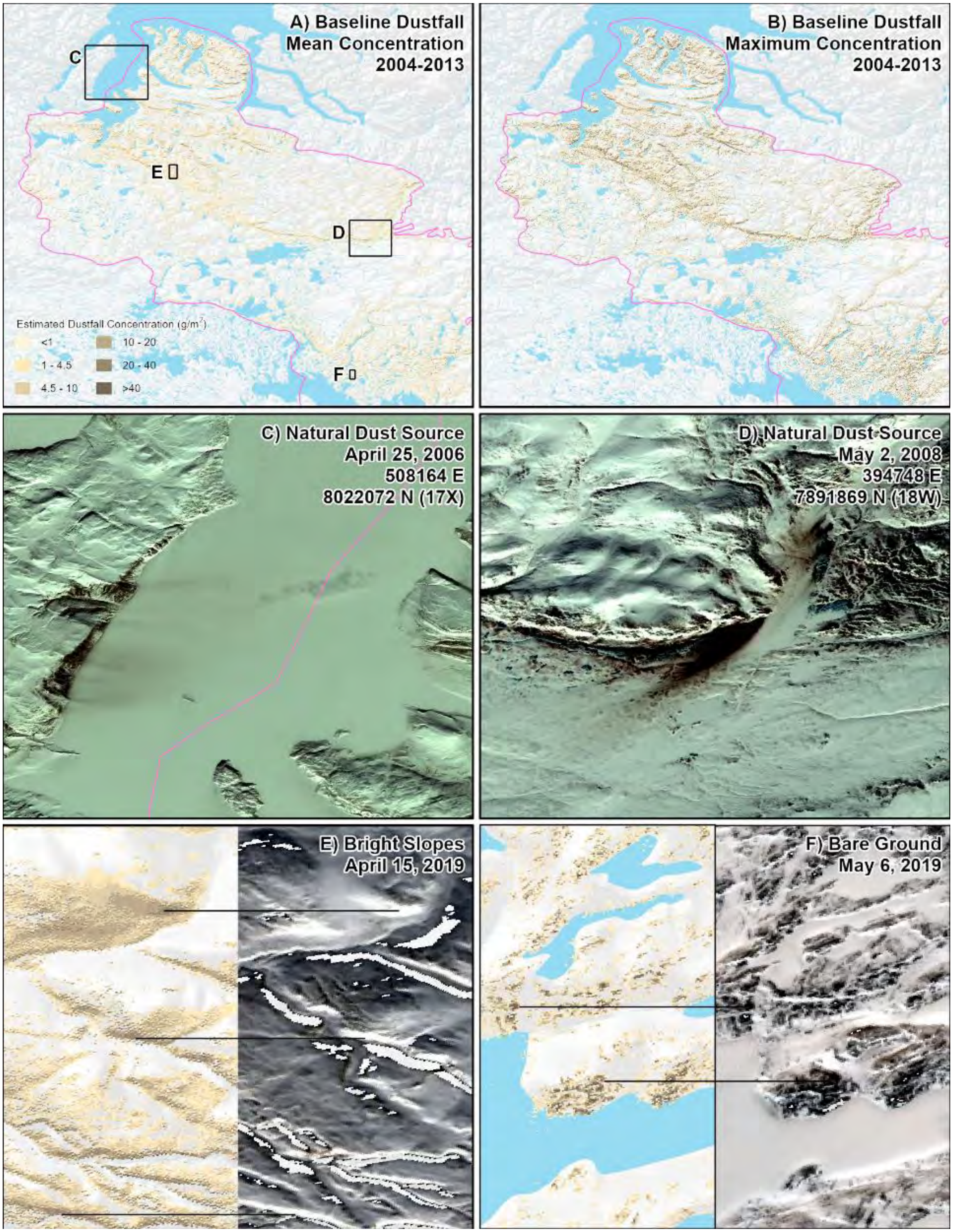


Figure 8-18. Examples of interpretive considerations for the dustfall imagery analysis. A) Baseline dustfall mean concentration, B) baseline dustfall maximum concentration, C-D) natural dust source, E) bright slopes, and F) bare ground.

8.4.2.4 Magnitude and Extent of 2022 Dustfall

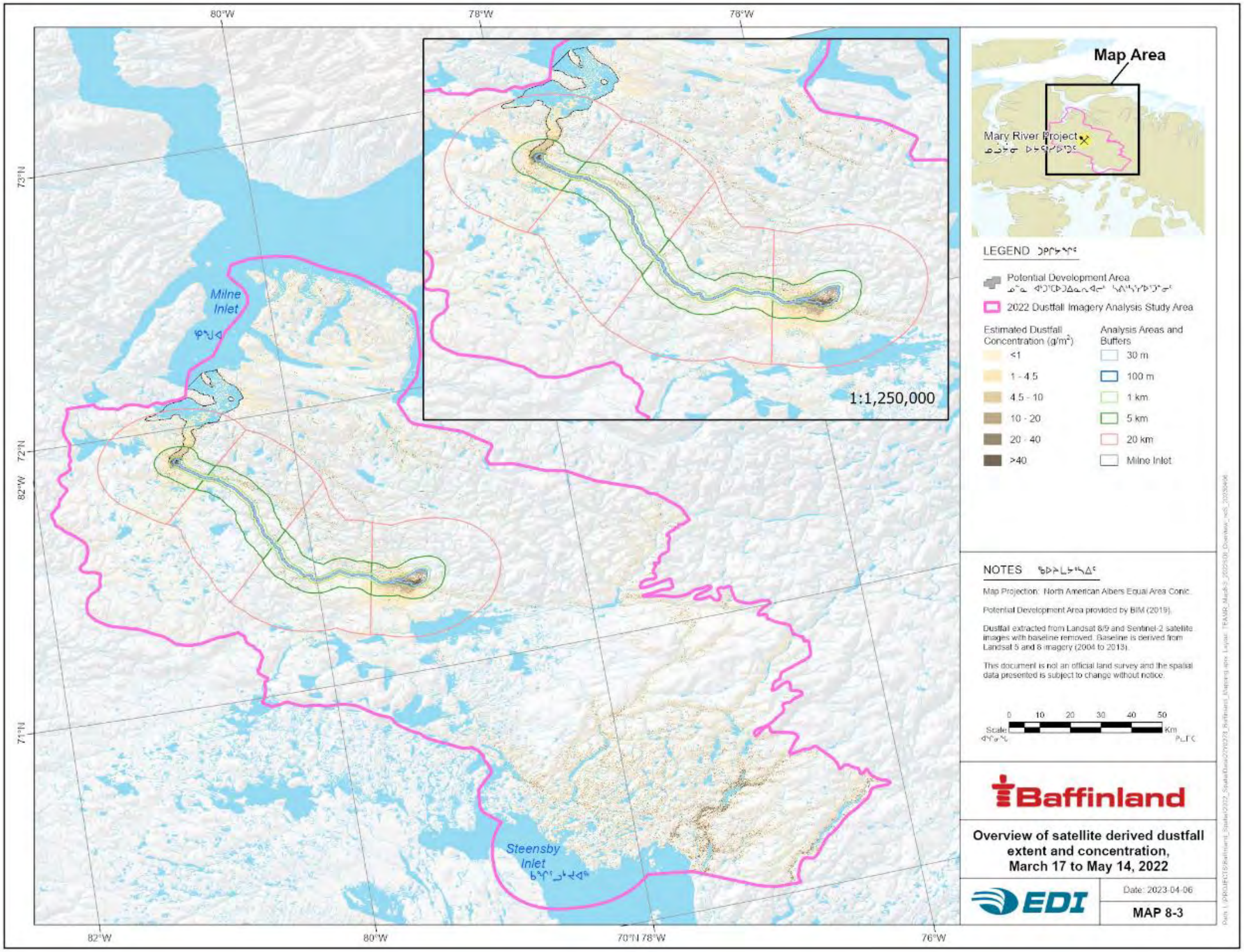
The 'extracted' dustfall extents and concentrations represent possible mineral dust accumulated on the snow cover. Dustfall extents and concentrations derived from Sentinel-2 and Landsat images were combined in the 2022 analysis to reduce the effect of low image coverage from one satellite and to provide a more consistent dataset for inter-annual comparisons.

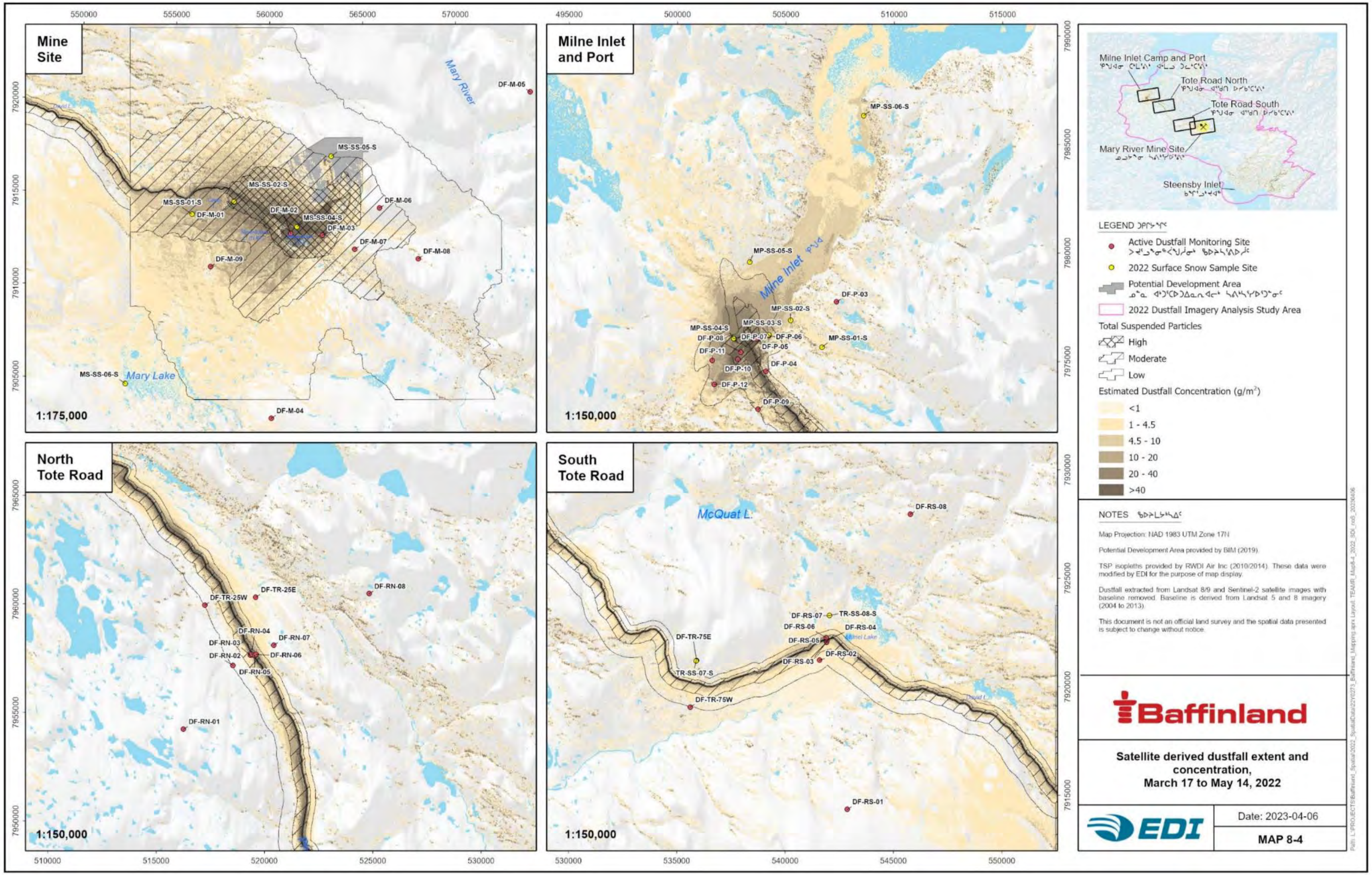
Map 8-3 to Map 8-13 represent dustfall extents and concentrations above baseline values, where baseline values are the mean dustfall concentrations calculated between 2004 and 2013. Identification and contributions from dust sources cannot be determined solely from the satellite imagery analysis presented herein. Possible dust sources across the landscape include naturally exposed/unvegetated ground, wind-exposed ridges, and mining operations (e.g., stockpiles, road traffic, and mining). Trends in dustfall extent and concentration around Project infrastructure (e.g., Milne Port, Map 8-3, Map 8-4, Map 8-8, and Map 8-9) suggest that the primary source of dust is related to mining operations as expected. In the outer surrounding terrain away from existing Project infrastructure, dustfall extents and concentrations likely occur and originate from multiple naturally-occurring sources and/or are indicative of south-facing slopes and exposed bare ground as they are present in the baseline (e.g., 2004 and 2013 in Map 8-6, Map 8-8, Map 8-10, and Map 8-12).

The 2022 dustfall extent covered 13.30% of the study area (Table 8-7 and Figure 8-19). Dust concentrations of <1 g/m² and 1 to 4.5 g/m² accounted for the largest areas at 4.67% and 5.08%, respectively, followed by 4.5 to 10 g/m² at 2.04%. Areas with concentrations >10 g/m² accounted for 1.42% of the study area. Milne Inlet and Milne Port had the largest percentage of dust extent at 33.62% and 28.77%, respectively, followed by the Mine Site and Tote Road South at 19.88% and 16.66%, respectively. The Tote Road North was the lowest at 11.59%. 2022 dustfall extent was greater than in 2013 for all concentrations (Figure 8-19). Compared to 2004, 2022 dustfall extent was greater in concentrations <4.5 g/m² and >40 g/m², but less than or similar to the middle concentrations. Milne Inlet showed the greatest increase.

Table 8-7. 2022 dustfall area extent (km² and %) by dustfall classes based on Landsat and Sentinel-2 imagery.

Concentration Class	<1 g/m²		1 to 4.5 g/m²		4.5 to 10 g/m²		10 to 20 g/m²		20 to 40 g/m²		>40 g/m²	
Area	**km²**	**%**	**km²**	**%**	**km²**	**%**	**km²**	**%**	**km²**	**%**	**km²**	**%**
Study Area	1,279.01	4.76	1,366.11	5.08	549.13	2.04	255.90	0.35	92.85	0.12	32.12	13.30
Mine Site	89.16	6.41	109.85	7.90	38.33	2.76	24.05	0.70	9.69	0.39	5.44	19.88
Milne Inlet	44.01	15.74	29.84	10.67	13.54	4.84	4.77	0.64	1.78	0.02	0.07	33.62
Milne Port	129.89	11.42	131.88	11.59	37.71	3.32	17.19	0.64	7.23	0.29	3.34	28.77
Tote Road North	105.34	7.43	85.24	6.01	29.48	2.08	11.34	0.25	3.51	0.10	1.41	16.66
Tote Road South	60.95	4.21	57.75	3.99	25.27	1.75	14.11	0.44	6.41	0.23	3.28	11.59


Map Area
Mary River Project
Milne Inlet
Steensby Inlet
1:1,250,000
80°W
78°W
76°W
82°W
73°N
72°N
71°N
70°N
LEGEND
Potential Development Area
2022 Dustfall Imagery Analysis Study Area
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
Analysis Areas and Buffers
30 m
100 m
1 km
5 km
20 km
Milne Inlet
NOTES
Map Projection: North American Albers Equal Area Conic.
Potential Development Area provided by BIM (2019).
Dustfall extracted from Landsat 8/9 and Sentinel-2 satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
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 of satellite derived dustfall extent and concentration, March 17 to May 14, 2022
EDI
Date: 2023-04-06
MAP 8-3


Mine Site
1:175,000
Milne Inlet and Port
1:150,000
North Tote Road
1:150,000
South Tote Road
1:150,000
Mary River
Mary Lake
Milne Inlet
McQuat L.
Milne Inlet Camp and Port
Tote Road North
Tote Road South
Mary River Mine Site
Steensby Inlet
LEGEND
Active Dustfall Monitoring Site
2022 Surface Snow Sample Site
Potential Development Area
2022 Dustfall Imagery Analysis Study Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Potential Development Area provided by BIM (2019).
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8/9 and Sentinel-2 satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Satellite derived dustfall extent and concentration,
March 17 to May 14, 2022
EDI
Date: 2023-04-06
MAP 8-4

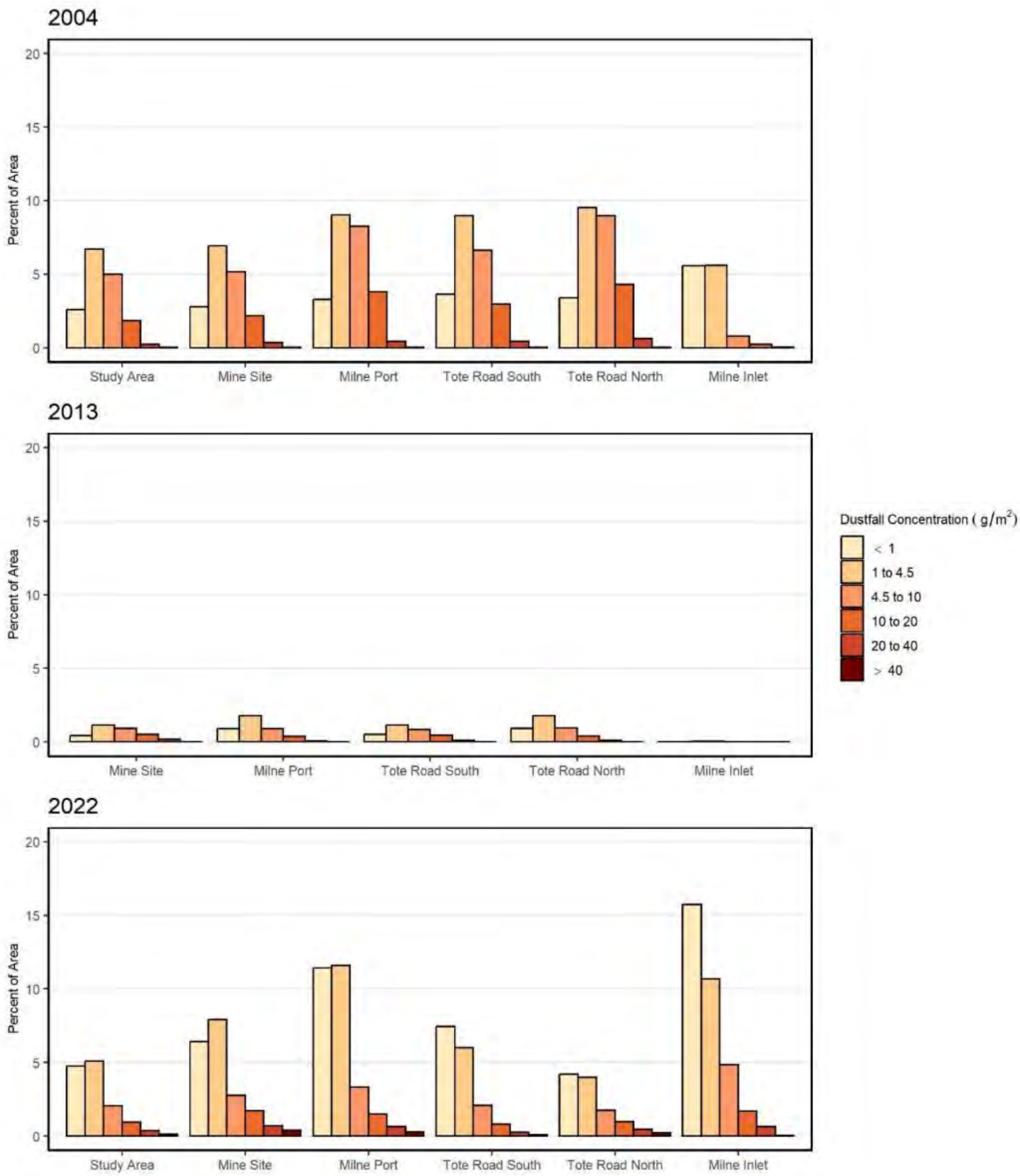


Figure 8-19. Percent dustfall area by concentration class within the study area for 2022 and baseline years 2004 and 2013.

Mean baseline has been removed from the data. The study area is not included for 2013 because it does not have full coverage.

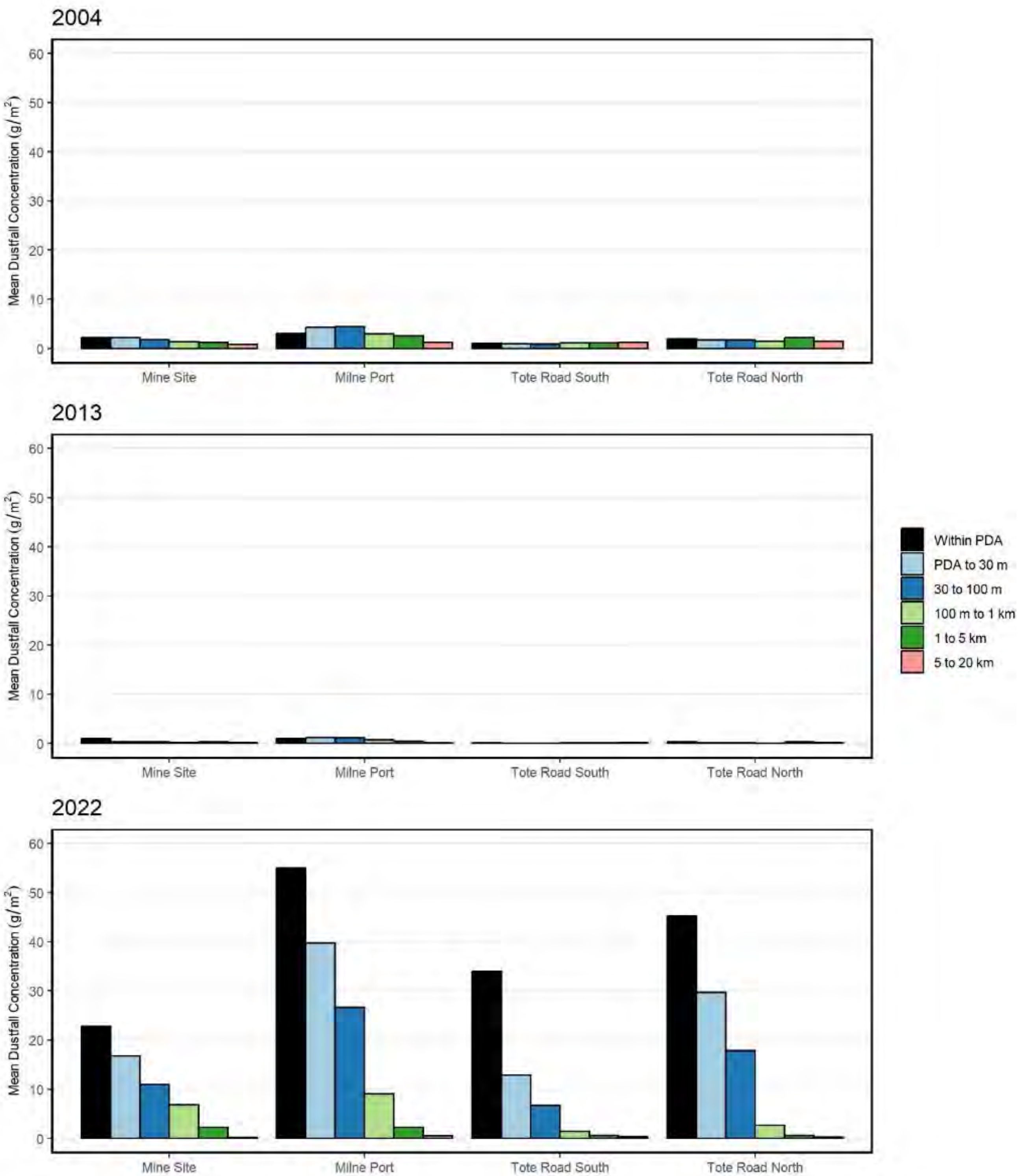


Figure 8-20. Mean dustfall concentrations within the Potential Development Area and 30 m, 100 m, 1 km, 5 km, and 20 km buffers for 2022 and baseline years 2004 and 2013.
Mean baseline has been removed from the data.

Dustfall concentration was highest at all sites within the PDA and decreased with distance from the Project (Figure 8-20). The Milne Port area had the highest concentrations within all distance buffers, except for the 1 km to 5 km buffer where the mean concentration was the same as the Mine Site area (i.e., 2.2 g/m²). The Tote Road North area had the second-highest mean dustfall concentration within 100 m of the PDA. The Tote Road South area had the third highest mean dustfall concentration within the PDA (i.e., 33.9 g/m²), followed by the Mine Site area (i.e., 22.9 g/m²). The lower Mine Site concentration within the PDA may be due to the size of the PDA and wind direction, which left the northern portion relatively free of dust (Map 8-4). Mean dustfall concentration was similar at all sites within the 5 km to 20 km buffer. Beyond 5 km, mean dustfall concentration was similar to the baseline years (Figure 8-20).

Mine Site — Dustfall extended to the west, south, and north, reflecting stronger winds from the southeast to northeast (Map 8-4; Section 4 – Climate). Dustfall extended beyond the modelled TSP isopleths primarily to the west, but otherwise followed a similar pattern. Dustfall extent was greatest for the 1 to 4.5 g/m² dustfall concentration class at 7.90% of the Mine Site area (within 20 km of the PDA), followed by <1 g/m² at 6.41% (Table 8-7 and Figure 8-19). For concentration classes >4.5 g/m², dustfall extent decreased from 2.76% to 0.39% with increasing concentration class. Mean dustfall concentration decreased with distance from the Project. The concentration decreased from 22.9 g/m² within the PDA to 0.2 g/m² within the 5 to 20 km buffer (Figure 8-20).

Milne Port and Inlet — Dustfall extended northeast along Milne Inlet into Koluktoo Bay, most likely carried by strong southwest winds. Around Milne Port, dustfall extended to the northwest and southwest (Map 8-3 and Map 8-4). Dustfall extended beyond the modelled TSP isopleths. Dustfall extent was similar between the <1 g/m² (11.42%) and 1 to 4.5 g/m² (11.59%) dustfall concentration classes of the Milne Port area within 20 km of the PDA (Table 8-7 and Figure 8-19). For concentration classes >4.5 g/m², dustfall extent decreased from 3.32% to 0.29% with increasing concentration class. The percent dustfall area for Milne Inlet alone followed a similar trend but was generally higher for concentration classes <20 g/m². Mean dustfall concentration decreased with distance from the Project. The concentration decreased from 54.0 g/m² within the PDA to 0.4 g/m² within the 5 to 20 km buffer (Figure 8-20).

Tote Road North — Dustfall extent was primarily within the modelled TSP isopleths except for some areas to the north (Map 8-3 and Map 8-4). The northern extent was reflected in the higher mean daily dustfall rates measured from dustfall monitors DF-TR-25E versus DF-TR-25W (Section 8.3.2.1). Dustfall extent was greatest for the <1 g/m² dustfall concentration class at 4.21% of the Tote Road North area (within 20 km of the PDA) and decreased to 0.23% with increasing concentration class. Mean dustfall concentration decreased with distance from the Project. The concentration decreased from 45.3 g/m² within the PDA to 0.2 g/m² within the 5 to 20 km buffer (Figure 8-20).

Tote Road South — Dustfall extent was primarily within the modelled TSP isopleths except for the South Crossing at KM 78 where dustfall extended past the isopleths to the south and a lesser extent to the north around Muriel Lake (Map 8-3 and Map 8-4). The dustfall extent was reflected in the higher mean daily dustfall rates measured from dustfall monitors DF-RS-02 and DF-TR-75W versus DF-RS-07 and DF-TR-75E (Section 8.3.2.1). Dustfall extent was greatest for the <1 g/m² dustfall concentration class at 7.43% of the Tote Road South area (within 20 km of the PDA) and decreased to 0.10% with increasing concentration class.

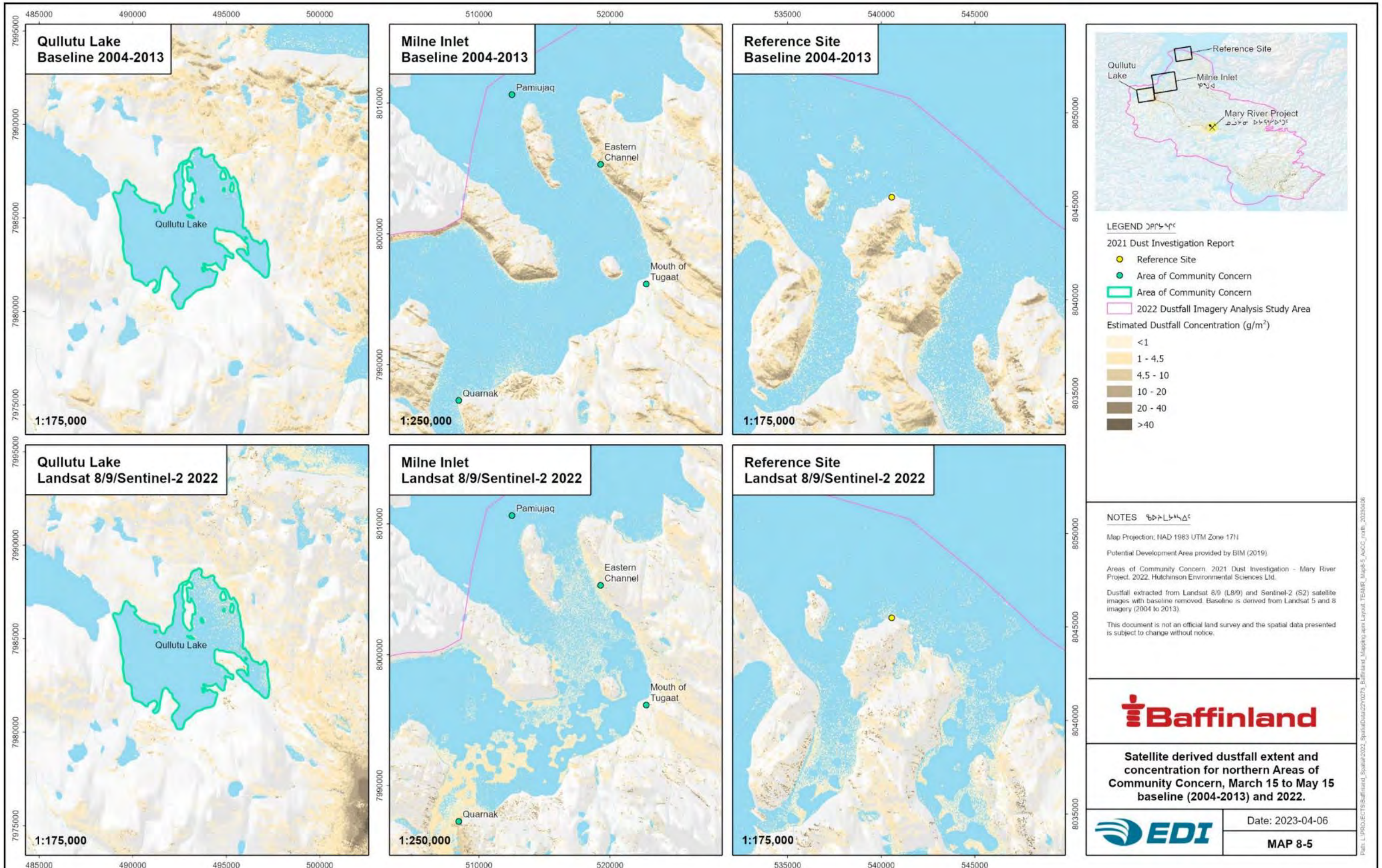
Mean dustfall concentration decreased with distance from the Project. The concentration decreased from 33.9 g/m^2 within the PDA to 0.3 g/m^2 within the 5 to 20 km buffer (Figure 8-20).

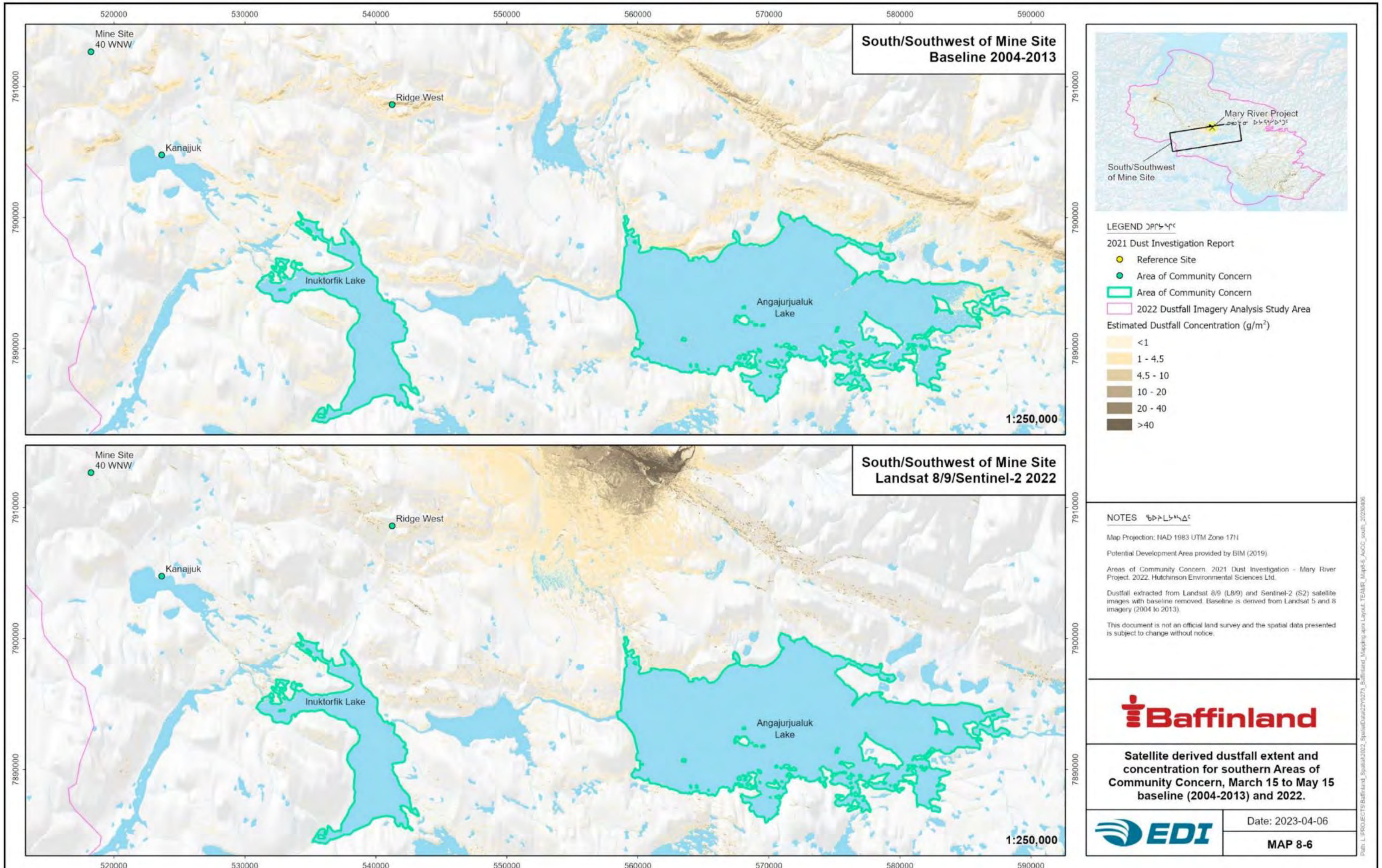
Areas of Community Concern[11] — The Quarnak site had a mean dustfall concentration of 4.52 g/m^2, followed by the Eastern Channel site at 1.11 g/m^2 and the Ridge West site at 0.82 g/m^2 (Table 8-8, Map 8-5, and Map 8-6). The remaining locations were <0.5 g/m^2, below the Reference site concentration. The lakes had mean dustfall concentrations below 0.1 g/m^2, with maximum values around 25 g/m^2 generally along the shoreline.

Table 8-8. Estimated 2022 dustfall concentrations in Areas of Community Concern.

Location	Mean Dustfall Concentration (g/m^2)	Standard Deviation (g/m^2)	Minimum Dustfall Concentration (g/m^2)	Maximum Dustfall Concentration (g/m^2)
Pamiujaq	0.00	0.00	0.00	0.00
Eastern Channel	1.11	1.01	0.00	3.16
Mouth of Tugaat	0.21	0.36	0.00	1.29
Quarnak	4.52	1.86	1.77	6.64
Mine Site 40 WNW	0.00	0.00	0.00	0.00
Kanajjuk	0.00	0.00	0.00	0.00
Ridge West	0.82	2.08	0.00	10.55
Qullutu Lake	0.07	0.61	0.00	26.37
Angajurjualuk Lake	0.02	0.32	0.00	24.62
Inuktorfik Lake	0.04	0.48	0.00	25.77
Reference	0.48	1.45	0.00	5.15

[11] Non-lake locations were digitized from Figure 11 in the 2021 Dust Investigation report (Hutchinson Environmental Sciences Ltd. 2022) at a scale of 1:750,000. Mapped locations are representative but hold some inherent variability.


Qullutu Lake
Baseline 2004-2013
Qullutu Lake
1:175,000
Milne Inlet
Baseline 2004-2013
Pamiujaq
Eastern Channel
Mouth of Tugaat
Quarnak
1:250,000
Reference Site
Baseline 2004-2013
1:175,000
Qullutu Lake
Landsat 8/9/Sentinel-2 2022
Qullutu Lake
1:175,000
Milne Inlet
Landsat 8/9/Sentinel-2 2022
Pamiujaq
Eastern Channel
Mouth of Tugaat
Quarnak
1:250,000
Reference Site
Landsat 8/9/Sentinel-2 2022
1:175,000
Reference Site
Qullutu Lake
Milne Inlet
Mary River Project
LEGEND
2021 Dust Investigation Report
Reference Site
Area of Community Concern
Area of Community Concern
2022 Dustfall Imagery Analysis Study Area
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Potential Development Area provided by BIM (2019)
Areas of Community Concern. 2021 Dust Investigation - Mary River Project. 2022. Hutchinson Environmental Sciences Ltd.
Dustfall extracted from Landsat 8/9 (L8/9) and Sentinel-2 (S2) satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Satellite derived dustfall extent and concentration for northern Areas of Community Concern, March 15 to May 15 baseline (2004-2013) and 2022.
EDI
Date: 2023-04-06
MAP 8-5


South/Southwest of Mine Site
Baseline 2004-2013
South/Southwest of Mine Site
Landsat 8/9/Sentinel-2 2022
Mine Site 40 WNW
Ridge West
Kanajjuk
Inuktorfik Lake
Angajurjualuk Lake
1:250,000
520000
530000
540000
550000
560000
570000
580000
590000
7910000
7900000
7890000
Mary River Project
South/Southwest of Mine Site
LEGEND
2021 Dust Investigation Report
Reference Site
Area of Community Concern
Area of Community Concern
2022 Dustfall Imagery Analysis Study Area
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Potential Development Area provided by BIM (2019)
Areas of Community Concern. 2021 Dust Investigation - Mary River Project. 2022. Hutchinson Environmental Sciences Ltd.
Dustfall extracted from Landsat 8/9 (L8/9) and Sentinel-2 (S2) satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Satellite derived dustfall extent and concentration for southern Areas of Community Concern, March 15 to May 15 baseline (2004-2013) and 2022.
EDI
Date: 2023-04-06
MAP 8-6

8.4.3 INTER-ANNUAL TRENDS

Areas of analysis for inter-annual trends presently focus on the area within 20 km of the PDA. In future, these data will be reanalyzed to account for the expanded study area (as described in Section 8.4.1.1) using post-baseline assessment years (2014 to 2021).

Dustfall extents across all areas had a small peak in 2015 followed by peaks in 2019 (i.e., within all dustfall concentration classes) and 2021 (i.e., in the lower dustfall concentrations classes, <4.5 g/m^2) (Figure 8-21). The 2022 dustfall extents in dustfall concentration classes <4.5 g/m^2 were generally lower than the previous four years and similar to the 2017 extents. Dustfall extents from 2022 in dustfall concentration classes >4.5 g/m^2 remained consistent with 2021 except for Milne Inlet, which indicated an increase. Milne Inlet total dustfall extent remained well above the baseline (2004 and 2013) extent since 2015. The Mine Site and Tote Road total dustfall extents dropped to similar baseline percentages in 2016, 2017, and 2022, but with a larger proportion of higher concentrations. The pattern of dustfall extent on the landscape was similar from 2014 to 2022 for all areas, with the highest concentrations near the Project and dustfall extending northeast along Milne Inlet, west and south of the Mine Site, and southwest of the South Crossing (KM78) in the direction of prevailing and/or strong winds (Map 8-6 to Map 8-13).

Observed fluctuations (i.e., 'peaks and valleys') of total dustfall extent from 2019 to 2022 generally followed changes in ore production (Figure 8-11, Section 8.3.3.2). Satellite-derived mean dustfall concentrations across all areas generally increased from 2014 to 2016 in line with ore production and annual dustfall trends from the passive dustfall monitors (Figure 8-22 and Figure 8-11, Section 8.3.3.2). Mean dustfall concentration decreased post 2016 to 2020 with modest fluctuations in some Project areas. All areas showed increased mean dustfall concentrations in 2022, primarily within 1 km of the PDA. The increase in dustfall concentration was also measured at approximately half the dustfall monitor locations shown in Figure 8-11 (Section 8.3.3.2) across the Project areas. Areas >1 km from the PDA along the Tote Road and areas >5 km from the PDA at the Mine Site and Milne Inlet for 2016, 2017, and 2022 had mean dustfall concentrations at or near 2004 and 2013 baseline values.

The overall trends between satellite-derived mean dustfall concentrations and annual dustfall from the passive dustfall monitors were similar for Milne Port and the Tote Road Crossings, capturing most of the same fluctuations. The trend fluctuations differed between the two datasets for the Mine Site and may be due to monitoring locations being located along the southern edge of the PDA where dustfall is high compared to the mean dustfall concentration within the whole PDA of the Mine Site, which includes areas of low dustfall due to prevailing winds.

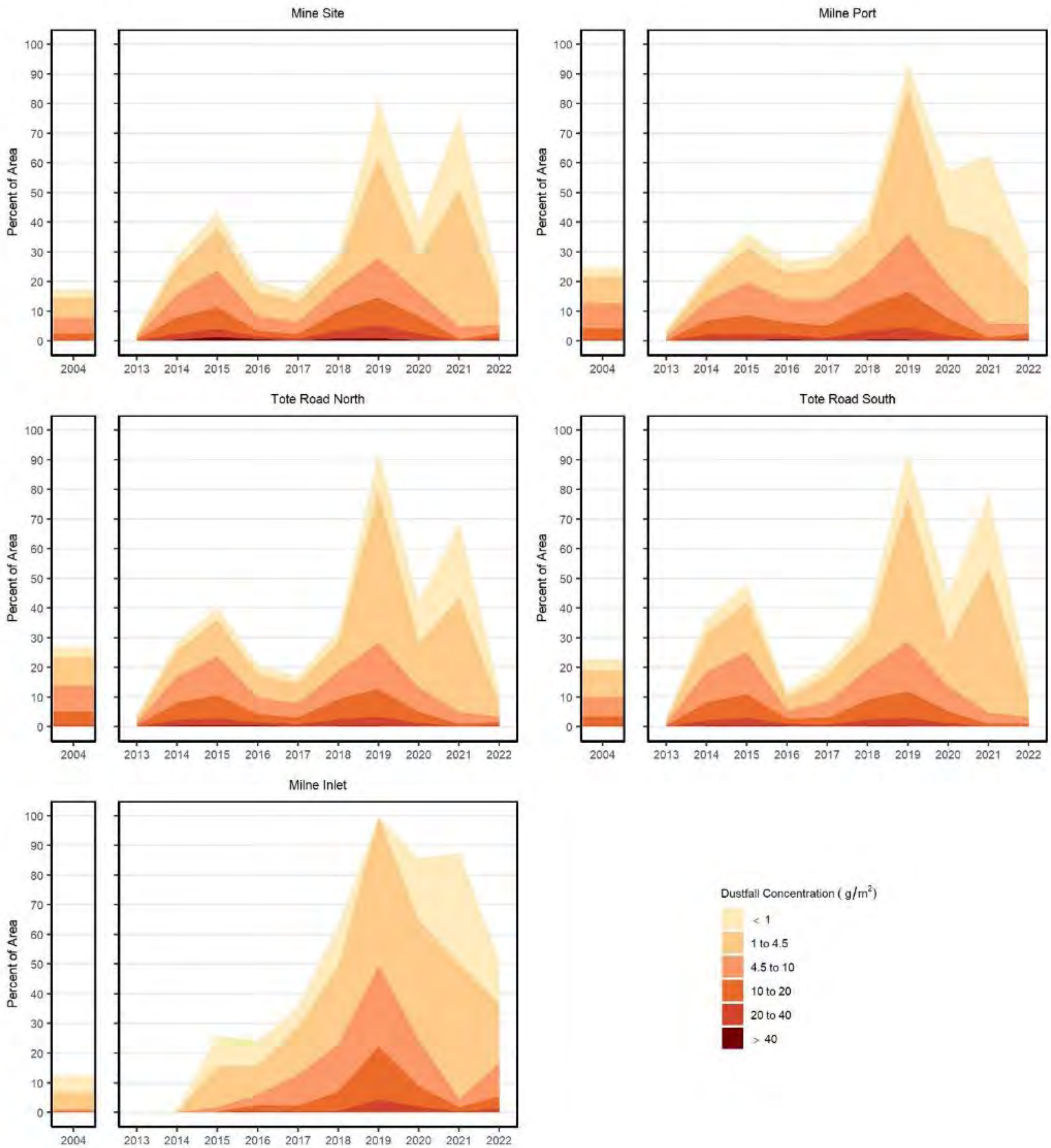


Figure 8-21. Satellite-derived dustfall extents from 2014 to 2022 with baseline years 2004 and 2013.
The mean baseline is removed from the data.

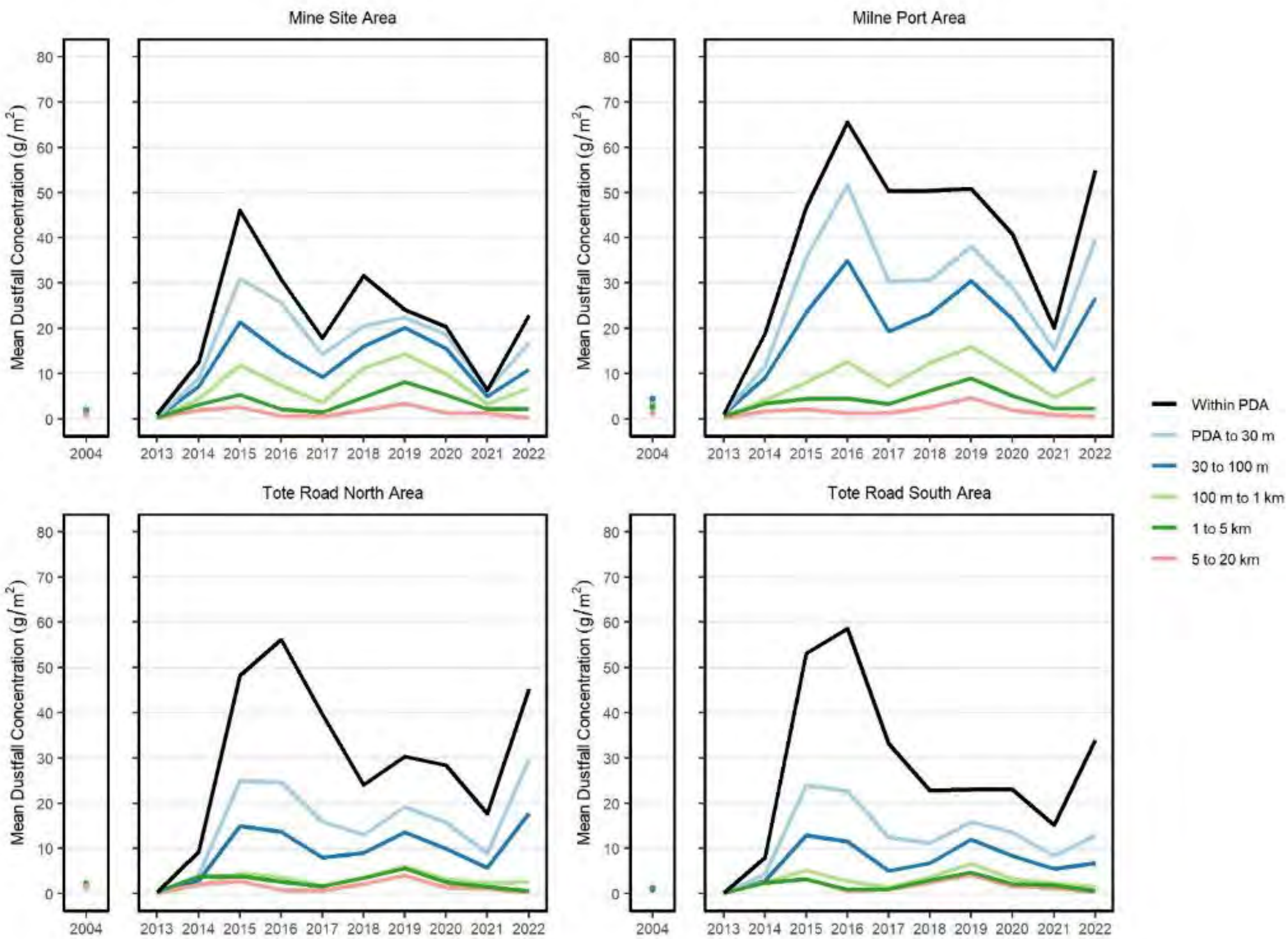
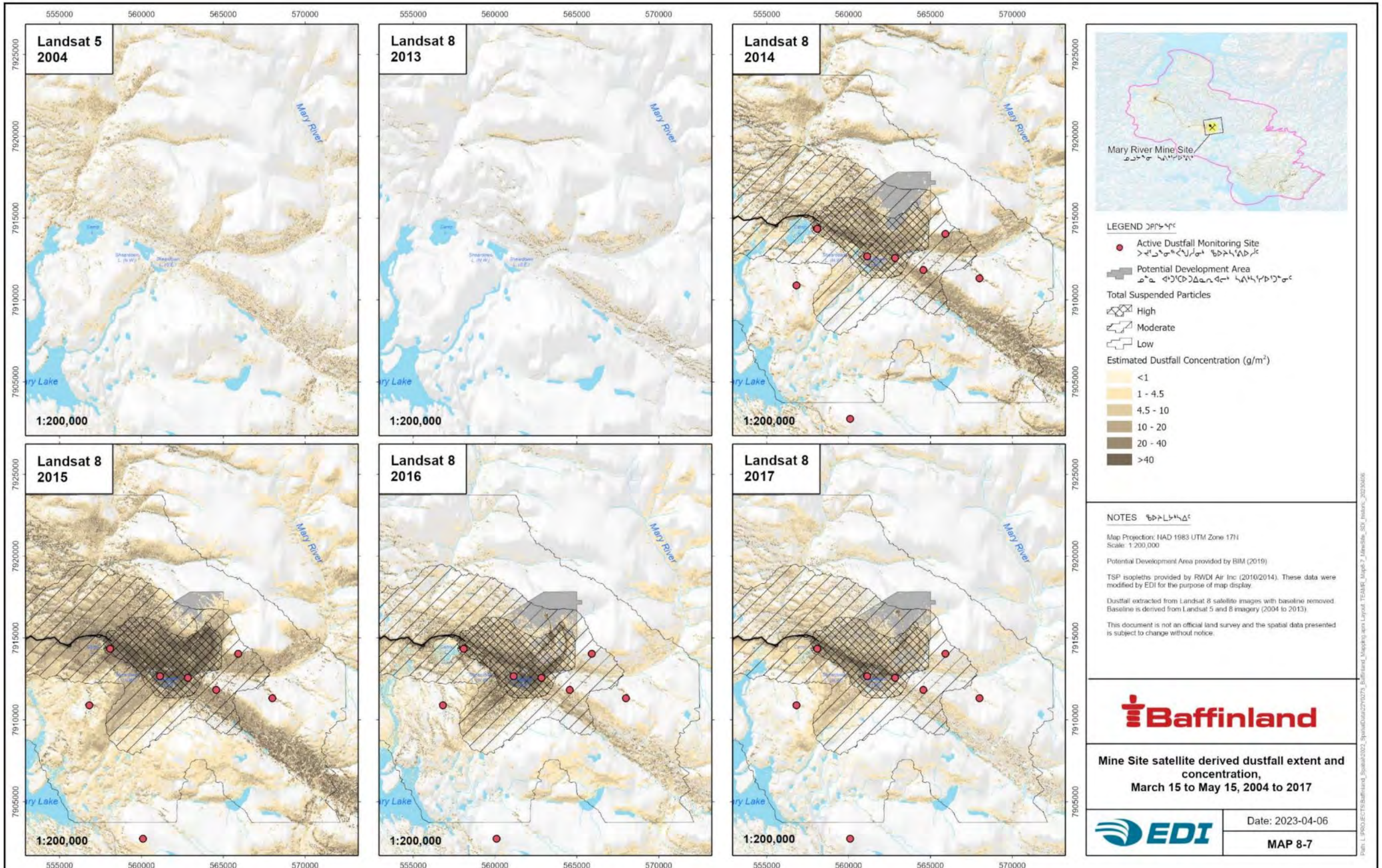
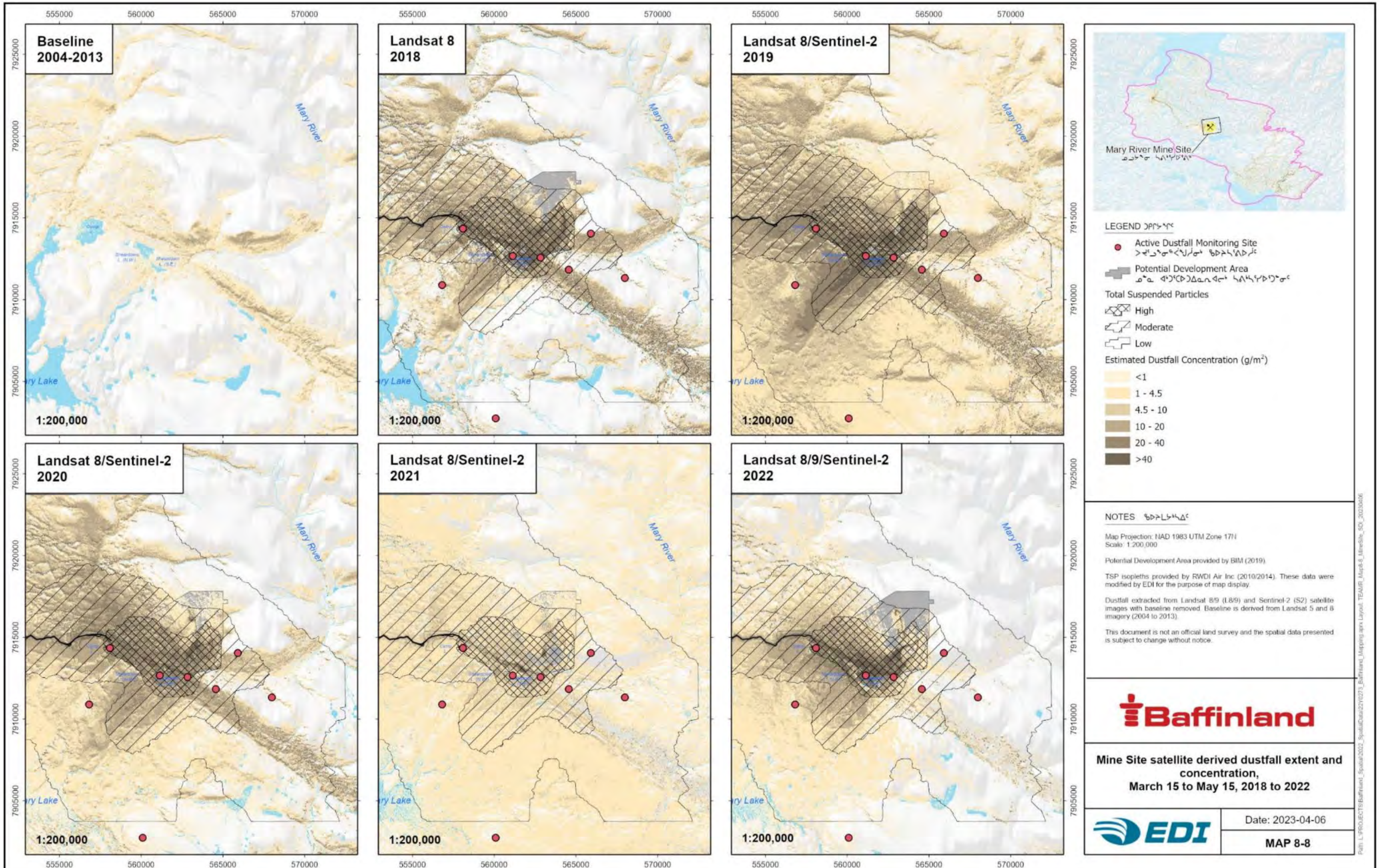
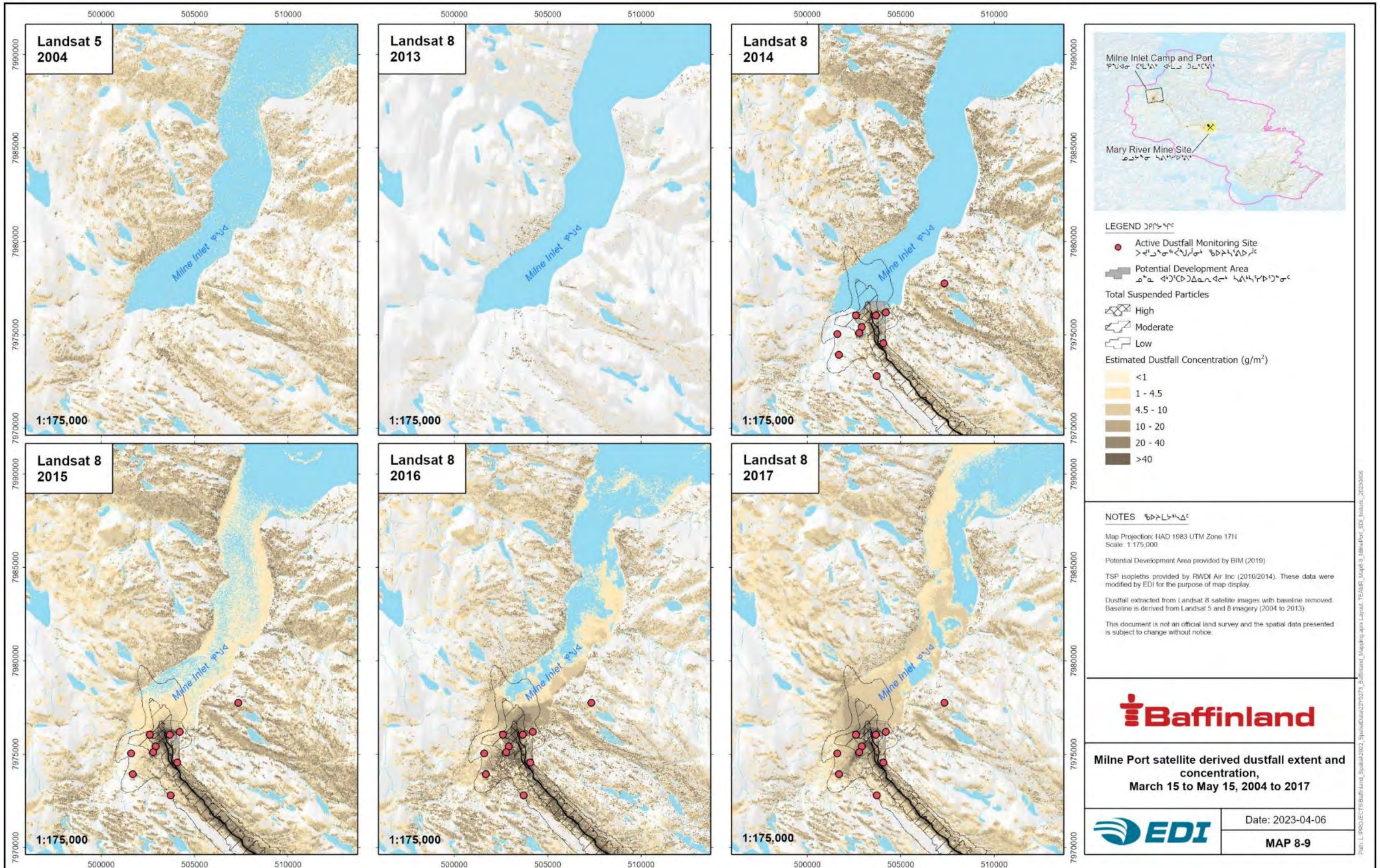
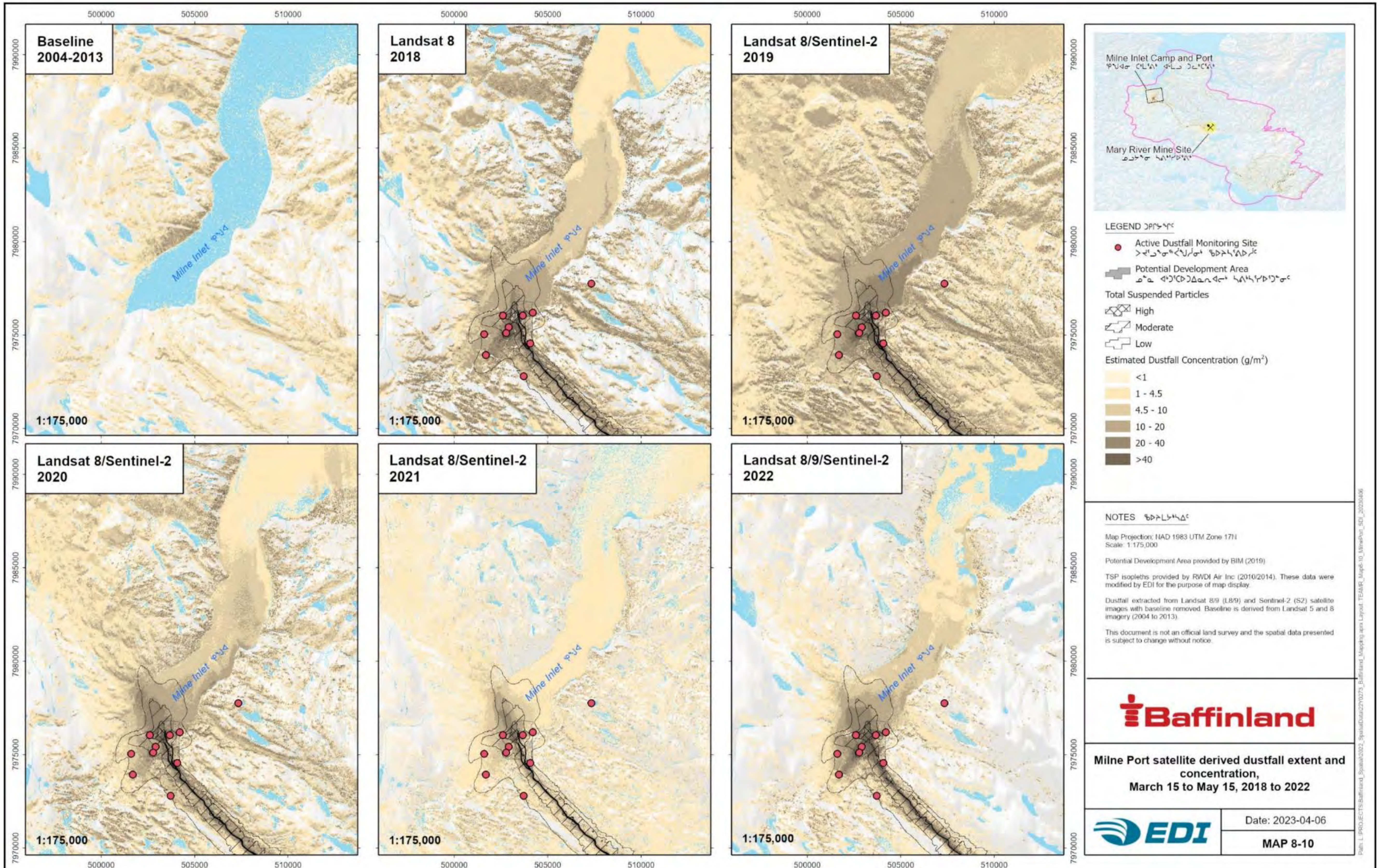


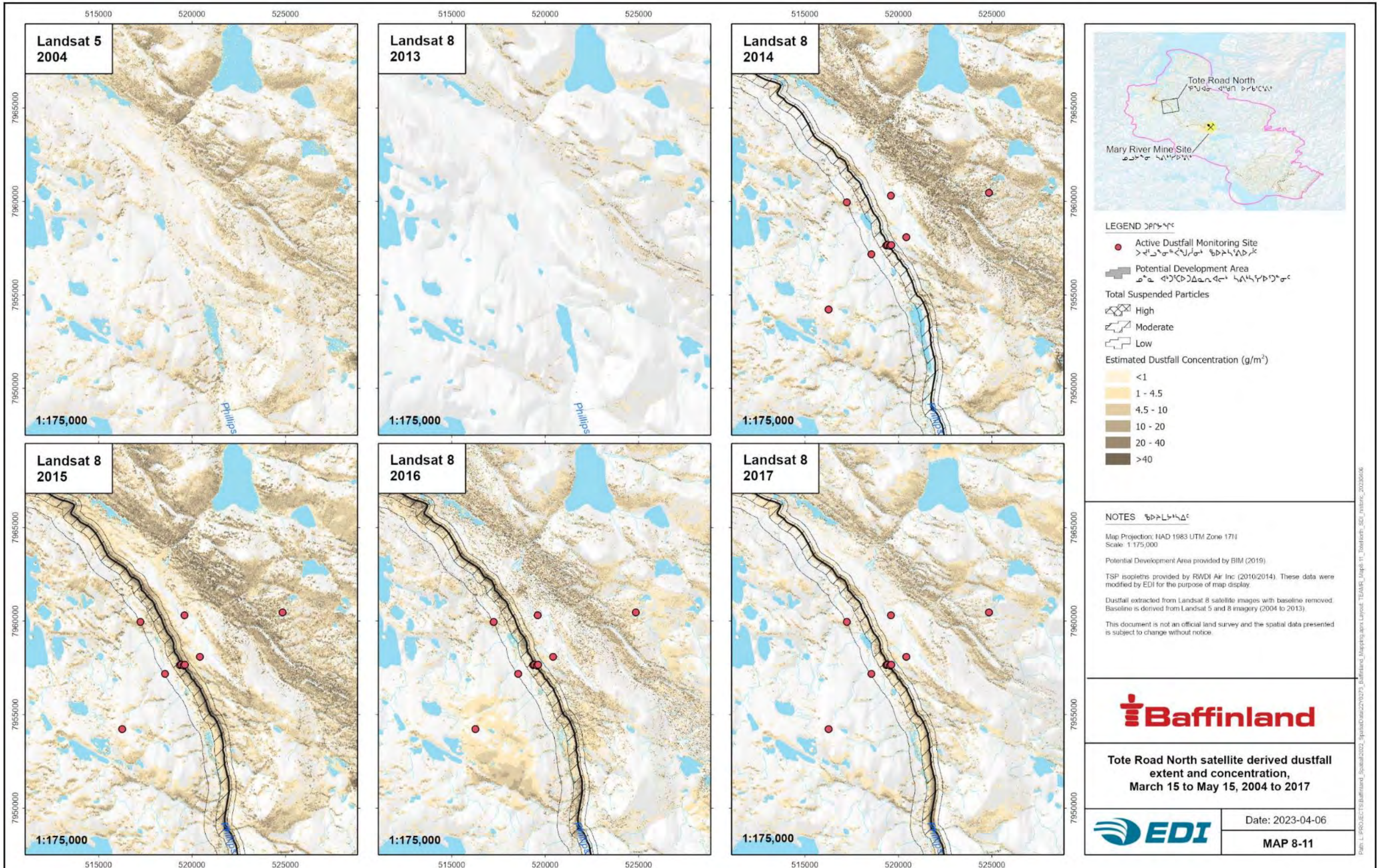
Figure 8-22. Satellite-derived mean dustfall concentrations from 2014 to 2022 with baseline years 2004 and 2013.
The mean baseline is removed from the data.

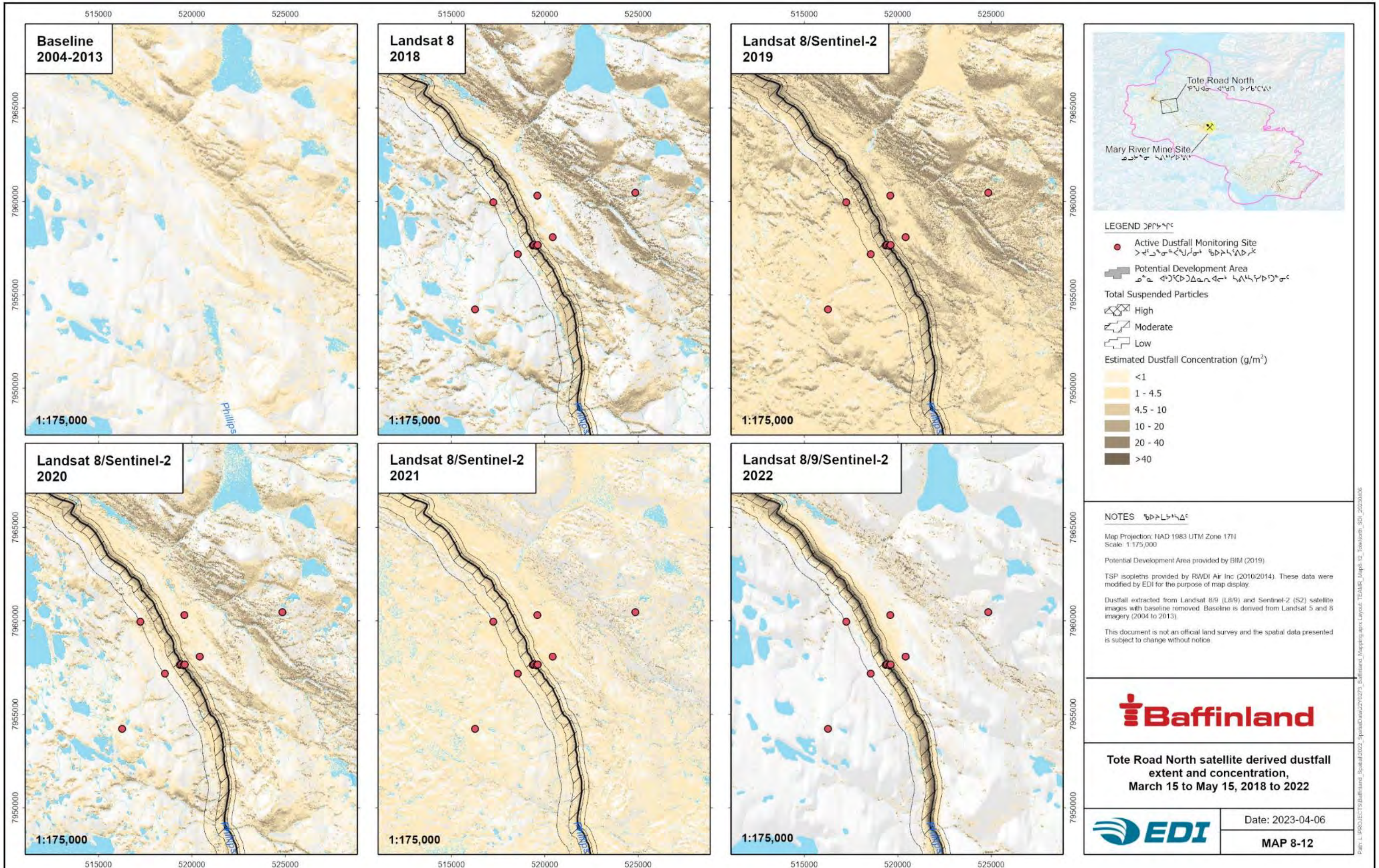

Landsat 5
2004
Landsat 8
2013
Landsat 8
2014
Landsat 8
2015
Landsat 8
2016
Landsat 8
2017
1:200,000
Mary River
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:200,000
Potential Development Area provided by BIM (2019)
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8 satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Mine Site satellite derived dustfall extent and concentration,
March 15 to May 15, 2004 to 2017
EDI
Date: 2023-04-06
MAP 8-7

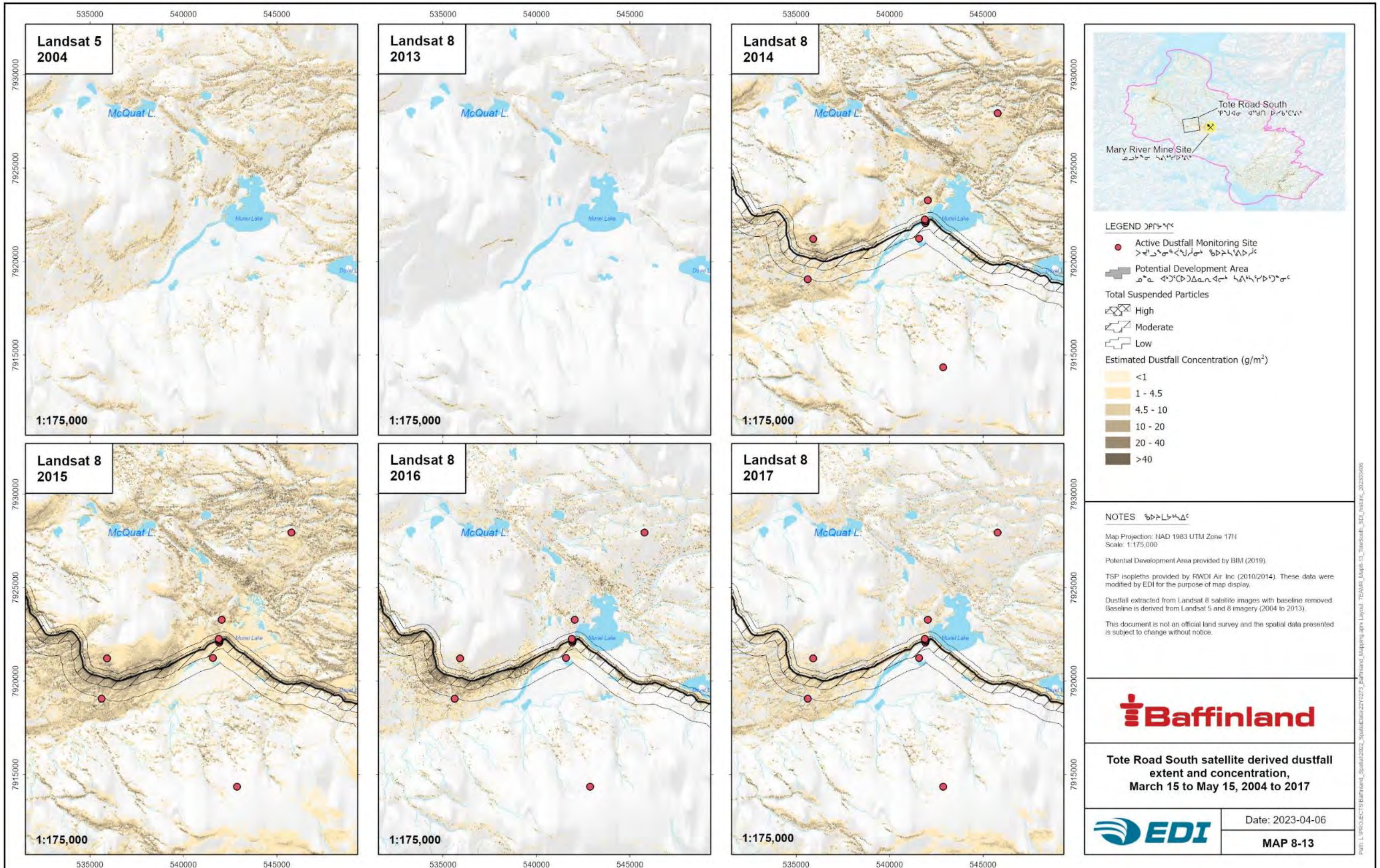

Baseline 2004-2013
Landsat 8 2018
Landsat 8/Sentinel-2 2019
Landsat 8/Sentinel-2 2020
Landsat 8/Sentinel-2 2021
Landsat 8/9/Sentinel-2 2022
Mary River
1:200,000
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:200,000
Potential Development Area provided by BIM (2019).
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8/9 (L8/9) and Sentinel-2 (S2) satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Mine Site satellite derived dustfall extent and concentration,
March 15 to May 15, 2018 to 2022
EDI
Date: 2023-04-06
MAP 8-8

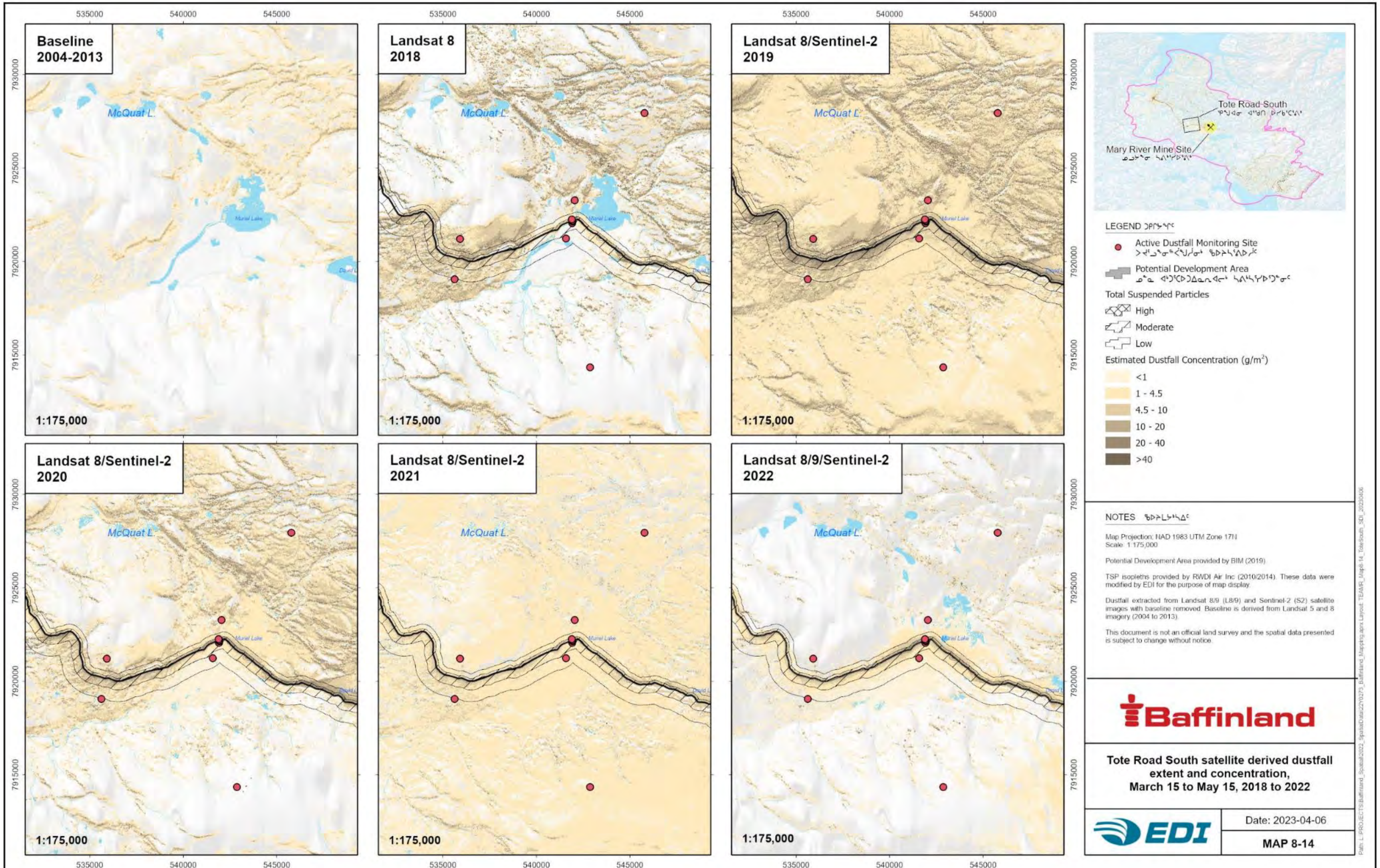

Landsat 5
2004
Landsat 8
2013
Landsat 8
2014
Landsat 8
2015
Landsat 8
2016
Landsat 8
2017
Milne Inlet
1:175,000
500000
505000
510000
7970000
7975000
7980000
7985000
7990000
Milne Inlet Camp and Port
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:175,000
Potential Development Area provided by BIM (2019)
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8 satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Milne Port satellite derived dustfall extent and concentration,
March 15 to May 15, 2004 to 2017
EDI
Date: 2023-04-06
MAP 8-9


Baseline
2004-2013
Landsat 8
2018
Landsat 8/Sentinel-2
2019
Landsat 8/Sentinel-2
2020
Landsat 8/Sentinel-2
2021
Landsat 8/9/Sentinel-2
2022
Milne Inlet
1:175,000
500000
505000
510000
7970000
7975000
7980000
7985000
7990000
Milne Inlet Camp and Port
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:175,000
Potential Development Area provided by BIM (2019)
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8/9 (L8/9) and Sentinel-2 (S2) satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Milne Port satellite derived dustfall extent and concentration,
March 15 to May 15, 2018 to 2022
EDI
Date: 2023-04-06
MAP 8-10


Landsat 5
2004
Landsat 8
2013
Landsat 8
2014
Landsat 8
2015
Landsat 8
2016
Landsat 8
2017
1:175,000
Phillips
515000
520000
525000
7965000
7960000
7955000
7950000
Tote Road North
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:175,000
Potential Development Area provided by BIM (2019).
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8 satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Tote Road North satellite derived dustfall extent and concentration, March 15 to May 15, 2004 to 2017
EDI
Date: 2023-04-06
MAP 8-11


Baseline 2004-2013
Landsat 8 2018
Landsat 8/Sentinel-2 2019
Landsat 8/Sentinel-2 2020
Landsat 8/Sentinel-2 2021
Landsat 8/9/Sentinel-2 2022
1:175,000
515000
520000
525000
7965000
7960000
7955000
7950000
Phillips
Tote Road North
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:175,000
Potential Development Area provided by BIM (2019).
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8/9 (L8/9) and Sentinel-2 (S2) satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Tote Road North satellite derived dustfall extent and concentration, March 15 to May 15, 2018 to 2022
EDI
Date: 2023-04-06
MAP 8-12


Landsat 5 2004
Landsat 8 2013
Landsat 8 2014
Landsat 8 2015
Landsat 8 2016
Landsat 8 2017
McQuat L.
1:175,000
535000
540000
545000
7930000
7925000
7920000
7915000
Tote Road South
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:175,000
Potential Development Area provided by BIM (2019).
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8 satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Tote Road South satellite derived dustfall extent and concentration, March 15 to May 15, 2004 to 2017
EDI
Date: 2023-04-06
MAP 8-13


Baseline 2004-2013
Landsat 8 2018
Landsat 8/Sentinel-2 2019
Landsat 8/Sentinel-2 2020
Landsat 8/Sentinel-2 2021
Landsat 8/9/Sentinel-2 2022
McQuat L.
1:175,000
535000
540000
545000
7930000
7925000
7920000
7915000
Tote Road South
Mary River Mine Site
LEGEND
Active Dustfall Monitoring Site
Potential Development Area
Total Suspended Particles
High
Moderate
Low
Estimated Dustfall Concentration (g/m²)
<1
1 - 4.5
4.5 - 10
10 - 20
20 - 40
>40
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Scale: 1:175,000
Potential Development Area provided by BIM (2019).
TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.
Dustfall extracted from Landsat 8/9 (L8/9) and Sentinel-2 (S2) satellite images with baseline removed. Baseline is derived from Landsat 5 and 8 imagery (2004 to 2013).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Tote Road South satellite derived dustfall extent and concentration, March 15 to May 15, 2018 to 2022
EDI
Date: 2023-04-06
MAP 8-14

8.4.4 SNOW SAMPLING PILOT STUDY

Ten of the 13 surface snow sample sites had corresponding Landsat images taken on the same day, and one site had a corresponding Sentinel-2 image (Table 8-9). Three sites without a corresponding image refer to MP-SS-03-S, MP-SS-04-S, and MP-SS-06-S that were sampled on May 6, 2022. Four sites (i.e., TR-SS-07-S, MP-SS-01-S, MP-SS-02-S, and MP-SS-05-S) had two corresponding images. The total sample size was 14.

As demonstrated in Section 8.4.2.2, Landsat and Sentinel-2 images produced significantly different SDI values, leading to the calculation of separate regression models. Using the rational equation presented in Mauro et al. (2015) for mineral dust versus SDI measured from hyperspectral data, a non-linear regression model was fit to the Landsat data (residual standard error = 0.0081).

$$SDI_L = \frac{0.1904 \times Conc - 11.1653}{Conc + 1226.3479}$$

None of the coefficients were significant ($P > 0.1$) and there was a large gap between the highest concentration data point and the lower concentration data points (<200 mg/L; Figure 8-23).

Table 8-9. Surface snow samples collected May 1 to 9, 2022, and corresponding Snow Darkening Index value from satellite imagery.

Sample ID	Date	Easting	Northing	Total Suspended Solids (mg/L)	Snow Darkening Index	Satellite
TR-SS-07-S	2022-05-01	535893	7921188	5.4	-0.002	Landsat 9
TR-SS-07-S	2022-05-01	535893	7921188	5.4	0.010	Sentinel-2
TR-SS-08-S	2022-05-01	542052	7923280	5.1	-0.006	Landsat 9
MP-SS-03-S	2022-05-06	504203	7976230	192	–	–
MP-SS-04-S	2022-05-06	502580[1]	7976051[1]	292	–	–
MP-SS-06-S	2022-05-06	508583	7986332	43.9	–	–
MP-SS-05-S	2022-05-09	503339	7979591	151	0.004	Landsat 8
MP-SS-02-S	2022-05-09	505212	7976892	17.6	-0.003	Landsat 8
MP-SS-01-S	2022-05-09	506661	7975666	<2[2]	-0.018	Landsat 8
MP-SS-05-S	2022-05-09	503339	7979591	151	0.001	Landsat 8
MP-SS-02-S	2022-05-09	505212	7976892	17.6	-0.006	Landsat 8
MP-SS-01-S	2022-05-09	506661	7975666	<2[2]	-0.015	Landsat 8
MS-SS-06-S	2022-05-01	552214	7904596	4.5	-0.002	Landsat 9
MS-SS-01-S	2022-05-01	555807	7913700	157	0.017	Landsat 9
MS-SS-04-S	2022-05-02	561454	7913021	746	0.065	Landsat 8
MS-SS-02-S	2022-05-02	558081	7914370	170	0.029	Landsat 8
MS-SS-05-S	2022-05-02	563308	7916817	14.5	-0.006	Landsat 8

[1] Coordinates estimated from nearby snow pit samples.

[2] < denotes below detection limit.

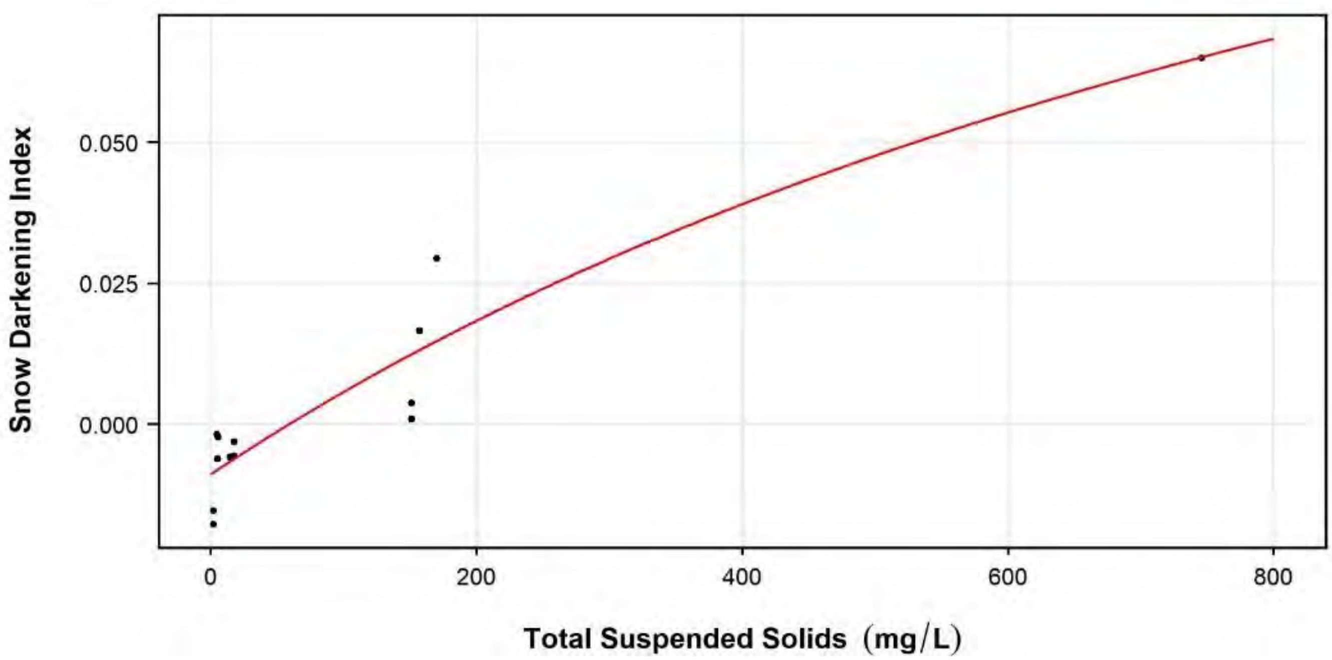


Figure 8-23. Non-linear regression (rational fit) between Total Suspended Solids and Landsat 8/9 Snow Darkening Index.

8.5 DUSTFALL SUMMARY

8.5.1 PASSIVE DUSTFALL MONITORING

Dustfall remained relatively constant at most year-round sampling locations throughout the Project area. Dry conditions during the summer likely contributed to some dustfall increases, particularly at the Mine Site. A summary of passive dustfall monitoring is provided in the following bullet points.

- The magnitude of annual dustfall at the Mine Site sample locations was elevated compared to recent years. In 2022, the highest dustfall at the Mine Site area was associated with the airstrip and the Mine haul road. The airstrip has consistently had the highest dustfall deposition in the Mine Site area in all years except 2019.
- The magnitude of dustfall at Milne Port has remained constant or, in some cases, has slightly decreased, a trend that began in 2018. The highest dustfall in the Milne Port area is associated with the ore stockpiles, with lesser amounts generated by the sealift staging area.
- Along the Tote Road, dustfall in 2022 was consistent at the North Crossing location compared with recent years. However, increased dustfall was noted at the South Crossing where site specific conditions including topography, and the presence of a bridge structure, following which vehicles accelerate likely affect the rate of dustfall.
- Dustfall 1,000 m from the PDA was measured at 12 sites in 2022. Dustfall was consistent with previous years' data.

- Despite increased production from 2016 to 2021, dustfall generally plateaued with only modest increases in some Project areas. Post-2016 decreases in dustfall are likely associated with the implementation of dustfall mitigation strategies in all Project areas. The 2022 dustfall imagery analysis included a quantitative dustfall extents and concentrations analysis. The additional analysis indicated extent and concentrations of dustfall increased from 2020 but were less than 2019 within 20 km of the PDA.

8.5.2 DUSTFALL IMAGERY ANALYSIS

- Satellite-estimated dustfall concentrations were derived from a relationship between the dustfall accumulation calculated from passive dustfall monitor deposition rates and the index of snow darkening.
- The 2022 dustfall extent covered 13.30% of the study area, with lower dustfall concentration classes (<4.5 g/m^2) accounting for the largest dustfall area.
- Milne Inlet and Milne Port had the largest percentage of dust extent followed by the Mine Site. The pattern of dustfall extent on the landscape was similar from 2014 to 2022 for all areas, with the highest concentrations near the Project and dustfall extending northeast along Milne Inlet, west and south of the Mine Site, and southwest of the South Crossing (KM78) in the direction of prevailing and/or strong winds.
- Mean dustfall concentration was highest at all sites within the PDA and decreased with distance from the Project. Milne Port had the highest mean concentrations, followed by the Tote Road. All areas showed increased mean dustfall concentration in 2022, primarily within 1 km of the PDA. The increase was also observed in the passive dustfall monitors.
- The overall trends between the satellite-derived mean dustfall concentrations and the annual dustfall from the passive dustfall monitors were similar for Milne Port and the Tote Road, capturing most of the same fluctuations. The trend fluctuations differed between the two datasets for the Mine Site monitors.

9 VEGETATION

Baffinland Iron Mines Corporation (Baffinland) is committed to monitoring potential Project-related effects on vegetation, including vegetation abundance and composition and vegetation health. Based on the committed monitoring frequency of 3 to 5 years, the 2022 monitoring focused on monitoring vegetation and soil base metals as an indicator of vegetation health.

9.1 VEGETATION AND SOIL BASE METALS MONITORING

The following Project Conditions (PCs) are tied to concerns regarding potential increases in trace metal concentrations in vegetation and soil from Project activities (Nunavut Impact Review Board 2020):

- **PC #34** *"The Proponent shall conduct soil sampling to determine metal levels of soils in areas with berry-producing plants near any of the potential development areas, prior to commencing operations."*
- **PC #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."*

Note: PC #38 and PC #50 and Project Commitments #67, 69, and 107 also relate (directly or indirectly) to these concerns and reporting requirements for the vegetation and soil base metals monitoring program.

To address these PCs, a long-term vegetation and soil base metals monitoring program was initiated in 2012, as described in the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP) (Baffinland Iron Mines Corporation 2016a). The objectives of the vegetation and soil base metals monitoring program are to:

- monitor metal concentrations in vegetation and soil, particularly caribou forage (i.e., lichen); and,
- verify that metal concentrations are within the acceptable range for established soil quality guidelines and relevant vegetation indicator values.

Given that dustfall deposition is the primary source of anthropogenic metals at the Mary River Project (the Project), the vegetation and soil base metals monitoring program has been designed to align and facilitate comparisons with the dustfall monitoring program (Section 8 – Dustfall) to assess metals in vegetation and soil in relation to Project activities.

9.1.1 METHODS

9.1.1.1 Monitoring History and Changes in Sampling Procedures

Procedures for the vegetation and soil base metals monitoring program have been adapted and refined over time due to Project circumstances, investigative outcomes, and recommendations from the Terrestrial Environment Working Group (TEWG).

2008 — Pre-construction baseline data on vegetation and soil base metal concentrations were first collected for the Project in 2008; however, these data were not used due to sampling and analytical discrepancies. At that time, collection methods were not effectively documented and did not facilitate data continuity or comparability (Baffinland Iron Mines Corporation 2010a).

2012-13 — Additional baseline sampling was conducted within the Regional Study Area in 2012 and 2013. Vegetation sampling targeted three focal groups: lichen (*Flavocetraria cucullata*, *F. nivalis*, *Cladina arbuscula*, and *C. rangiferina*), willow (*Salix* spp.), and blueberry (*Vaccinium uliginosum*). The analysis focused on seven metals/metalloids selected as contaminants of potential concern (CoPCs): aluminum (Al), arsenic (As), cadmium (Cd), copper (Cu), lead (Pb), selenium (Se), and zinc (Zn). The selection of CoPCs considered chemical composition of the ore and construction material (i.e., road cover/capping material and road-generated dust) and use of similar indicators at other projects to evaluate potential risk to humans and wildlife (Baffinland Iron Mines Corporation 2010b, 2012d, b, EDI Environmental Dynamics Inc. 2014). Standardized sampling procedures and soil quality guidelines from the Canadian Council of Ministers of the Environment (CCME) were used as threshold values for soil. Peer-reviewed literature sources were used in the absence of explicit quality guidelines for lichen. Monitoring design and key findings are presented in the 2013 Terrestrial Environment Annual Monitoring Report (EDI Environmental Dynamics Inc. 2014).

2014 — Sampling intensity was increased in 2014 to improve data capture and analysis. Lichen —recognized as an indicator of environmental conditions and accumulator of atmospheric pollutants (Naeth and Wilkinson 2008, Aslan et al. 2011)— was selected as the key indicator and focal group for metals uptake. Blueberry and willow were removed as assessment targets due to their limited abundance or lack of reference guidelines (EDI Environmental Dynamics Inc. 2015). Aluminum was removed as a CoPC due to its high variability, ubiquitous nature, and lack of CCME and United States Environment Protection Agency soil quality guidelines to protect environmental and human health.

2015 — In 2015, the TEWG recommended further increasing sampling and data capture. Before implementing any modifications, Baffinland evaluated the program's experimental design—especially concerning statistical power and the ability to detect Project-related effects—to optimize sampling intensity and distribution. Ultimately, the study design was expanded to facilitate 'Near', 'Far', and 'Reference' locations; the procedures were then aligned with the dustfall monitoring program, where feasible. Monitoring design and key findings are presented in the 2017 and 2018 Terrestrial Environment Annual Monitoring Reports (EDI Environmental Dynamics Inc. 2017, 2018).

2016 — Additional 'Reference' sites were added to the sample design to increase regional data capture.

2019 — The vegetation and soil base metals monitoring program was formalized in 2019 (using the present methods) with considerations and inclusions per the NIRB and Government of Nunavut recommendations (EDI Environmental Dynamics Inc. 2017). The analysis focused on six CoPCs in soil and lichen: As, Cd, Cu, Pb, Se, and Zn (i.e., selected in 2012-2013). Soil and lichen CoPC concentrations were compared between the 'Before' and 'After' periods and the distance from the Potential Development Area (PDA).

2020 — Ten additional sample sites were added in 2020 to the Far distance category. Since most Project-emitted dust is deposited within 1,000 m of the PDA, increasing sample size in this range is intended to improve data capture and resolution within a targeted survey area. This modification to the study design was implemented in response to TEWG reviewer comments in 2019 (Qikiqtani Inuit Association; 2018 TEAMR comments; T-24042019).

2021 — In 2021, the soil and vegetation metals monitoring sampling program met its five-year monitoring commitment. For logistical reasons, timing and access, sampling (12 sites) primarily focused on Milne Port and the Tote Road, resulting in a reduced sample size; sampling of Far/Reference sites were less represented in the data capture.

2022 — In 2022, a full review of the vegetation and soil base metals analysis was conducted, including historic reference standards and indicator values. Notably, a central database was created to consolidate all vegetation and soil base metals (from 2012 to the present); statistical analysis has been updated to account for improvements in analytical methods, and appropriate p-value adjustments for multiple pairwise comparisons have been applied[12]. Concentration thresholds for soil and indicator values for lichen were reviewed and updated (if/where applicable).

Where possible, modifications to the vegetation and soil base metals monitoring program methods have incorporated input from the TEWG and NIRB to improve and further refine data capture and baseline comparisons. Baseline data for the vegetation and soil base metals monitoring program includes field sampling of reference sites from 2012 to 2016.

9.1.1.2 Vegetation and Soil Sampling

The study area was divided into three Project areas (i.e., Milne Port, the Tote Road, and Mine Site). Sampling was conducted at three distances from the PDA (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Sampling locations and distances from the PDA were informed by the results of the dustfall monitoring program (EDI Environmental Dynamics Inc. 2015). In 2020, all past sampling sites were renamed with a permanent Site ID to compare metal concentrations between sampling periods. To account for variability in site selection (which may differ due to GPS accuracy, microsite, and lichen availability), past sampling sites within a 35 m radius of each other were assumed to represent the same Site ID.

Vegetation (i.e., lichen) and soil sampling were conducted from July 14 to 24, 2022. A total of 61 sites were sampled across the study area; sampling sites and locations are presented in Table 9-1 and shown on Map 9-1 and Map 9-2. Site summary descriptors (location identifiers, georeferencing, and other parameters) for the vegetation and soil base metals monitoring program are presented in Appendix B.

[12] Changes to methods and analysis are detailed below (Section 9.1.1.4) and in summary recommendations (Section 9.2).

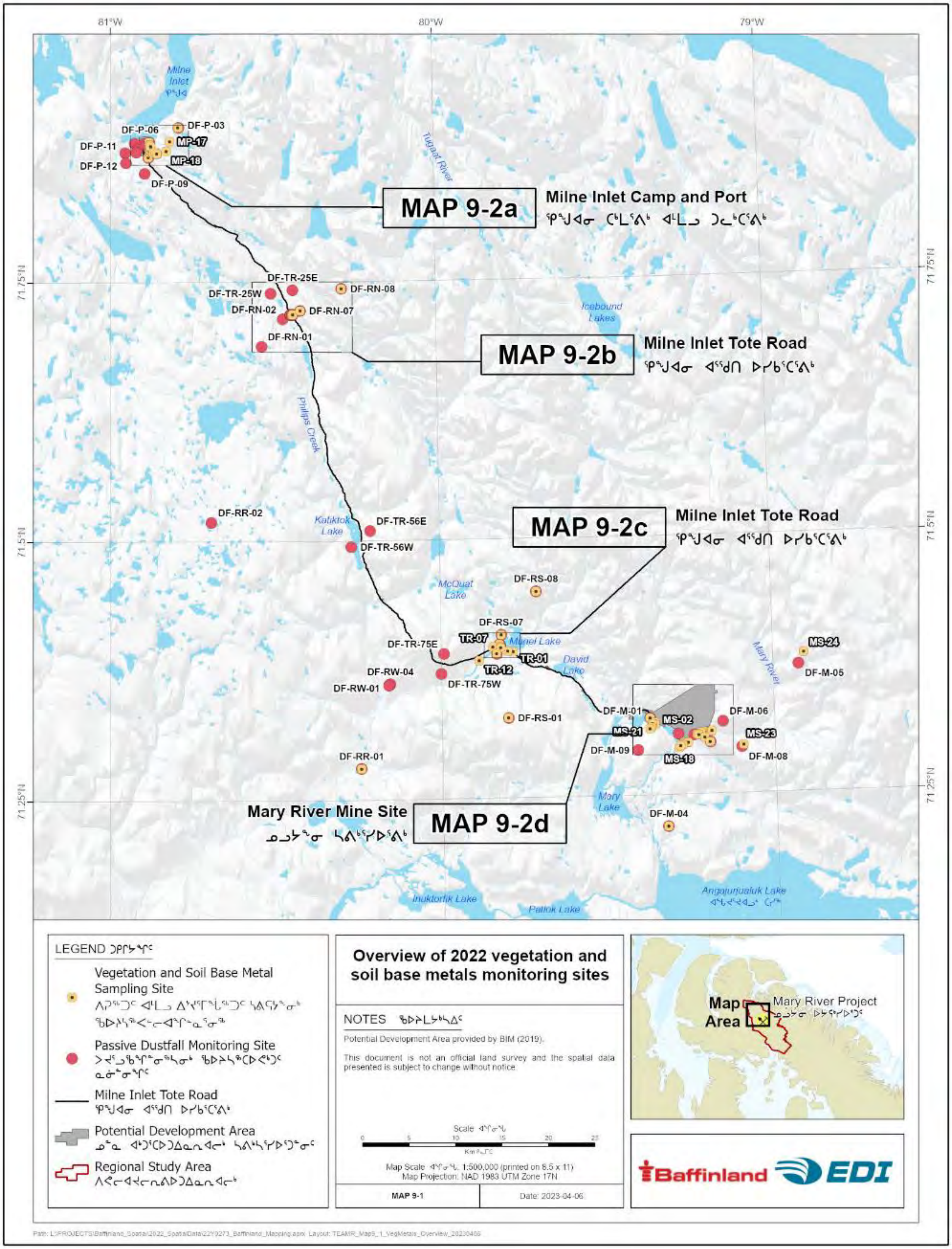
The following technical procedures were conducted during field sampling to provide quality assurance and quality control.

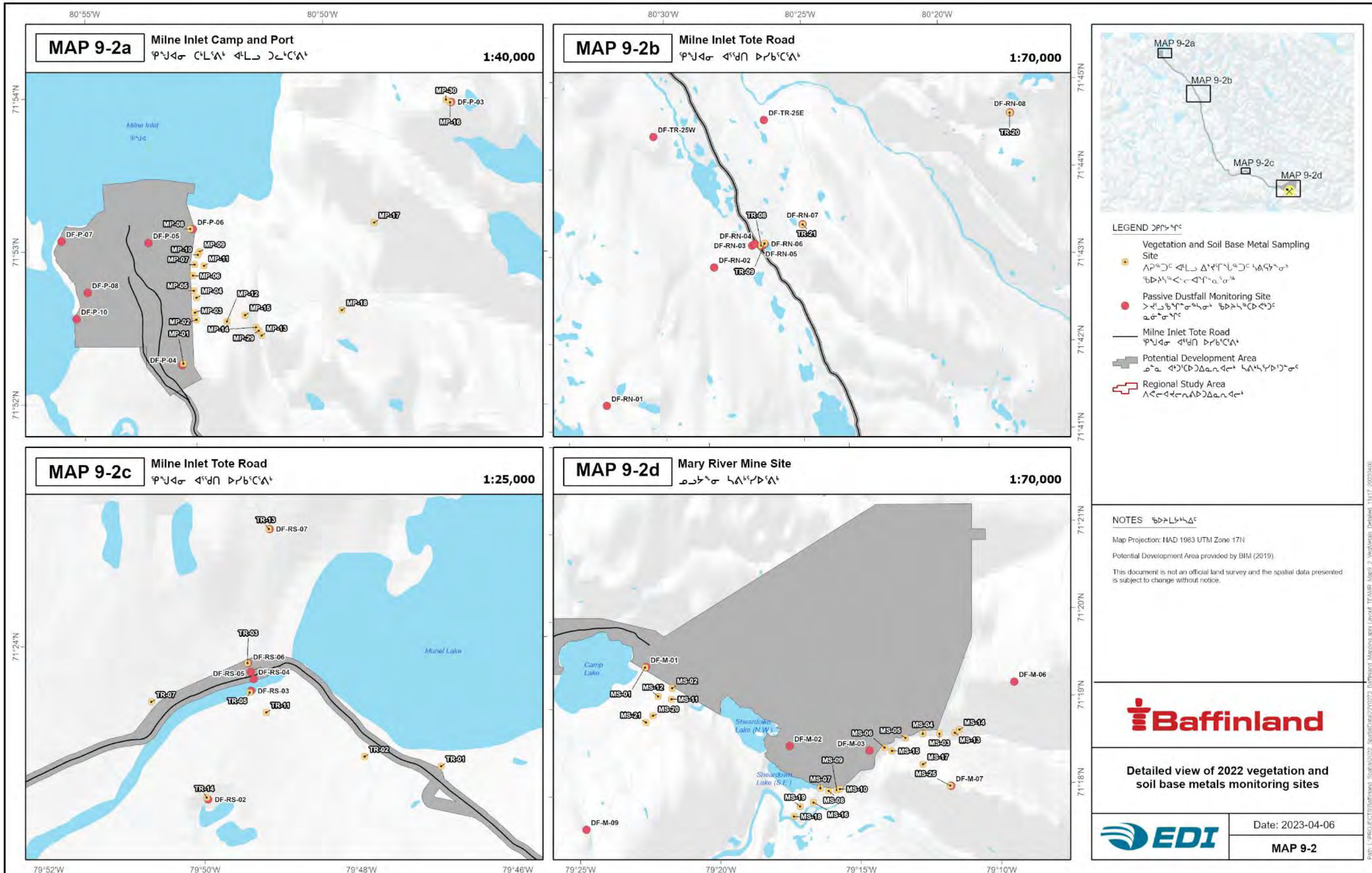
- New/clean nitrile gloves were worn at each sample site.
- A minimum 10 g vegetation sample was collected at each site.
- A minimum 100 g soil sample was collected from the A horizon (typically 5 to 15 cm from the surface and above the permafrost). The sample area coincided with the rooting zone where plant metal uptake is primarily expected to occur.
- Samples were transferred to new/clean plastic bags, maintained under cold conditions (0°C), and submitted to an accredited laboratory for additional handling and analysis.
- Replicate samples of both soil and lichen were collected at one or more sample sites as internal quality controls to evaluate the precision of field and laboratory methods and inherent variability of the samples (Horowitz 1990).

Table 9-1. Survey summary details for vegetation and soil base metals monitoring in 2022.

Distance Category	Distance from PDA (m)	Number of Sites	Project Area	Number of Samples	
				Soil	Lichen
Near	0–100	27	Mine Site	10	10
			Milne Port	10	10
			Tote Road	7	7
Far	>100–1,000	22	Mine Site	11	11
			Milne Port	6	6
			Tote Road	5	5
Reference	>1,000	12	Mine Site	4	4
			Milne Port	4	4
			Tote Road	4	4
Total	**—**	**61**	**—**	**61**	**61**

Notes: PDA = Potential Development Area.


MAP 9-2a
Milne Inlet Camp and Port
MAP 9-2b
Milne Inlet Tote Road
MAP 9-2c
Milne Inlet Tote Road
MAP 9-2d
Mary River Mine Site
Milne Inlet
Tugaat River
Phillips Creek
Katiktok Lake
McQuat Lake
Icebound Lakes
Mary River
David Lake
Mary Lake
Inuktorfik Lake
Angajurjualuk Lake
DF-P-03
DF-P-06
DF-P-11
DF-P-12
DF-P-09
MP-17
MP-18
DF-TR-25E
DF-TR-25W
DF-RN-08
DF-RN-02
DF-RN-07
DF-RN-01
DF-RR-02
DF-TR-56E
DF-TR-56W
DF-RS-08
DF-RS-07
DF-TR-75E
TR-07
TR-01
TR-12
DF-RW-04
DF-RW-01
DF-TR-75W
DF-RS-01
DF-RR-01
DF-M-01
MS-02
MS-21
MS-23
MS-18
MS-24
DF-M-05
DF-M-06
DF-M-09
DF-M-08
DF-M-04
81°W
80°W
79°W
71.75°N
71.5°N
71.25°N
LEGEND
Vegetation and Soil Base Metal Sampling Site
Passive Dustfall Monitoring Site
Milne Inlet Tote Road
Potential Development Area
Regional Study Area
Overview of 2022 vegetation and soil base metals monitoring sites
NOTES
Potential Development Area provided by BIM (2019).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
Map Scale: 1:500,000 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N
MAP 9-1
Date: 2023-04-06
Map Area
Mary River Project
Baffinland
EDI


MAP 9-2a
Milne Inlet Camp and Port
1:40,000
MAP 9-2b
Milne Inlet Tote Road
1:70,000
MAP 9-2c
Milne Inlet Tote Road
1:25,000
MAP 9-2d
Mary River Mine Site
1:70,000
LEGEND
Vegetation and Soil Base Metal Sampling Site
Passive Dustfall Monitoring Site
Milne Inlet Tote Road
Potential Development Area
Regional Study Area
NOTES
Map Projection: NAD 1983 UTM Zone 17N
Potential Development Area provided by BIM (2019)
This document is not an official land survey and the spatial data presented is subject to change without notice.
Baffinland
Detailed view of 2022 vegetation and soil base metals monitoring sites
EDI
Date: 2023-04-06
MAP 9-2

9.1.1.3 Vegetation and Soil Base Metals Analysis

Soil and vegetation samples were analyzed for 36 elements by ALS Environmental Laboratory[13]. The Certificate of Analysis, comprising the comprehensive list of metals analyzed and respective assessment standards and analytical detection limits, is presented in Appendix C. Six metal/metalloid CoPCs have been reported on since 2012: As, Cd, Cu, Pb, Se, and Zn. The CoPCs presented in this report (and previous annual reports) represent a subset of the base metals analysis, selected based on the following criteria:

- analysis and outcomes of baseline metal concentrations in soil and vegetation (EDI Environmental Dynamics Inc. 2015, 2017);
- analysis of metal concentrations in the ore sampled[14] from the Project (Appendix 6G- 1, FEIS; Baffinland Iron Mines Corporation 2010b); consideration of constituents in construction material (i.e., road cover/capping material and road-generated dust);
- review of various guidelines and information sources relating to metals of concern for vegetation health with potential for uptake by wildlife and humans; use of similar indicators at other projects;
- the CCME soil quality guidelines for the protection of environmental and human health (CCME Canadian Council of Ministers of the Environment 2006);
- peer-reviewed literature on native flora and lichen-specific toxicity (Nash 1975, Tomassini et al. 1976, Nieboer et al. 1978, Folkeson and Andersson-Bringmark 1988, Kinalioglu et al. 2010);
- peer-reviewed literature on the presence and effects of metals in the Arctic and northern terrestrial biota (Canadian Arctic Contaminants Assessment Report 2003, Gamberg 2008); and,
- the evaluation of exposure potential from ore dusting (Appendix 6G-1 and 6G-2, FEIS; Baffinland Iron Mines Corporation 2010b, Intrinsik Environmental Sciences Inc 2011).

Base metal concentration thresholds for soil and vegetation (i.e., lichen) are presented in Table 9-2. The CCME soil quality guidelines for the protection of environmental and human health were used (where available) as threshold values to determine exceedances for soil-metal concentrations. The 'Agricultural' land use category—representing the highest soil quality standard in Canada—was chosen as a point reference for the Project based on the following criteria:

[13] Laboratory analyses followed the British Columbia Lab Manual for "Metals in Animal Tissue and Vegetation (Biota) – Prescriptive". Tissue samples are homogenized and sub-sampled prior to hot block digestion with nitric and hydrochloric acids, in combination with the addition of hydrogen peroxide (modified from Environment Protection Agency Method 6020A; (Environmental Protection Agency 1998). Soils were analyzed following the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the *Environmental Protection Act* (July 1, 2011). Before 2019 monitoring, the micro-digestion analysis for total metal concentrations in soil and vegetation tissues was performed by high-resolution mass spectrometry using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). As of 2019, accredited laboratories across Canada and the United States replaced high-resolution mass spectrometry with collision cell inductively coupled plasma-mass spectrometry (Hawthorne 2020). Despite this change, no significant differences in the results are expected (Jenson 2020). To account for the analyses of total mercury in soil and vegetation tissues, which considers both elemental and organic (e.g., methyl mercury), a strong acid digestion followed by analysis with cold vapor-atomic absorption spectrometry (CVAAS) was used.

[14] Ore is comprised mostly of iron (64%) and 21 other trace metals (including the final selected CoPCs); mercury was not present at measurable concentrations in the ore sampled and, therefore, was not considered for analytical presentation.

- land use types at the Project (i.e., hunting and foraging) with a potential for soil and food ingestion (CCME Canadian Council of Ministers of the Environment 2006);
- background soil-metal concentrations, which were already well below CCME guidelines for Agricultural land use (compared to commercial or industrial land uses); and,
- CCME guidelines were consistent with the risk assessment and evaluation of exposure potential from ore dusting events in selected Valued Ecosystem Components (VECs; Intrinsik Environmental Sciences Inc 2011).

No quality standard (from CCME or other agencies) is available for lichen base metal concentrations in Arctic environments. For this reason, indicator values were chosen from peer-reviewed literature sources pertinent to the Canadian High Arctic. Indicator values were defined for Cd, Cu, Pb, and Zn, whereas no reference indicator values could be defined for Se or As. The threshold values were selected to signal an early indicator for potential changes in vegetation health, including reduced vigour or growth. Values are predictive and describe a potential for initial adverse effects on vegetation health, not a threshold past which acute toxicity occurs. As part of the 2022 vegetation and soil base metals analysis review, the lichen indicator values were reassessed from peer-reviewed literature sources pertinent to the Canadian High Arctic. Lichen indicator values were updated after considering species-specific or lichen type (e.g., fruticose vs foliose lichen) information (Table 9-2). As data continue to be collected through the vegetation and dustfall monitoring programs or other relevant research initiatives, indicator values may be revised to improve the dose-response relationship between metals and lichen.

Table 9-2. Concentration thresholds for vegetation and soil base metals monitoring in 2022.

Contaminants of Potential Concern	Soil Guidelines (mg/kg)[1]	Lichen Indicator Values (mg/kg dry weight)
Arsenic	12	—[2]
Cadmium	1.4	3-30 [3]
Copper	63	7-15 [4]
Lead	70	5-10 [5]
Selenium	1	—[2]
Zinc	250	75 [6]
Other Parameters		
pH	6–8	—[2]

[1] CCME soil quality guidelines for the protection of environmental and human health.
[2] No reference indicator values identified.
[3] From Nash 1975, Nieboer et al. 1978.
[4] From Tomassini et al. 1976, Nieboer et al. 1978, Folkeson and Andersson-Bringmark 1988.
[5] From Tomassini et al. 1976, Nieboer et al. 1978, Kinalioglu et al. 2010.
[6] From Nash 1975, Nieboer et al. 1978, Folkeson and Andersson-Bringmark 1988.

9.1.1.4 Data Trends and Statistical Analysis

Before conducting statistical analyses, each sample's soil and vegetation base metal concentrations were vetted and compared with CCME soil quality guidelines or lichen indicator values. For this report, means and variance estimates were calculated for each CoPC. Besides evaluating environmental compliance, these values were examined to identify potential trends and tendencies that may warrant further investigation. Statistical data were grouped and analyzed according to the Project area and sampling distances to determine trends across the entire Project. Statistical analyses were handled in two stages.

Stage 1: General Trends — Two-way ANOVA, used to estimate variation among and between groups, were applied to the data to compare baseline (2012 to 2016) versus 2019, 2020, and 2022 monitoring outcomes. Pairwise comparisons (i.e., multiple Welch's t-tests) were used to determine whether metal concentrations in soil and lichen differed significantly between baseline conditions and subsequent monitoring years at a given sampling distance. All data distributions were evaluated and handled to verify the assumptions of parametric analyses. If normality assumptions could not be met, then a nonparametric alternative was applied (i.e., Wilcoxon rank sum test). To account for an increased risk in the probability of Type I errors (false positive effect) due to multiple tests, p-values were adjusted using the Holm method. Statistical significance, referring to the probability that the means (or medians) are different from one another, was set at 95% (i.e., p-value <0.05).

Stage 2: Distance Analysis — A simple regression analysis was used to fit a linear model and estimate parameters to further describe the trend in metal concentrations across sampling distances. Both metal concentrations and distance were logarithmically transformed for this analysis. Any values within the dataset below the metal analysis detection level were allocated a value of one-half of the detection limit. If model residuals did not meet parametric assumptions (normality and homoscedasticity), a bootstrapping approach was used to calculate a 95% confidence interval for each regression.

All analyses were performed using R version 4.2.1 (R Development Core Team 2022). Pairwise comparisons were conducted using the 'emmeans' package for R version 1.8.1. Graphs were created using 'ggplot2' version 3.4.0.

9.1.1.5 Dust-deposited Metals on Lichen

To better understand potential metal uptake pathways—differentiating metal uptake and sequestration (i.e., internalization) versus surficial deposition and surface metal binding—handling and analysis of lichen tissues compared washed and unwashed subsamples collected from sample sites. One-half of the lichen sample was washed (or cleansed) to remove surficial deposits. In contrast, the other half of the lichen sample was not washed. Washed samples would reflect metal uptake and sequestration, whereas unwashed samples would reflect dust-borne surface metals (termed 'dust-deposited metals'). An index for dust-deposited metals was calculated based on the difference in metal concentrations between washed and unwashed sample values. Positive index values indicated metal concentrations on the lichen's surface rather than in the lichen tissue. Due to natural variation of metal concentrations in lichen (even those collected from the same site), index values less than 0 can occur; however, large (negative) deviations in index values are not expected because washed samples are expected to have lower metal concentrations than unwashed samples. Index values for each CoPC were used as the random variable in a paired, two-sample t-test for each Project area (i.e., Mine Site, Milne Port, and the Tote Road) and sampling distance (i.e., Near, Far, and Reference). If assumptions of normality were not met, then a nonparametric alternative was used (i.e., Wilcoxon signed rank test). Due to multiple testing, p-values were adjusted using the Holm method.

9.1.1.6 Relationship Between Metals in Dustfall Versus Soil-metals and Lichen-metals

A strategic objective is to align and (where possible) correlate data from the dustfall monitoring program with vegetation and soil base metals monitoring program outcomes. Efforts have been made to streamline the sampling locations and study design to facilitate comparisons between these respective monitoring programs. For example, pairing vegetation and soil sample sites in proximity to permanent dustfall locations and conducting sampling concurrently. These steps are intended to bridge interpretations of the effects of dustfall on soil-metal and lichen-metal concentrations and align any triggers and corrective actions.

Dustfall monitoring data and soil-metals and lichen-metals monitoring data were fit to a statistical model to explore potential interactions based on paired sample sites. Given the probability distributions of each respective dataset, data were handled and transformed (as necessary) to meet parametric analysis assumptions. If, after such treatment, parametric assumptions remained violated, then nonparametric procedures and tests were applied. For brevity, the description of these procedures has been abridged. All statistical analyses were conducted, and all plots were created in R version 4.2.1 (R Development Core Team 2022).

The analysis focused on the CoPCs (i.e., As, Cd, Cu, Pb, Se, and Zn). Only two-dimensional and three-dimensional relationships were examined. For the analysis of three-dimensional relationships, soil pH and/or distance from the PDA were included, and corrected Akaike's Information Criteria (AICc) were used for model selection (Hastie and Tibshirani 1990). All candidate models with an ΔAIC (difference in AICc between the given model and the lowest AICc) of two or less were considered to have equivalent support (Burnham and Anderson 2002). In the case of multiple possible models, the most parsimonious model was selected to be the focus of the results and discussion.

9.1.2 RESULTS AND DISCUSSION

Soil-metal and lichen-metal concentrations are described in the following subsections, focusing on CoPCs. Tables summarizing the net changes in CoPC concentrations for soil and lichen identify in green the years when statistically significant decreases occur and in yellow the years when statistically significant increases occur compared to the baseline years (i.e., 2012 to 2016). Orange identifies years when the mean concentration is above the lower soil guideline or lichen indicator value in addition to a statistically significant increase in concentration compared to baseline. For brevity and clarity of presentation, comprehensive statistical analyses are not shown but available as required. The dataset for soil and vegetation base metal concentrations and quality assurance certificates for all laboratory analyses from the 2022 monitoring program are provided in Appendix C. Generally, values were below or otherwise within acceptable ranges in relation to applicable CCME soil quality guidelines or lichen indicator values. Should they occur, discrete increases or other notable trends warranting more in-depth consideration during future monitoring activities are highlighted.

9.1.2.1 Soil-metal Concentrations

Table 9-3 summarizes net changes in soil-metal CoPCs comparing 2022 values with baseline conditions across Project areas and sampling distances. Colour categories highlight if/where (1) mean concentrations were significantly lower than baseline or (2) mean concentrations exceeded CCME soil quality guidelines. Overall, all 2022 mean concentrations across Project areas and sample distances showed no significant changes or were significantly lower in relation to baseline values. There were also no exceedances in relation to CCME soil quality guidelines, and all values were within an acceptable range of variability. The following paragraphs summarize net changes, trends, and distributions for all soil-metal CoPCs. Given their respective toxicities and effects on environmental and human health, any significant increases in CoPCs at the Project—even those below soil quality thresholds and within acceptable concentrations—were flagged for closer investigation.

Upon review of analytical and statistical methods from 2012 to the present, the laboratory detection limits (RDLs) for some CoPCs (i.e., As, Cd, and Se) have improved. Changes in RDL values can result in trend artifacts (e.g., where analytical values seemingly decrease due to more sensitive methods of detection [highlighted green in Table 9-3]). This effect is identified where relevant. Future analyses must account for this effect by comparing annual data with appropriate RDL standards and controls.

Table 9-3. The net changes in soil-metal contaminants of potential concern in 2022.

Analyte	Mine Site			Milne Port			Tote Road		
	Near	Far	Reference	Near	Far	Reference	Near	Far	Reference
Arsenic									
Cadmium									
Copper									
Lead									
Selenium									
Zinc									

Notes: Near = 0–100 m; Far = 100–1,000 m; and Reference = >1,000 m.

Gray = No change from baseline.

Green = Statistically significant decrease from baseline; mean concentration below the CCME soil quality guidelines for the protection of environmental and human health. The decrease is associated with improved laboratory detection limits for some metals (i.e., Cd and Se) resulting in an artificial decrease due to more sensitive detection methods.

Arsenic (As) — Table 9-4 summarizes net changes in soil-As concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-5 provides a further breakdown of soil-As concentrations (i.e., mean and median values and maximum and minimum ranges) in relation to RDLs and applicable soil quality thresholds. Figure 9-1 illustrates the distribution of soil-As concentrations at the Project (2019, 2020, and 2022 values). Figure 9-2 shows the regression analysis of the distribution of soil-As concentrations (2019, 2020, and 2022).

No relationship was identified between Arsenic concentration in soil and distance from the PDA.

Significant decreases in soil-As concentrations compared to baseline conditions were observed at the Near and Far sites along the Tote Road in 2019. However, the decrease is likely attributed to the five-fold lower RDL (i.e., greater detection sensitivity) for soil-As concentrations after 2016 compared to baseline years (Table 9-5). Samples with concentrations below the RDL were assigned values that were half of the corresponding year's RDL. Therefore, during the baseline years when the RDL was high, adjusted values would also be high in comparison to after 2016 when the RDL was lower. Given that the percent of soil-As concentrations below the RDL is highest for baseline years compared to after 2016, the significant decrease is likely a reflection of the RDL and not actual soil-As concentration differences, indicating that the baseline data are not appropriate to use as a comparison to detect increases in soil-As concentrations. Nonetheless, all mean values were below the CCME soil quality guideline.

Table 9-4. The net change in soil-arsenic concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Green = Statistically significant decrease from baseline; mean concentration below the CCME soil quality guideline for the protection of environmental and human health.

Table 9-5. Mean soil-arsenic concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Mine Site	Near	Baseline[1]	12	0.5	50.00	0.49	0.43	0.65	0.25	1.53	12	0
		2019	11	0.1	0.00	0.66	0.49	0.80	0.31	3.35	12	0
		2020	9	0.2	0.00	0.91	0.66	1.45	0.29	3.29	12	0
		2022	10	0.1	0.00	1.09	1.05	1.53	0.43	4.55	12	0
	Far	Baseline	4	0.5	75.00	0.31	0.25	0.08	0.25	0.56	12	0
		2019	4	0.1	0.00	0.56	0.58	0.53	0.25	1.30	12	0
		2020	11	0.1	0.00	0.50	0.43	0.42	0.24	1.52	12	0
		2022	11	0.1	0.00	0.79	0.71	0.58	0.14	10.00	12	0
	Reference	Baseline	14	0.5	50.00	0.47	0.41	0.58	0.25	1.86	12	0
		2019	5	0.1	0.00	0.43	0.37	0.23	0.25	0.71	12	0
		2020	4	0.1	0.00	0.66	0.74	0.21	0.31	1.09	12	0
		2022	4	0.1	0.00	0.49	0.45	0.16	0.39	0.73	12	0
Milne Port	Near	Baseline	14	0.5	21.43	0.70	0.78	0.40	0.25	1.82	12	0
		2019	10	0.1	0.00	1.54	1.31	2.06	0.69	4.38	12	0
		2020	10	0.1	0.00	1.39	1.29	0.89	0.46	3.59	12	0
		2022	10	0.1	0.00	1.21	1.18	0.40	0.53	3.06	12	0
	Far	Baseline	4	0.5	75.00	0.33	0.25	0.13	0.25	0.75	12	0
		2019	3	0.1	0.00	1.65	1.79	0.72	1.02	2.46	12	0
		2020	5	0.2	0.00	1.38	1.41	0.27	1.13	1.75	12	0
		2022	6	0.1	0.00	1.27	1.42	0.54	0.75	1.82	12	0
	Reference	Baseline	3	0.5	0.00	0.75	0.83	0.16	0.57	0.89	12	0
		2019	4	0.1	0.00	0.82	0.91	0.63	0.34	1.65	12	0
		2020	3	0.1	0.00	1.18	1.09	0.29	0.97	1.55	12	0
		2022	4	0.1	0.00	1.09	1.07	0.19	0.92	1.35	12	0

Table 9-5. Mean soil-arsenic concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Tote Road	Near	Baseline	14	0.5	78.57	0.33	0.25	0.00	0.25	1.25	12	0
		2019	12	0.1	0.00	0.24	0.20	0.08	0.11	1.08	12	0
		2020	10	0.1	10.00	0.29	0.21	0.60	0.05	1.56	12	0
		2022	7	0.1	0.00	0.73	0.59	1.61	0.21	2.36	12	0
	Far	Baseline	9	0.5	66.67	0.37	0.25	0.35	0.25	1.26	12	0
		2019	4	0.1	25.00	0.10	0.13	0.04	0.05	0.14	12	0
		2020	4	0.1	0.00	0.19	0.20	0.10	0.13	0.30	12	0
		2022	5	0.1	0.00	0.31	0.33	0.20	0.14	0.91	12	0
	Reference	Baseline	14	0.5	42.86	0.58	0.62	0.65	0.25	4.14	12	0
		2019	4	0.1	0.00	0.66	0.76	0.30	0.33	1.03	12	0
		2020	3	0.1	0.00	0.78	0.98	0.68	0.29	1.65	12	0
		2022	4	0.1	0.00	0.93	0.84	0.35	0.62	1.72	12	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

[1] Baseline = baseline sampling during pre-construction for all years up to and including 2016.

[2] Number of sample sites.

[3] The percent of samples below the RDL is only comparable between years with the same RDL.

[4] Guideline based on the CCME soil quality guideline for the protection of environmental and human health.

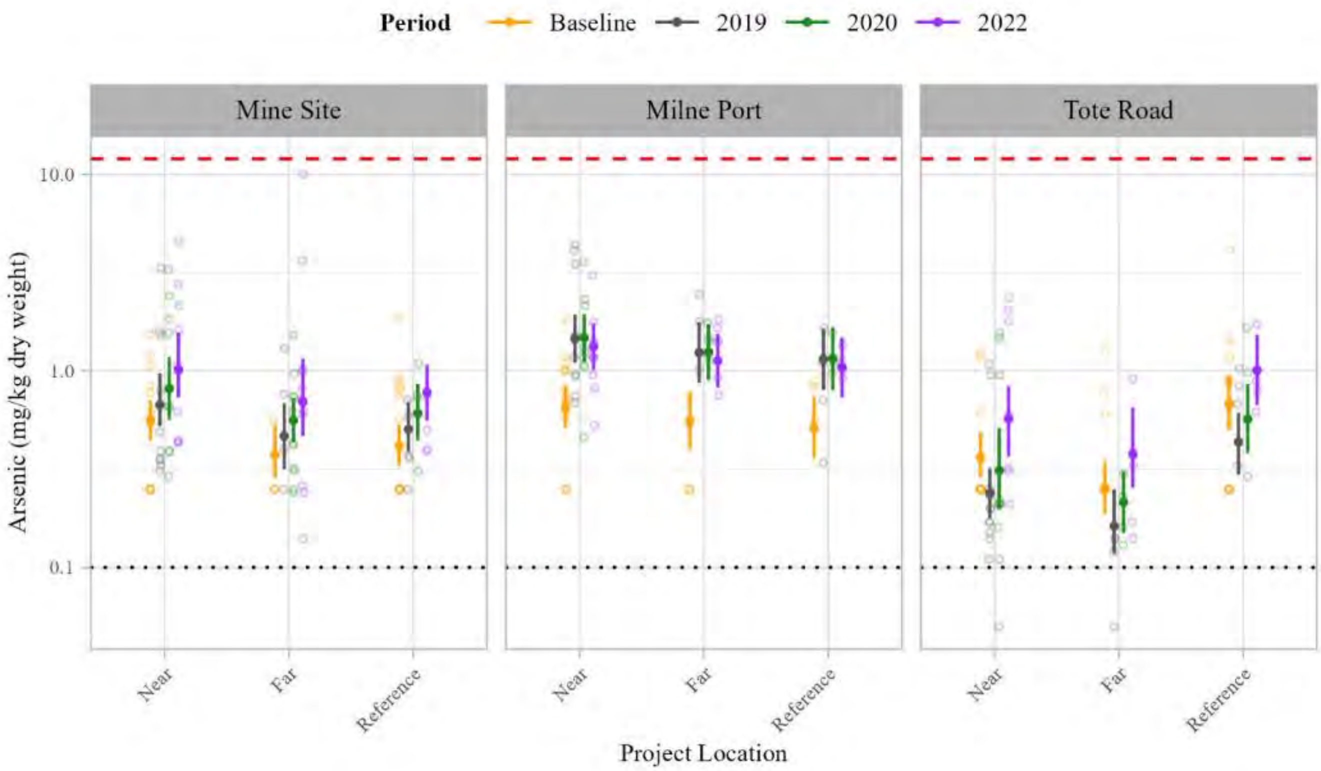


Figure 9-1. Distribution of soil-arsenic concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the CCME soil quality guideline (12 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.1 mg/kg).

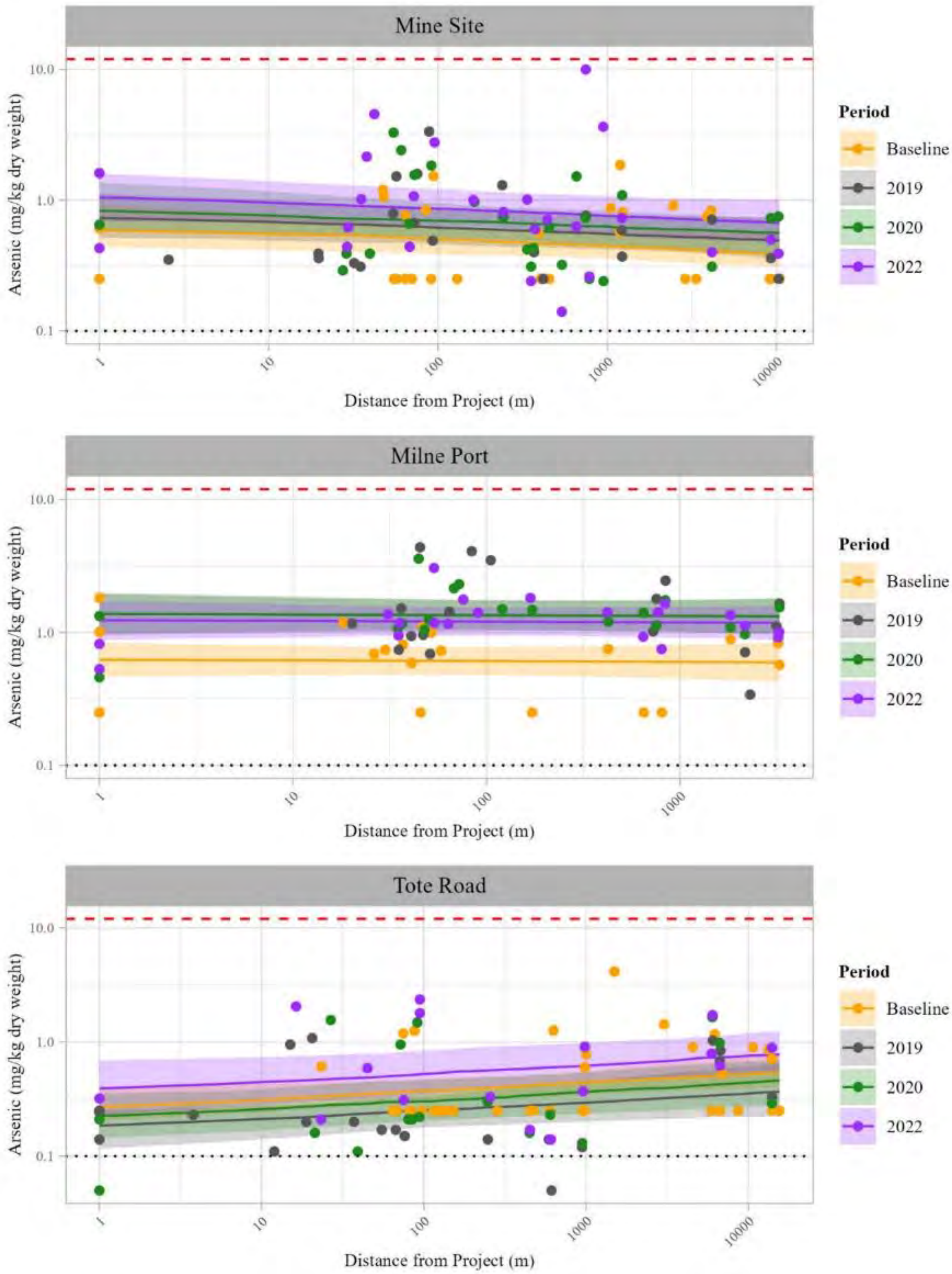


Figure 9-2. Regression analysis of the distribution of soil-arsenic concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. The red dashed line shows the CCME soil quality guideline (12 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.1 mg/kg).

Cadmium (Cd) — Table 9-6 summarizes net changes in soil-Cd concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-7 provides a further breakdown of soil-Cd concentrations (i.e., mean and median values and maximum and minimum ranges) in relation to RDLs and applicable soil quality thresholds. Figure 9-3 illustrates the distribution of soil-Cd concentrations at the Project (2019, 2020, and 2022 values). Figure 9-4 shows the regression analysis of the distribution of soil-Cd concentrations (2019, 2020, and 2022).

No relationship was identified between Cadmium concentration in soil and distance from the PDA.

Significant decreases in soil-Cd concentrations compared to baseline conditions were observed at Reference sites at the Mine Site in 2022, at Near and Reference sites at Milne Port in 2022, and at Near (2019 to 2022), Far (2019 to 2022), and Reference (2020) sites along the Tote Road. However, the decreases are likely attributed to the 2.5-fold lower RDL for soil-Cd after 2016 compared to baseline years (Table 9-7). When attributing a value of half the corresponding year's RDL to samples with concentrations below the RDL, samples from baseline years would be attributed higher concentrations compared to samples after 2016. The greater sensitivity in soil-Cd detection since 2016 therefore indicates that the baseline data are not appropriate to use as a comparison to detect increases in soil-Cd concentrations. Nonetheless, all mean values were below the CCME soil quality guideline.

Table 9-6. The net change in soil-cadmium concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Green = Statistically significant decrease from baseline; mean concentration below the CCME soil quality guideline for the protection of environmental and human health.

Table 9-7. Mean soil-cadmium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Mine Site	Near	Baseline[1]	12	0.05	41.67	0.06	0.06	0.07	0.03	0.15	1.4	0
		2019	11	0.02	54.55	0.02	0.02	0.02	0.01	0.09	1.4	0
		2020	9	0.04	44.44	0.05	0.05	0.02	0.01	0.56	1.4	0
		2022	10	0.02	20.00	0.04	0.03	0.03	0.01	0.76	1.4	0
	Far	Baseline	4	0.05	50.00	0.04	0.04	0.04	0.03	0.07	1.4	0
		2019	4	0.02	100.00	0.01	0.01	0.00	0.01	0.01	1.4	0
		2020	11	0.02	36.36	0.02	0.03	0.02	0.01	0.08	1.4	0
		2022	11	0.02	45.45	0.02	0.02	0.02	0.01	0.07	1.4	0
	Reference	Baseline	14	0.05	42.86	0.06	0.06	0.10	0.03	0.28	1.4	0
		2019	5	0.02	80.00	0.01	0.01	0.00	0.01	0.03	1.4	0
		2020	4	0.02	25.00	0.02	0.02	0.01	0.01	0.03	1.4	0
		2022	4	0.02	100.00	0.01	0.01	0.00	0.01	0.01	1.4	0
Milne Port	Near	Baseline	14	0.05	28.57	0.06	0.07	0.06	0.03	0.15	1.4	0
		2019	10	0.02	20.00	0.03	0.03	0.03	0.01	0.07	1.4	0
		2020	10	0.02	0.00	0.04	0.04	0.03	0.02	0.08	1.4	0
		2022	10	0.02	20.00	0.03	0.03	0.02	0.01	0.07	1.4	0
	Far	Baseline	4	0.05	25.00	0.06	0.08	0.02	0.03	0.10	1.4	0
		2019	3	0.02	0.00	0.04	0.05	0.01	0.03	0.05	1.4	0
		2020	5	0.04	40.00	0.05	0.04	0.01	0.02	0.19	1.4	0
		2022	6	0.02	16.67	0.03	0.03	0.01	0.01	0.04	1.4	0
	Reference	Baseline	3	0.05	0.00	0.09	0.08	0.03	0.06	0.12	1.4	0
		2019	4	0.02	25.00	0.02	0.02	0.01	0.01	0.04	1.4	0
		2020	3	0.02	66.67	0.02	0.01	0.01	0.01	0.04	1.4	0
		2022	4	0.02	75.00	0.01	0.01	0.00	0.01	0.02	1.4	0

Table 9-7. Mean soil-cadmium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Tote Road	Near	Baseline	14	0.05	85.71	0.03	0.03	0.00	0.03	0.08	1.4	0
		2019	12	0.02	83.33	0.01	0.01	0.00	0.01	0.21	1.4	0
		2020	10	0.02	60.00	0.02	0.01	0.01	0.01	0.04	1.4	0
		2022	7	0.02	57.14	0.02	0.01	0.02	0.01	0.04	1.4	0
	Far	Baseline	9	0.05	66.67	0.04	0.03	0.04	0.03	0.08	1.4	0
		2019	4	0.02	100.00	0.01	0.01	0.00	0.01	0.01	1.4	0
		2020	4	0.02	75.00	0.01	0.01	0.00	0.01	0.02	1.4	0
		2022	5	0.02	100.00	0.01	0.01	0.00	0.01	0.01	1.4	0
	Reference	Baseline	14	0.05	42.86	0.06	0.06	0.11	0.03	0.25	1.4	0
		2019	4	0.02	75.00	0.01	0.01	0.00	0.01	0.03	1.4	0
		2020	3	0.02	66.67	0.01	0.01	0.01	0.01	0.02	1.4	0
		2022	4	0.02	50.00	0.02	0.02	0.02	0.01	0.04	1.4	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

1 Baseline = baseline sampling during pre-construction for all years up to and including 2016.

2 Number of sample sites.

3 The percent of samples below the RDL is only comparable between years with the same RDL.

4 Guideline based on the CCME soil quality guideline for the protection of environmental and human health.

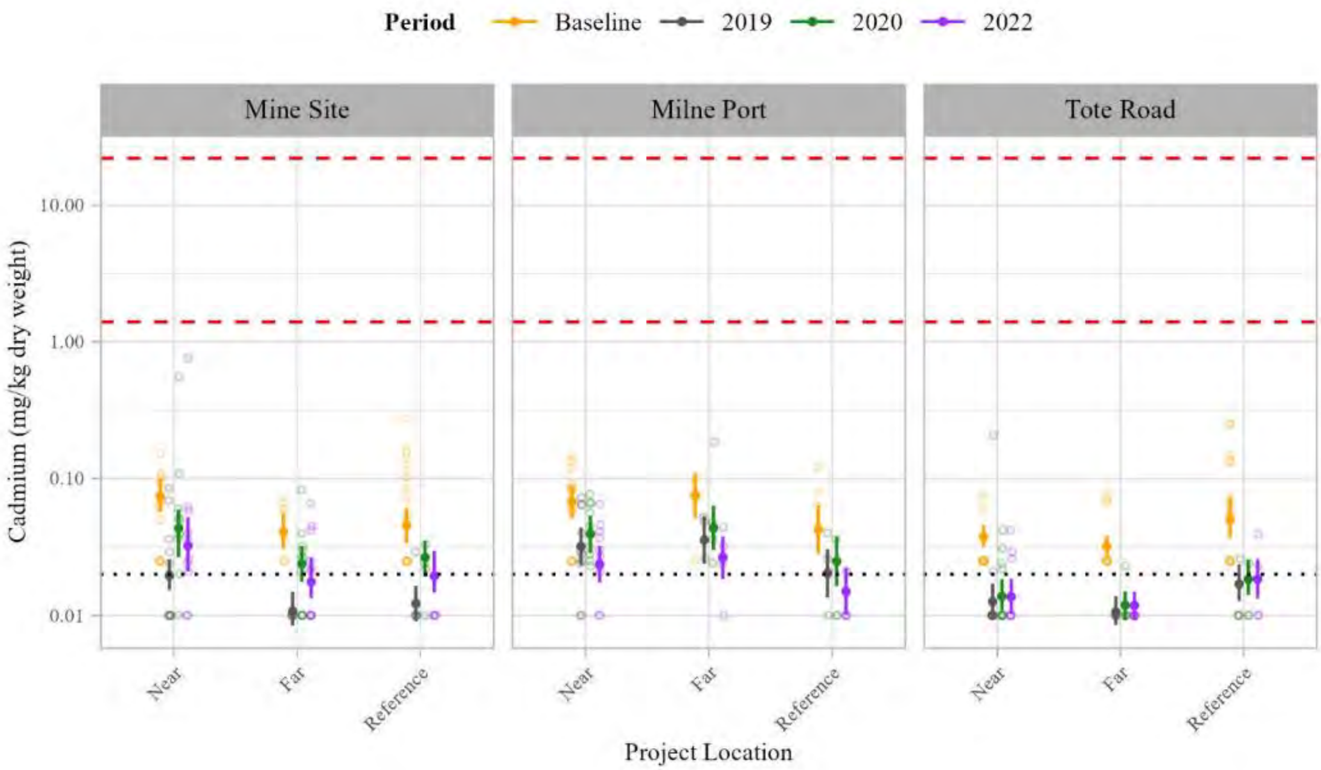


Figure 9-3. Distribution of soil-cadmium concentrations in 2022.

Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed lines shows the lower and upper CCME soil quality guidelines (1.4 and 22 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

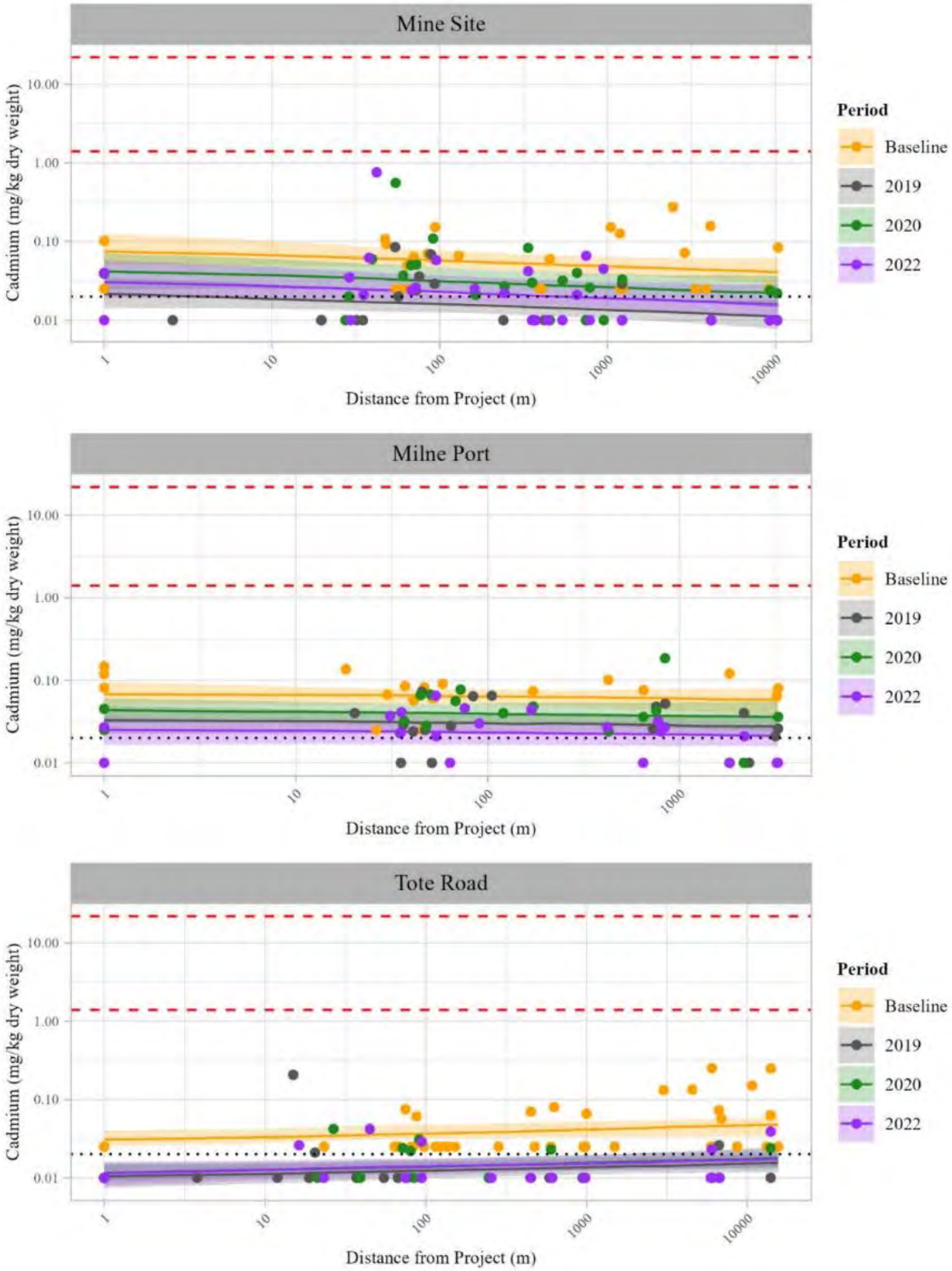


Figure 9-4. Regression analysis of the distribution of soil-cadmium concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. The red dashed lines shows the lower and upper CCME soil quality guidelines (1.4 and 22 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

Copper (Cu) — Table 9-8 summarizes net changes in soil-Cu concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-9 provides a further breakdown of soil-Cu concentrations (i.e., mean and median values and maximum and minimum ranges) in relation to the RDL and applicable soil quality thresholds. Figure 9-5 illustrates the distribution of soil-Cu concentrations at the Project (2019, 2020, and 2022 values). Figure 9-6 shows the regression analysis of the distribution of soil-Cu concentrations (2019, 2020, and 2022).

No relationship was identified between Copper concentration in soil and distance from the PDA.

Figure 9-7 shows year-over-year soil-Cu concentrations at MS-06 (Mine Site-Near), where the soil-Cu threshold exceedance has been recorded since 2019. However, this exceedance is associated with high variability and wide confidence intervals at the site, and it has not affected the mean values for this distance and Project area category. With updates to the statistical analysis (i.e., appropriate p-value adjustment for multiple pairwise comparisons), the soil-Cu concentrations indicate no change from baseline conditions across all Project areas and sampling distances for all years. Since the RDL has not changed during sample collection, the data after 2016 are directly comparable to the baseline data. All mean values were below the CCME soil quality guideline.

Table 9-8. The net change in soil-copper concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Table 9-9. Mean soil-copper concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Mine Site	Near	Baseline[1]	12	0.5	0.00	4.60	4.66	5.06	1.54	19.10	63	0
		2019[5]	11	0.5	0.00	6.04	3.74	5.67	2.13	81.20	63	9.09
		2020[5]	9	1	0.00	10.29	7.09	11.36	2.09	370.00	63	11.11
		2022[5]	10	0.5	0.00	9.31	6.90	9.52	2.21	119.00	63	10
	Far	Baseline	4	0.5	0.00	2.89	2.90	0.64	2.09	3.97	63	0
		2019	4	0.5	0.00	2.36	2.86	2.47	0.90	4.77	63	0
		2020	11	0.5	0.00	3.58	3.19	2.52	1.86	6.07	63	0
		2022	11	0.5	0.00	4.69	3.83	5.53	0.77	47.80	63	0
	Reference	Baseline	14	0.5	0.00	4.68	4.57	4.99	0.86	16.90	63	0
		2019	5	0.5	0.00	2.70	2.32	1.23	2.03	4.07	63	0
		2020	4	0.5	0.00	5.53	7.57	3.48	1.30	12.60	63	0
		2022	4	0.5	0.00	3.50	3.53	1.59	2.31	5.35	63	0
Milne Port	Near	Baseline	14	0.5	0.00	4.43	4.90	1.69	1.56	11.10	63	0
		2019	10	0.5	0.00	7.14	6.30	8.64	3.41	18.10	63	0
		2020	10	0.5	0.00	6.52	6.49	2.30	2.28	14.60	63	0
		2022	10	0.5	0.00	5.41	5.54	2.38	1.29	13.20	63	0
	Far	Baseline	4	0.5	0.00	3.02	3.43	1.14	1.55	4.56	63	0
		2019	3	0.5	0.00	7.69	7.69	3.54	4.92	12.00	63	0
		2020	5	1	0.00	7.59	6.23	2.03	5.37	15.40	63	0
		2022	6	0.5	0.00	5.82	6.52	3.30	3.05	8.91	63	0
	Reference	Baseline	3	0.5	0.00	5.23	4.20	3.03	3.55	9.60	63	0
		2019	4	0.5	0.00	4.90	5.30	1.91	2.65	7.80	63	0
		2020	3	0.5	0.00	4.86	4.12	2.19	3.53	7.90	63	0
		2022	4	0.5	0.00	4.52	4.67	0.87	3.78	5.11	63	0

Table 9-9. Mean soil-copper concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Tote Road	Near	Baseline	14	0.5	14.29	1.12	1.08	0.47	0.25	7.03	63	0
		2019	12	0.5	0.00	1.97	1.50	0.60	0.89	49.80	63	0
		2020	10	0.5	0.00	2.02	2.12	2.51	0.51	5.85	63	0
		2022	7	0.5	0.00	3.15	3.57	4.04	1.14	6.72	63	0
	Far	Baseline	9	0.5	0.00	1.65	1.77	3.24	0.52	4.45	63	0
		2019	4	0.5	25.00	0.71	0.98	0.23	0.25	1.07	63	0
		2020	4	0.5	0.00	1.59	1.87	1.25	0.74	2.69	63	0
		2022	5	0.5	0.00	1.79	2.02	1.72	0.83	4.15	63	0
	Reference	Baseline	14	0.5	0.00	4.00	4.79	2.74	0.67	8.77	63	0
		2019	4	0.5	0.00	4.27	5.85	2.26	1.04	9.37	63	0
		2020	3	0.5	0.00	5.09	9.13	4.39	1.42	10.20	63	0
		2022	4	0.5	0.00	7.31	8.34	3.81	3.84	11.00	63	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

[1] Baseline = baseline sampling during pre-construction for all years up to and including 2016.

[2] Number of sample sites.

[3] The percent of samples below the RDL is only comparable between years with the same RDL.

[4] Guideline based on the CCME soil quality guideline for the protection of environmental and human health.

[5] Exceedance of the CCME soil quality guideline at individual site(s), and mean concentrations below the CCME soil quality guideline. An exceedance occurred at site MS-06.

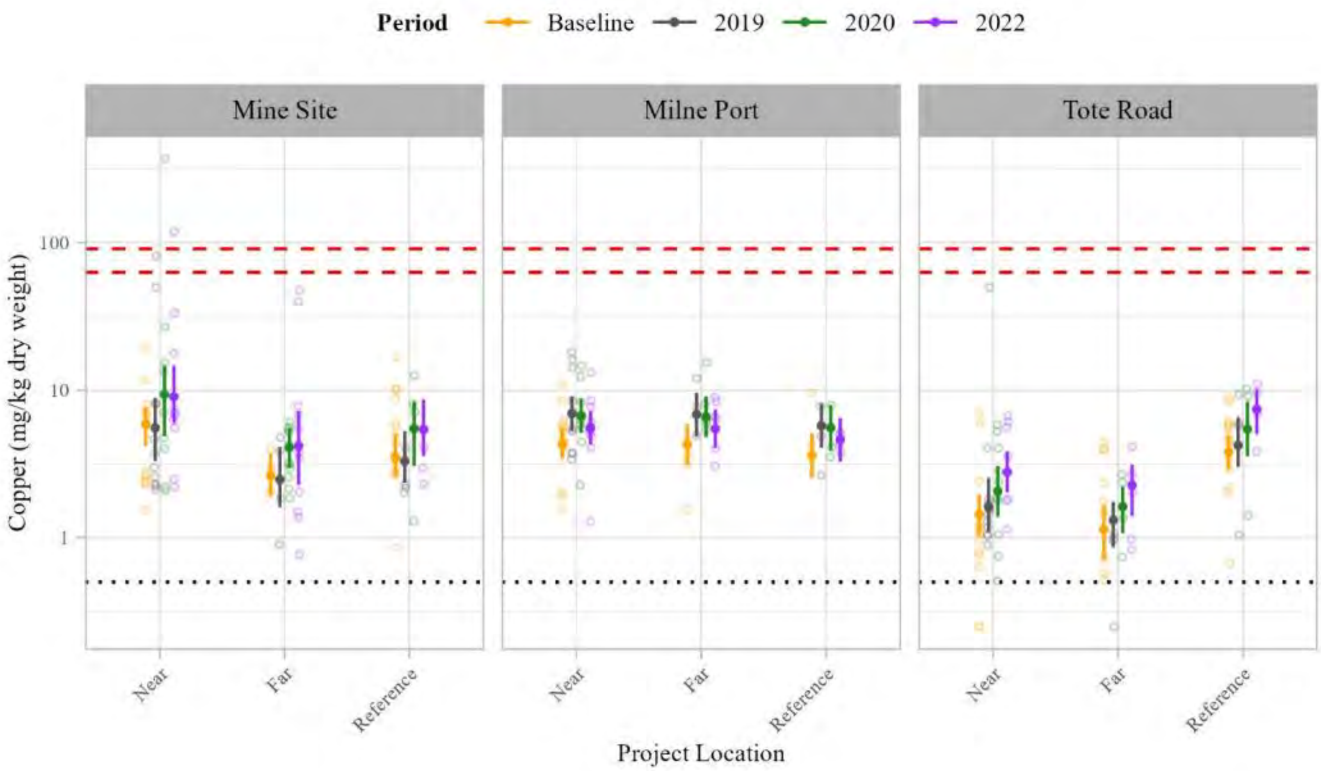


Figure 9-5. Distribution of soil-copper concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed lines shows the lower and upper CCME soil quality guidelines (63 and 91 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.5 mg/kg).

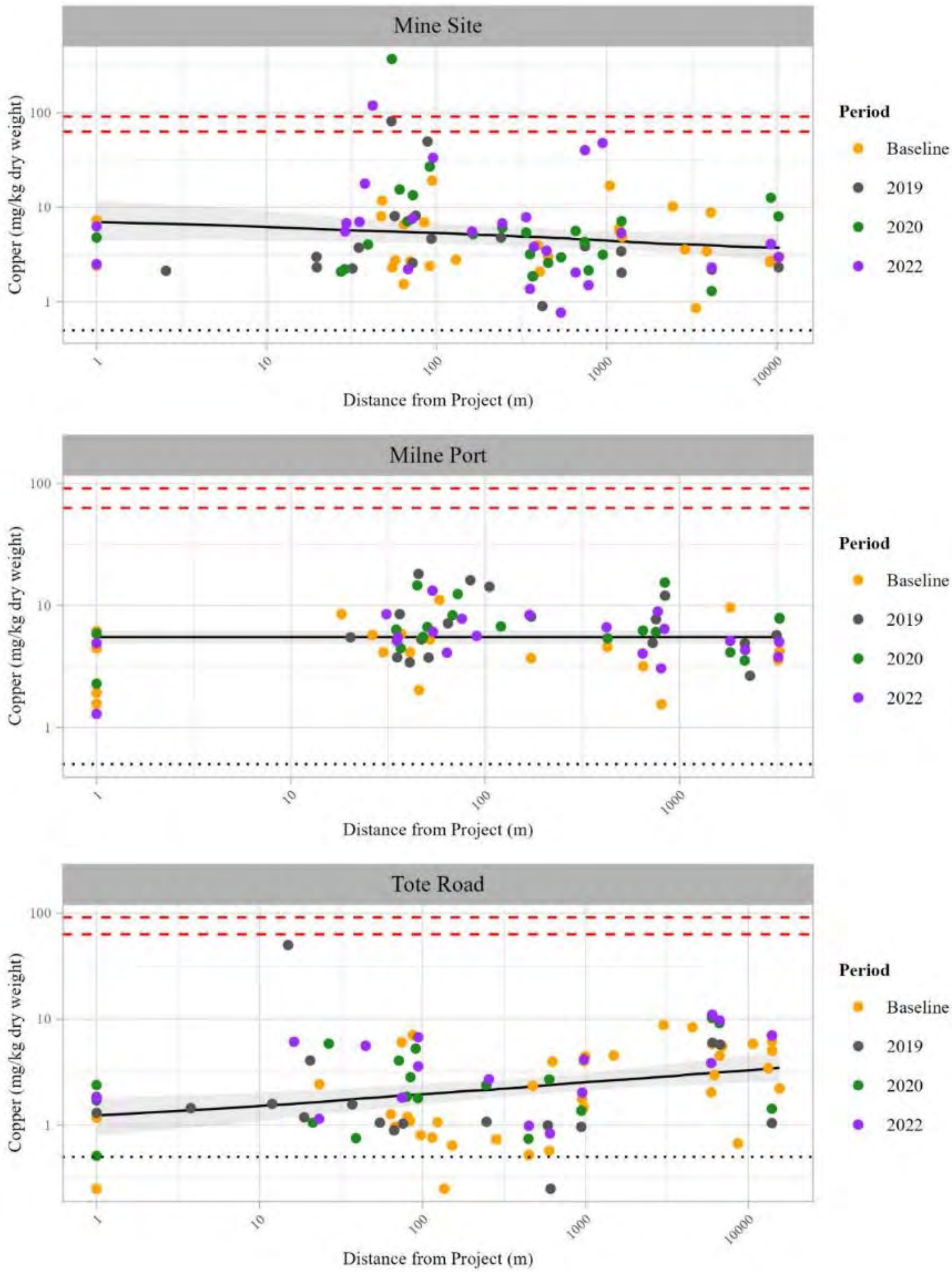


Figure 9-6. Regression analysis of the distribution of soil-copper concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. The red dashed lines shows the lower and upper CCME soil quality guidelines (63 and 91mg/kg) and the black dotted line shows the current year's minimum detection limit (0.5 mg/kg).

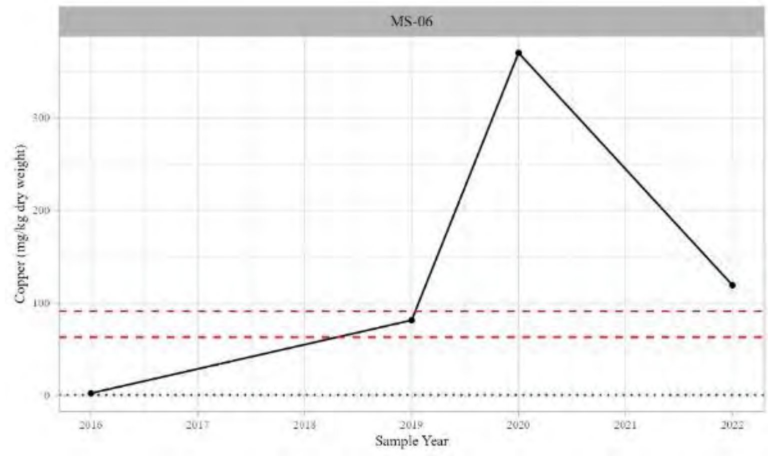


Figure 9-7. Year-over-year soil-copper concentration at MS-06 (Mine Site, Near: 0-100 m from potential development area).

Solid points show yearly sample concentration values. The red dashed lines shows the lower and upper CCME soil quality guidelines (63 and 91 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.5 mg/kg).

Lead (Pb) — Table 9-10 summarizes net changes in soil-Pb concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-11 provides a further breakdown of soil-Pb concentrations (i.e., mean and median values and maximum and minimum ranges) in relation to the RDL and applicable soil quality thresholds. Figure 9-8 illustrates the distribution of soil-Pb concentrations at the Project (2019, 2020, and 2022 values). Figure 9-9 shows the regression analysis of the distribution of soil-Pb concentrations (2019, 2020, and 2022).

No relationship was identified between Lead concentration in soil and distance from the PDA.

Since all sample concentrations were above the RDL, the data after 2016 are directly comparable to the baseline data (Table 9-11). With updates to the statistical analysis (i.e., appropriate p-value adjustment for multiple pairwise comparisons), the soil-Pb concentrations indicate no change from baseline conditions across all Project areas and sampling distances for all years. All mean values were below the CCME soil quality guideline.

Table 9-10. The net change in soil-lead concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Table 9-11. Mean soil-lead concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Mine Site	Near	Baseline[1]	12	0.1	0.00	5.11	4.29	4.94	2.61	11.20	70	0
		2019	11	0.5	0.00	4.50	4.62	4.93	1.84	17.90	70	0
		2020	9	1	0.00	5.48	5.11	3.91	1.72	38.50	70	0
		2022	10	0.5	0.00	6.22	4.75	6.59	1.96	42.90	70	0
	Far	Baseline	4	0.1	0.00	2.87	2.85	1.49	2.02	4.34	70	0
		2019	4	0.5	0.00	2.90	2.85	1.11	1.60	5.42	70	0
		2020	11	0.5	0.00	2.82	2.53	1.09	1.66	5.15	70	0
		2022	11	0.5	0.00	3.78	3.46	2.21	1.54	18.30	70	0
	Reference	Baseline	14	0.1	0.00	3.65	4.15	1.94	1.40	6.83	70	0
		2019	5	0.5	0.00	3.24	2.96	2.07	2.35	4.72	70	0
		2020	4	0.5	0.00	4.49	5.68	1.12	2.12	5.98	70	0
		2022	4	0.5	0.00	3.04	2.92	0.50	2.37	4.23	70	0
Milne Port	Near	Baseline	14	0.1	0.00	4.57	4.60	2.13	1.64	8.31	70	0
		2019	10	0.5	0.00	7.41	6.29	5.61	3.69	14.00	70	0
		2020	10	0.5	0.00	5.75	5.80	2.55	2.12	12.30	70	0
		2022	10	0.5	0.00	5.39	5.72	2.30	1.59	11.20	70	0
	Far	Baseline	4	0.1	0.00	3.18	3.52	0.73	1.82	4.52	70	0
		2019	3	0.5	0.00	9.71	9.31	6.92	5.17	19.00	70	0
		2020	5	1	0.00	8.15	7.05	4.71	5.63	11.60	70	0
		2022	6	0.5	0.00	6.17	6.32	2.83	3.13	11.40	70	0
	Reference	Baseline	3	0.1	0.00	3.37	2.98	0.75	2.92	4.41	70	0
		2019	4	0.5	0.00	3.54	4.13	1.63	1.39	6.65	70	0
		2020	3	0.5	0.00	4.57	4.32	1.08	3.74	5.89	70	0
		2022	4	0.5	0.00	4.20	4.26	0.82	3.62	4.75	70	0

Table 9-11. Mean soil-lead concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Tote Road	Near	Baseline	14	0.1	0.00	1.34	1.12	0.70	0.54	6.51	70	0
		2019	12	0.5	0.00	1.65	1.27	0.40	0.80	28.20	70	0
		2020	10	0.5	0.00	1.81	1.65	1.65	0.80	4.90	70	0
		2022	7	0.5	0.00	2.14	1.67	1.99	1.31	5.35	70	0
	Far	Baseline	9	0.1	0.00	1.47	1.29	1.17	0.82	3.89	70	0
		2019	4	0.5	0.00	1.10	1.10	0.10	0.96	1.26	70	0
		2020	4	0.5	0.00	1.35	1.45	1.11	0.86	2.16	70	0
		2022	5	0.5	0.00	1.91	1.92	0.75	1.32	2.92	70	0
	Reference	Baseline	14	0.1	0.00	3.70	3.95	2.39	1.18	7.85	70	0
		2019	4	0.5	0.00	3.18	3.45	1.45	1.78	4.91	70	0
		2020	3	0.5	0.00	3.16	3.64	2.82	1.26	6.90	70	0
		2022	4	0.5	0.00	4.31	3.82	2.00	3.06	7.93	70	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

[1] Baseline = baseline sampling during pre-construction for all years up to and including 2016.

[2] Number of sample sites.

[3] The percent of samples below the RDL is only comparable between years with the same RDL.

[4] Guideline based on the CCME soil quality guideline for the protection of environmental and human health.

Figure 9-8. Distribution of soil-lead concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed lines shows the lower and upper CCME soil quality guidelines (70 and 600 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.1 mg/kg).

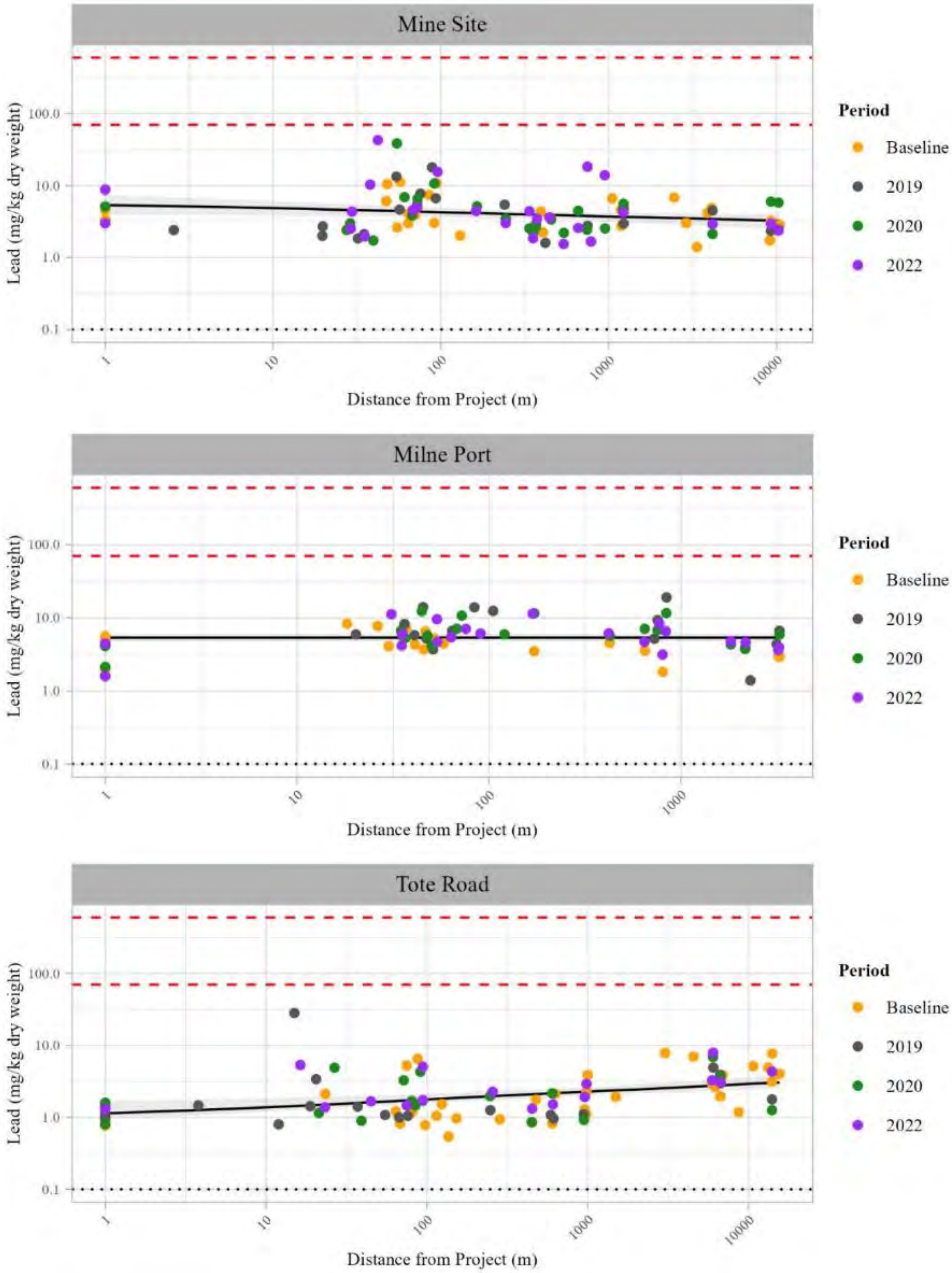


Figure 9-9. Regression analysis of the distribution of soil-lead concentrations in 2022.

Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. The red dashed lines shows the lower and upper CCME soil quality guidelines (70 and 600 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.1 mg/kg).

Selenium (Se) — Table 9-12 summarizes net changes in soil-Se concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-13 provides a further breakdown of soil-Se concentrations (i.e., mean and median values and maximum and minimum ranges) in relation to the RDL and applicable soil quality thresholds. Figure 9-10 illustrates the distribution of soil-Se concentrations at the Project (2019, 2020, and 2022 values). Figure 9-11 shows the regression analysis of the distribution of soil-Se concentrations (2019, 2020, and 2022).

There is no relationship between Selenium concentration in soil and distance from the PDA.

Significant decreases in soil-Se concentrations compared to baseline conditions were observed at Near (2019 to 2022) and Far sites (2022) at the Mine Site and Near (2022) and Far (2022) sites at Milne Port. However, these decreases are likely attributed to the 2.5-fold lower RDL for soil-Se after 2016 compared to baseline years (Table 9-13). When attributing a value of half the year's RDL to samples with concentrations below the RDL, samples from baseline years would be attributed higher concentrations compared to samples after 2016. The greater sensitivity in soil-Se detection since 2016 therefore indicates that the baseline data are not appropriate to use as a comparison to detect for increases in soil-Se. Nonetheless, all mean values were below the CCME soil quality guideline.

Table 9-12. The net change in soil-selenium concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Green = Statistically significant decrease from baseline, mean concentration below the CCME soil quality guideline for the protection of environmental and human health.

Table 9-13. Mean soil-selenium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Mine Site	Near	Baseline[1]	12	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	11	0.2	90.91	0.11	0.10	0.00	0.10	0.36	1	0
		2020	9	0.4	100.00	0.12	0.10	0.00	0.10	0.24	1	0
		2022	10	0.2	80.00	0.13	0.10	0.00	0.10	0.39	1	0
	Far	Baseline	4	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	11	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2022	11	0.2	90.91	0.11	0.10	0.00	0.10	0.22	1	0
	Reference	Baseline	14	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	5	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2022	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
Milne Port	Near	Baseline	14	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	10	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	10	0.2	90.00	0.11	0.10	0.00	0.10	0.21	1	0
		2022	10	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
	Far	Baseline	4	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	3	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	5	0.4	100.00	0.11	0.10	0.00	0.10	0.20	1	0
		2022	6	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
	Reference	Baseline	3	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	3	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2022	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0

Table 9-13. Mean soil-selenium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Tote Road	Near	Baseline	14	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	12	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	10	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2022	7	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
	Far	Baseline	9	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2022	5	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
	Reference	Baseline	14	0.5	100.00	0.25	0.25	0.00	0.25	0.25	1	0
		2019	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2020	3	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0
		2022	4	0.2	100.00	0.10	0.10	0.00	0.10	0.10	1	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

1 Baseline = baseline sampling during pre-construction for all years up to and including 2016.

2 Number of sample sites.

3 The percent of samples below the RDL is only comparable between years with the same RDL.

4 Guideline based on the CCME soil quality guideline for the protection of environmental and human health.

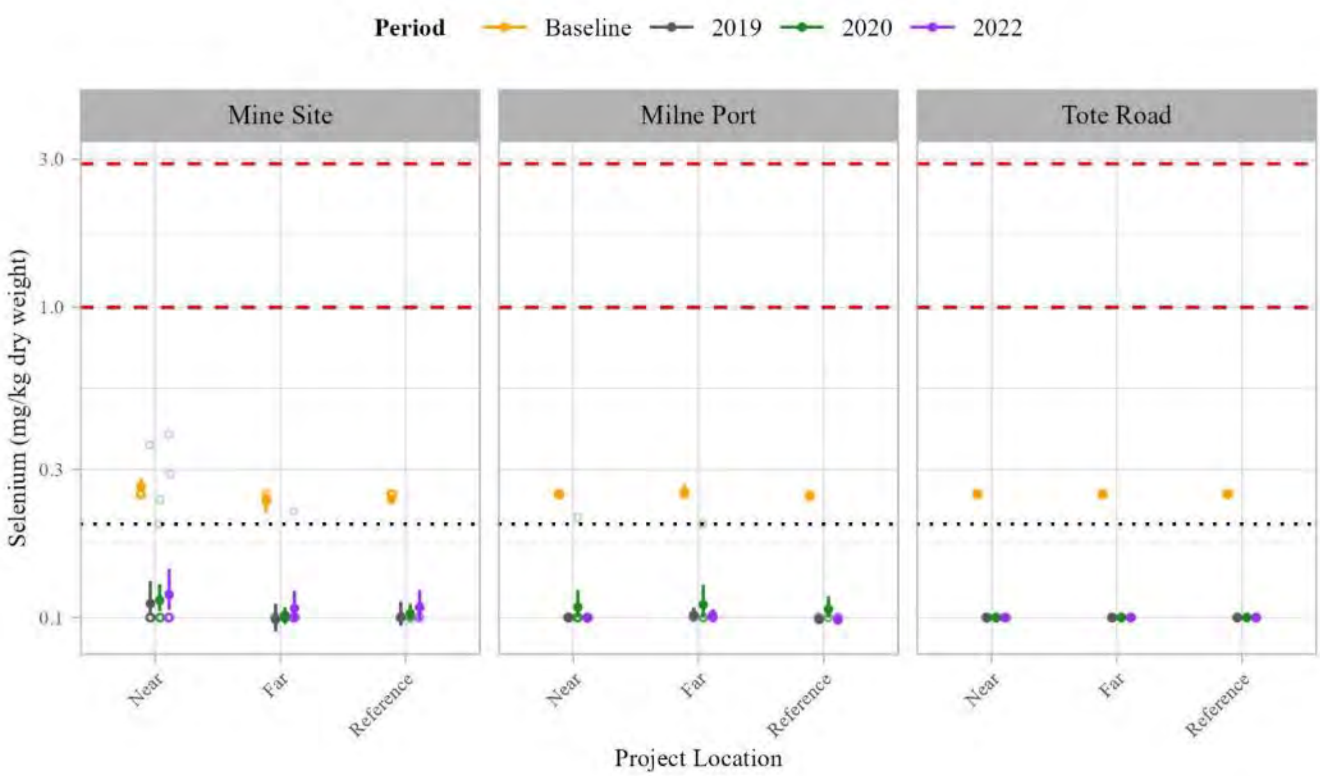


Figure 9-10. Distribution of soil-selenium concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed lines shows the lower and upper CCME soil quality guidelines (1 and 2.9 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.2 mg/kg).

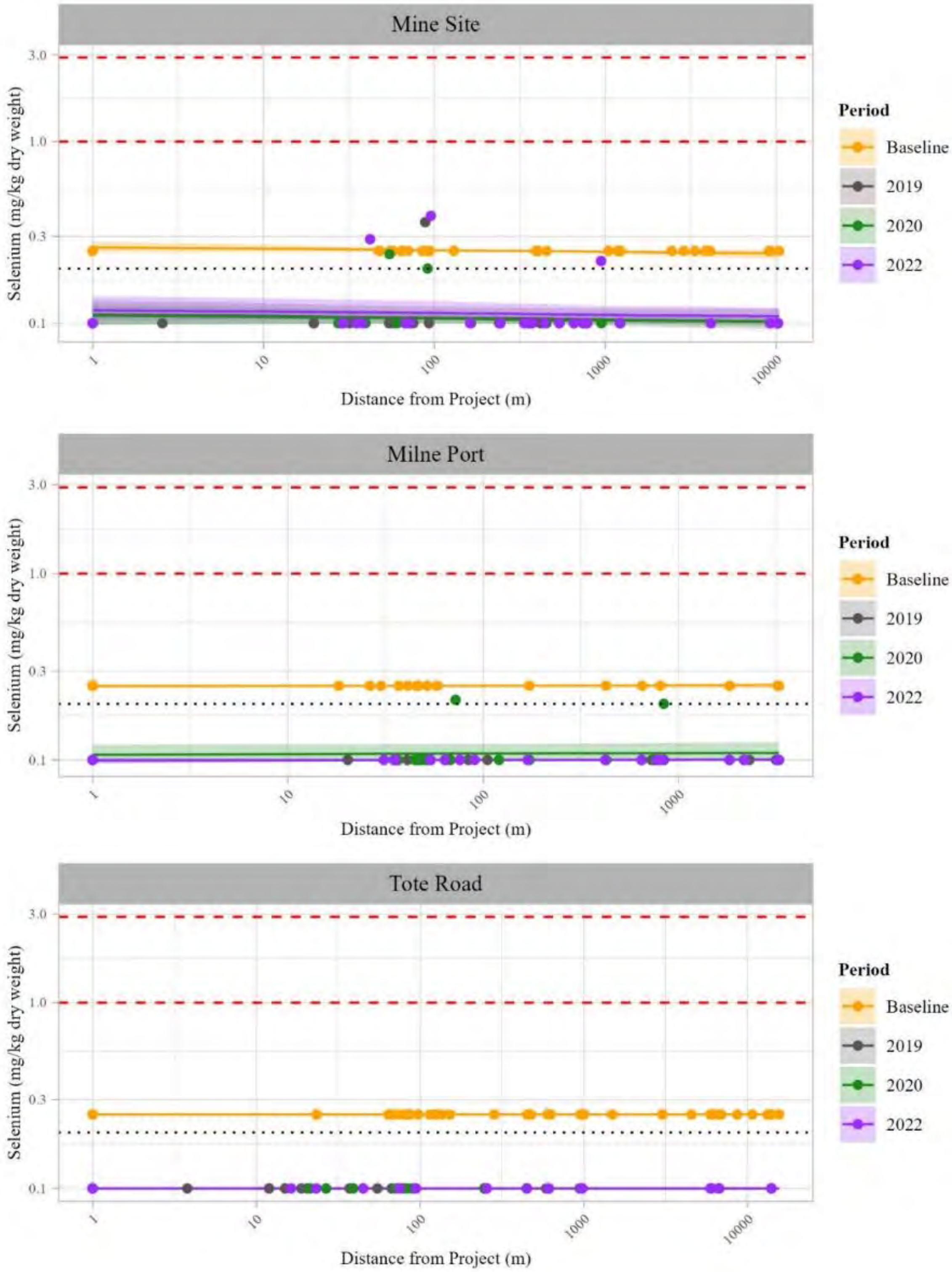


Figure 9-11. Regression analysis of the distribution of soil-selenium concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. The red dashed lines shows the lower and upper CCME soil quality guidelines (1 and 2.9 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.2 mg/kg).

Zinc (Zn) — Table 9-14 summarizes net changes in soil-Zn concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-15 provides a further breakdown of soil-Zn concentrations (i.e., mean and median values and maximum and minimum ranges) in relation to the RDL and applicable soil quality thresholds. Figure 9-12 illustrates the distribution of soil-Zn concentrations at the Project (2019, 2021, and 2022 values). Figure 9-13 shows the regression analysis of the distribution of soil-Zn concentrations (2019, 2020, and 2022).

No relationship was identified between Zinc concentration in soil and distance from the PDA.

Figure 9-14 shows year-over-year soil-Zn concentrations at TR-08 (Tote Road, Near), where a soil-Zu threshold exceedance was recorded in 2020. However, this exceedance is associated with high variability and wide confidence intervals, and it has not affected the mean values for this distance and Project area category. Since the RDL is lowest (and hence the soil-Zn sensitivity detection is highest) during the baseline years, the data after 2016 are directly comparable to the baseline data (Table 9-15). With updates to the statistical analysis (i.e., appropriate p-value adjustment for multiple pairwise comparisons), the soil-Zn concentrations indicate no change from baseline conditions across all Project areas and sampling distances for all years. All mean values were below the CCME soil quality guideline.

Table 9-14. The net change in soil-zinc concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Table 9-15. Mean soil-zinc concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Mine Site	Near	Baseline[1]	12	1	0.00	13.29	12.80	6.83	6.40	29.70	250	0
		2019	11	2	0.00	13.23	9.20	11.85	4.20	88.40	250	0
		2020	9	4	0.00	18.88	13.50	20.10	8.10	152.00	250	0
		2022	10	2	0.00	13.95	13.70	15.55	2.10	74.60	250	0
	Far	Baseline	4	1	0.00	9.59	10.10	0.65	7.90	10.50	250	0
		2019	4	2	0.00	5.38	5.40	5.35	2.90	11.70	250	0
		2020	11	2	0.00	9.32	10.00	2.35	2.90	15.00	250	0
		2022	11	2	0.00	11.28	12.00	9.80	3.00	47.70	250	0
	Reference	Baseline	14	1	0.00	14.42	14.70	4.13	4.10	39.60	250	0
		2019	5	2	0.00	10.34	10.30	2.20	6.90	19.90	250	0
		2020	4	2	0.00	15.02	19.00	10.18	5.40	26.90	250	0
		2022	4	2	0.00	10.31	10.35	3.23	8.00	13.40	250	0
Milne Port	Near	Baseline	14	1	0.00	14.51	15.65	10.03	4.10	34.30	250	0
		2019	10	2	0.00	20.18	19.25	12.10	9.70	32.00	250	0
		2020	10	2	0.00	24.22	18.95	10.70	13.60	179.00	250	0
		2022	10	2	0.00	15.23	17.00	8.40	3.10	25.50	250	0
	Far	Baseline	4	1	0.00	10.80	11.80	7.78	4.20	23.90	250	0
		2019	3	2	0.00	25.21	30.60	7.05	16.90	31.00	250	0
		2020	5	4	0.00	27.86	22.90	9.10	20.30	49.60	250	0
		2022	6	2	0.00	18.26	18.80	8.20	8.50	35.70	250	0
	Reference	Baseline	3	1	0.00	12.85	11.40	5.05	9.50	19.60	250	0
		2019	4	2	0.00	12.74	14.80	6.68	5.80	21.10	250	0
		2020	3	2	0.00	16.76	20.30	5.95	10.40	22.30	250	0
		2022	4	2	0.00	11.86	12.65	1.83	8.60	14.40	250	0

Table 9-15. Mean soil-zinc concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Guildeline[4]	Above Guideline[4] (%)
Tote Road	Near	Baseline	14	1	7.14	3.37	3.50	1.98	0.50	16.20	250	0
		2019	12	2	0.00	4.76	3.65	0.90	2.40	86.20	250	0
		2020[5]	10	2	10.00	7.41	5.80	5.95	1.00	316.00	250	10
		2022	7	2	14.29	4.79	4.50	5.30	1.00	12.30	250	0
	Far	Baseline	9	1	0.00	5.07	4.80	5.60	2.00	17.00	250	0
		2019	4	2	25.00	2.30	2.85	1.15	1.00	3.50	250	0
		2020	4	2	0.00	4.24	4.10	1.65	2.60	7.40	250	0
		2022	5	2	0.00	4.60	3.90	2.30	3.00	9.10	250	0
	Reference	Baseline	14	1	0.00	10.91	14.20	8.43	2.40	19.40	250	0
		2019	4	2	0.00	9.88	11.40	9.03	4.20	19.30	250	0
		2020	3	2	0.00	11.33	14.30	9.05	4.50	22.60	250	0
		2022	4	2	0.00	14.49	15.30	7.12	7.00	27.10	250	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

1 Baseline = baseline sampling during pre-construction for all years up to and including 2016.

2 Number of sample sites.

3 The percent of samples below the RDL is only comparable between years with the same RDL.

4 Guidelines based on the CCME soil quality guidelines for the protection of environmental and human health.

5 Exceedance of the CCME soil quality guideline at individual site(s), and mean concentrations below the CCME soil quality guideline. An exceedance occurred at site TR-08.

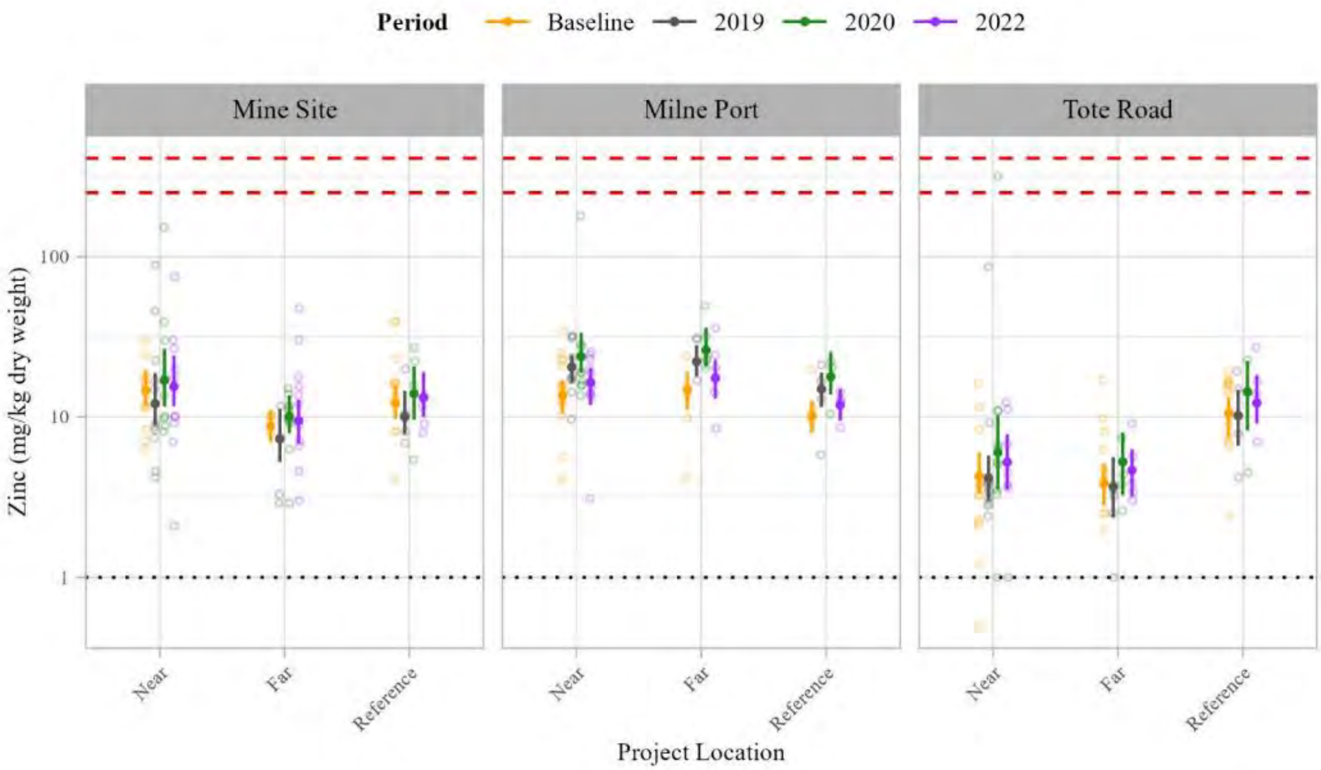


Figure 9-12. Distribution of soil-zinc concentrations in 2022.

Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed lines shows the lower and upper CCME soil quality guidelines (250 and 410 mg/kg) and the black dotted line shows the current year's minimum detection limit (1 mg/kg).

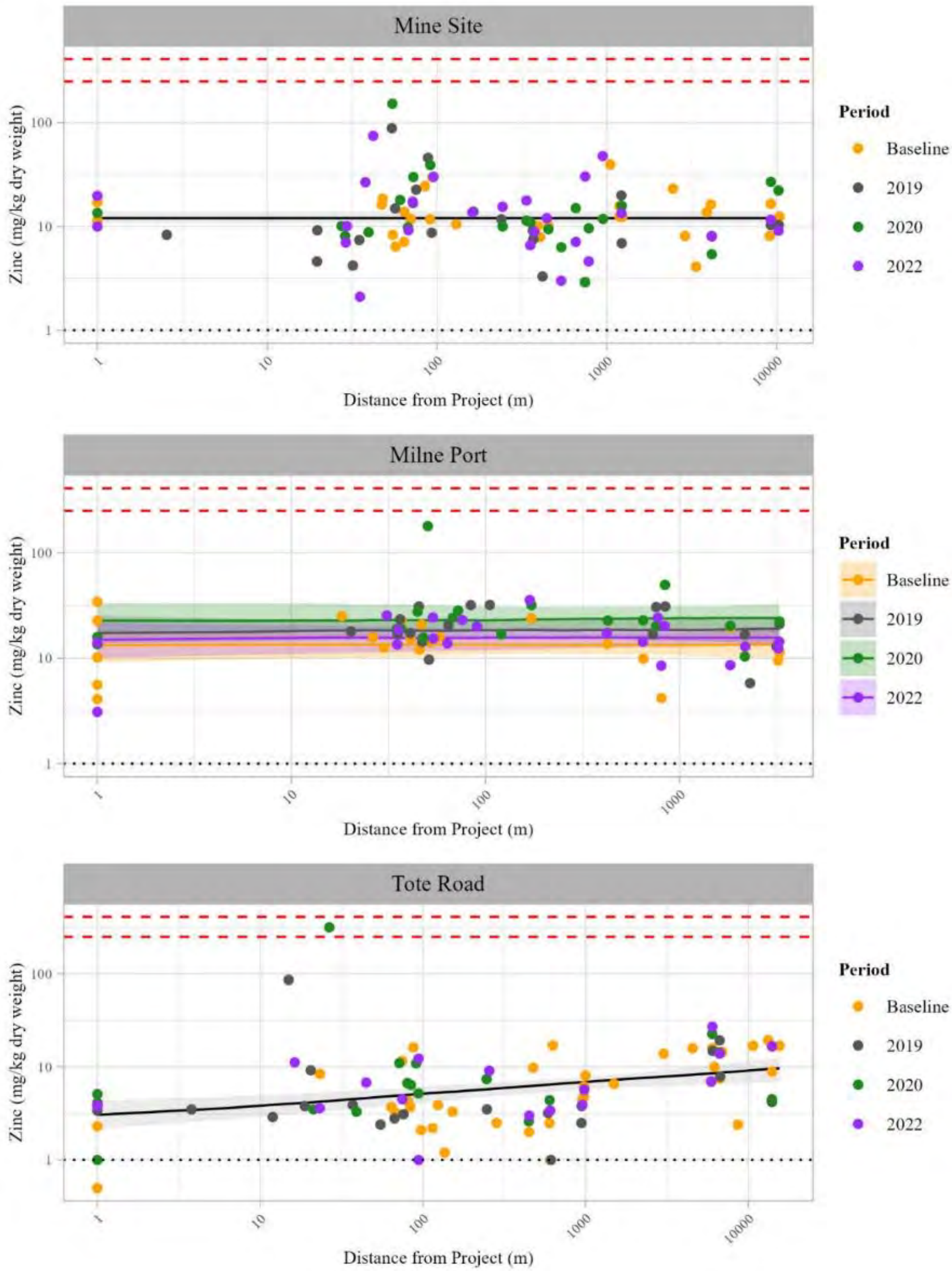


Figure 9-13. Regression analysis of the distribution of soil-zinc concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. The red dashed lines shows the lower and upper CCME soil quality guidelines (250 and 410 mg/kg) and the black dotted line shows the current year's minimum detection limit (1 mg/kg).

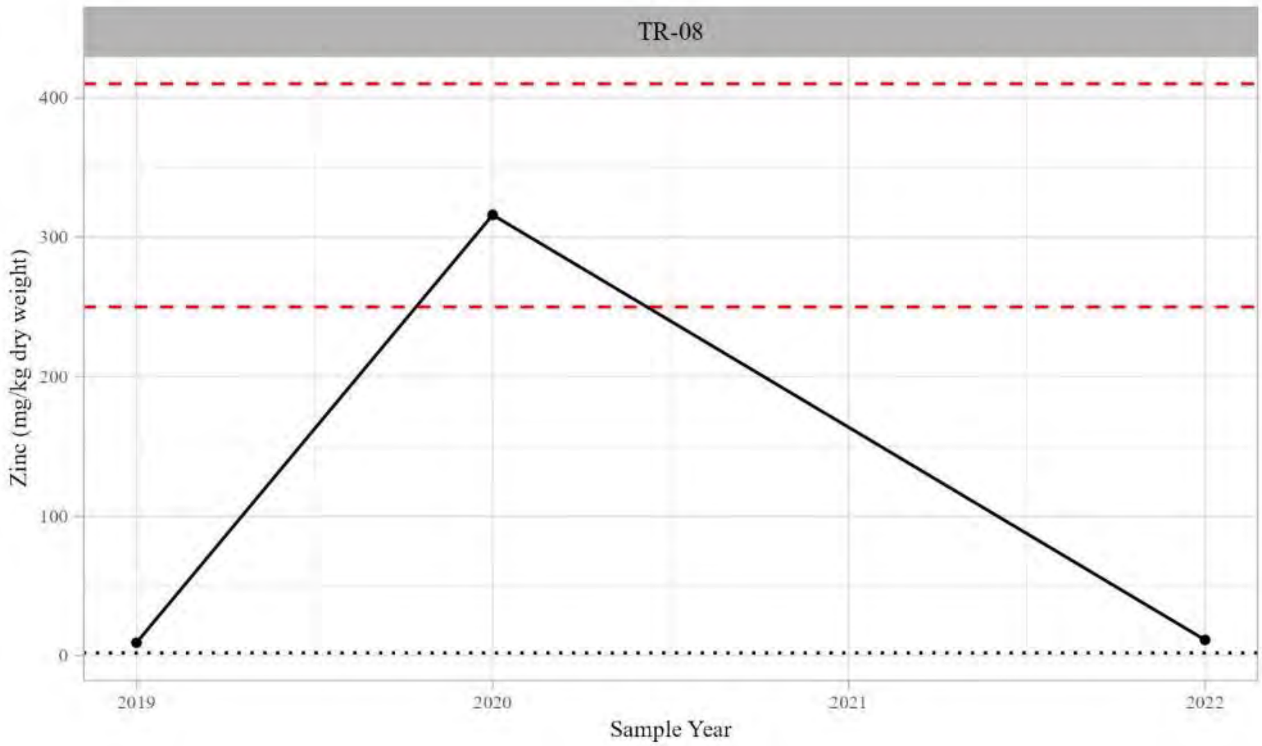


Figure 9-14. Year-over-year soil-zinc concentration at TR-08 (Tote Road, Near: 0-100 m from potential development area).
Solid points show yearly sample concentration values. The red dashed lines shows the lower and upper CCME soil quality guidelines (250 and 410 mg/kg) and the black dotted line shows the current year's minimum detection limit (2 mg/kg).

9.1.2.2 Lichen-metal Concentrations

Table 9-16 summarizes net changes in lichen-metal CoPCs (i.e., comparing 2022 values with baseline conditions) across Project areas and sampling distances. Colour categories highlight if/where (1) mean concentrations were significantly greater than baseline and/or (2) mean concentrations exceeded threshold indicator values (based on peer-reviewed literature sources). Overall, many 2022 mean concentrations across Project areas and sample distances showed no significant changes in relation to baseline values. Discrete increases in CoPCs (i.e., As, Cd, Cu, Pb, and Se) in relation to baseline conditions were recorded at the Mine Site at Near and Far sampling locations, with some individual values (i.e., Cu and Pb) at or above indicator values. Discrete increases in CoPCs (i.e., As, Cu, and Pb) were also recorded at Milne Port at Near sampling locations, but no samples exceeded the indicator values. Lastly, discrete increases in CoPCs (i.e., Pb and Se) were recorded along the Tote Road at Near and Reference sampling locations, with some individual values (i.e., Pb) at or above the indicator values.

Mean values were generally within an acceptable range of variation. The following paragraphs summarize net changes, trends, and distributions for all lichen-metal CoPCs. Given their respective toxicities and environmental and human health effects, any significant increases in CoPCs at the Project are flagged for ongoing monitoring.

Table 9-16. Net changes in lichen-metal contaminants of potential concern in 2022.

Analyte	Mine Site			Milne Port			Tote Road		
	Near	Far	Reference	Near	Far	Reference	Near	Far	Reference
Arsenic									
Cadmium									
Copper									
Lead									
Selenium									
Zinc									

Notes: Near = 0–100 m; Far = 100–1,000 m; and Reference = >1,000 m.

Gray = No change from baseline.

Yellow = Statistically significant increase from baseline; mean concentration below lower lichen indicator value.

Orange = Statistically significant increase from baseline; mean concentration above lower lichen indicator value.

Arsenic (As) — Table 9-17 summarizes net changes in lichen-As concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-18 provides a breakdown of lichen-As concentrations in relation to the RDL. Figure 9-15 illustrates the distribution of lichen-As concentrations at the Project (2019, 2020, and 2022 values). Figure 9-16 shows the regression analysis for lichen-As concentrations in relation to distance from the Project (2019, 2020, and 2022).

Significant increases in Arsenic concentration in lichen were recorded at the Mine Site and at Milne Port, prompting further evaluation of potential trends. Figure 9-17 shows the year-over-year lichen-As concentrations for Mine Site and Milne Port. Upon closer analysis, there is a sustained increasing trend; however, the dataset holds high variability and wide confidence intervals. These locations have been flagged for ongoing monitoring.

Table 9-17. The net change in lichen-arsenic concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Yellow = Statistically significant increase from baseline.

Table 9-18. Mean lichen-arsenic concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Mine Site	Near	Baseline[1]	12	0.05	0.00	0.09	0.10	0.03	0.06	0.24	-	-
		2019	11	0.02	0.00	0.17	0.15	0.04	0.11	0.33	-	-
		2020	9	0.02	0.00	0.17	0.17	0.02	0.14	0.23	-	-
		2022	10	0.02	0.00	0.26	0.25	0.08	0.14	0.62	-	-
	Far	Baseline	4	0.05	50.00	0.05	0.05	0.05	0.03	0.11	-	-
		2019	4	0.02	0.00	0.12	0.13	0.05	0.09	0.15	-	-
		2020	11	0.02	0.00	0.14	0.16	0.06	0.08	0.20	-	-
		2022	11	0.02	0.00	0.23	0.24	0.05	0.12	0.39	-	-
	Reference	Baseline	13	0.05	30.77	0.08	0.09	0.10	0.03	1.10	-	-
		2019	5	0.02	0.00	0.09	0.07	0.08	0.04	0.36	-	-
		2020	4	0.02	0.00	0.06	0.05	0.04	0.03	0.14	-	-
		2022	4	0.02	0.00	0.08	0.07	0.04	0.05	0.12	-	-
Milne Port	Near	Baseline	13	0.05	23.08	0.07	0.07	0.03	0.03	0.23	-	-
		2019	10	0.02	0.00	0.12	0.13	0.04	0.08	0.16	-	-
		2020	10	0.02	0.00	0.11	0.12	0.04	0.08	0.19	-	-
		2022	10	0.02	0.00	0.22	0.21	0.10	0.14	0.33	-	-
	Far	Baseline	4	0.05	75.00	0.03	0.03	0.01	0.03	0.07	-	-
		2019	3	0.02	0.00	0.06	0.06	0.01	0.06	0.08	-	-
		2020	5	0.02	0.00	0.09	0.08	0.08	0.05	0.16	-	-
		2022	6	0.02	0.00	0.11	0.10	0.10	0.06	0.23	-	-
	Reference	Baseline	3	0.05	33.33	0.05	0.06	0.03	0.03	0.08	-	-
		2019	4	0.02	0.00	0.04	0.04	0.00	0.04	0.05	-	-
		2020	3	0.02	0.00	0.05	0.04	0.01	0.04	0.06	-	-
		2022	4	0.02	0.00	0.05	0.05	0.01	0.04	0.07	-	-

Table 9-18. Mean lichen-arsenic concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Tote Road	Near	Baseline	14	0.05	0.00	0.18	0.18	0.06	0.10	0.35	-	-
		2019	12	0.02	0.00	0.23	0.23	0.06	0.18	0.31	-	-
		2020	10	0.02	0.00	0.16	0.15	0.03	0.13	0.24	-	-
		2022	7	0.02	0.00	0.21	0.21	0.05	0.14	0.30	-	-
	Far	Baseline	9	0.05	0.00	0.08	0.07	0.04	0.05	0.11	-	-
		2019	4	0.02	0.00	0.10	0.08	0.03	0.07	0.19	-	-
		2020	4	0.02	0.00	0.08	0.09	0.02	0.05	0.11	-	-
		2022	5	0.02	0.00	0.10	0.11	0.03	0.07	0.17	-	-
	Reference	Baseline	11	0.05	72.73	0.04	0.03	0.03	0.03	0.15	-	-
		2019	4	0.02	0.00	0.04	0.04	0.01	0.03	0.07	-	-
		2020	3	0.02	0.00	0.04	0.05	0.01	0.04	0.05	-	-
		2022	4	0.02	0.00	0.06	0.05	0.03	0.03	0.12	-	-

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

1 Baseline = baseline sampling during pre-construction for all years up to and including 2016.

2 Number of sample sites.

3 The percent of samples below the RDL is only comparable between years with the same RDL.

4 The indicator value is a metal concentration (mg/kg dry weight) selected from the best available scientific research for a similar or related lichen species and metal/metalloid, which may signal a change in vegetation health, such as reduced vigour or growth. No reference indicator value could be defined for arsenic from an investigation of peer-reviewed literature.

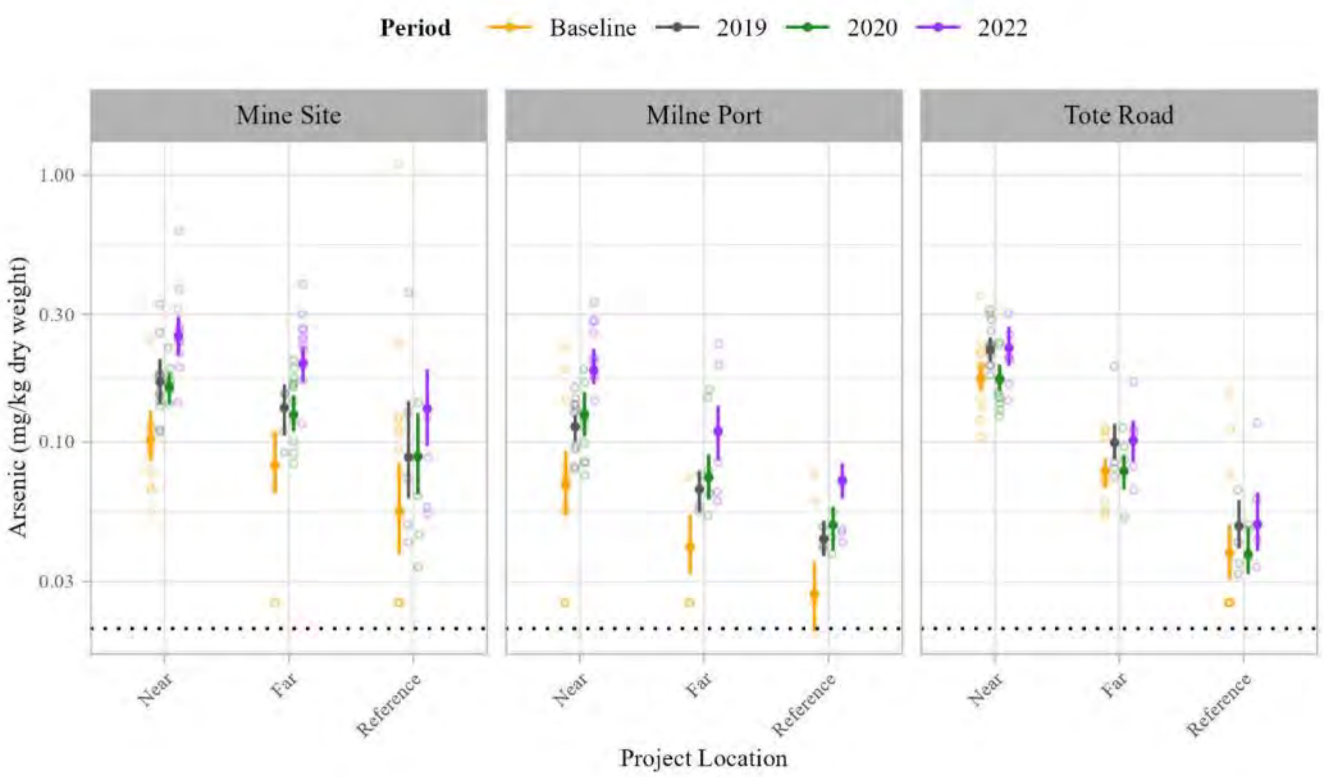


Figure 9-15. Distribution of lichen-arsenic concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

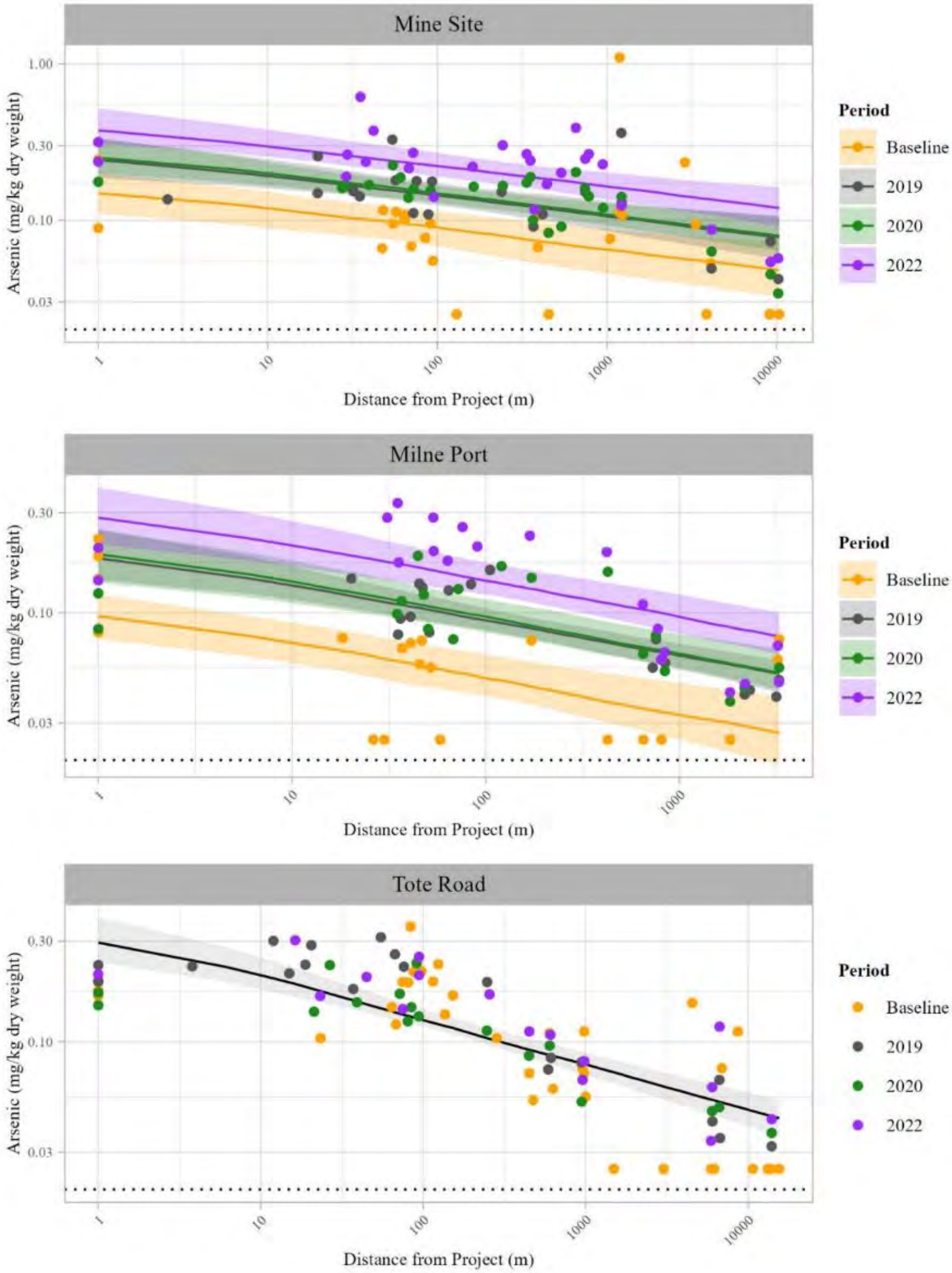


Figure 9-16. Regression analysis of the distribution of lichen-arsenic concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

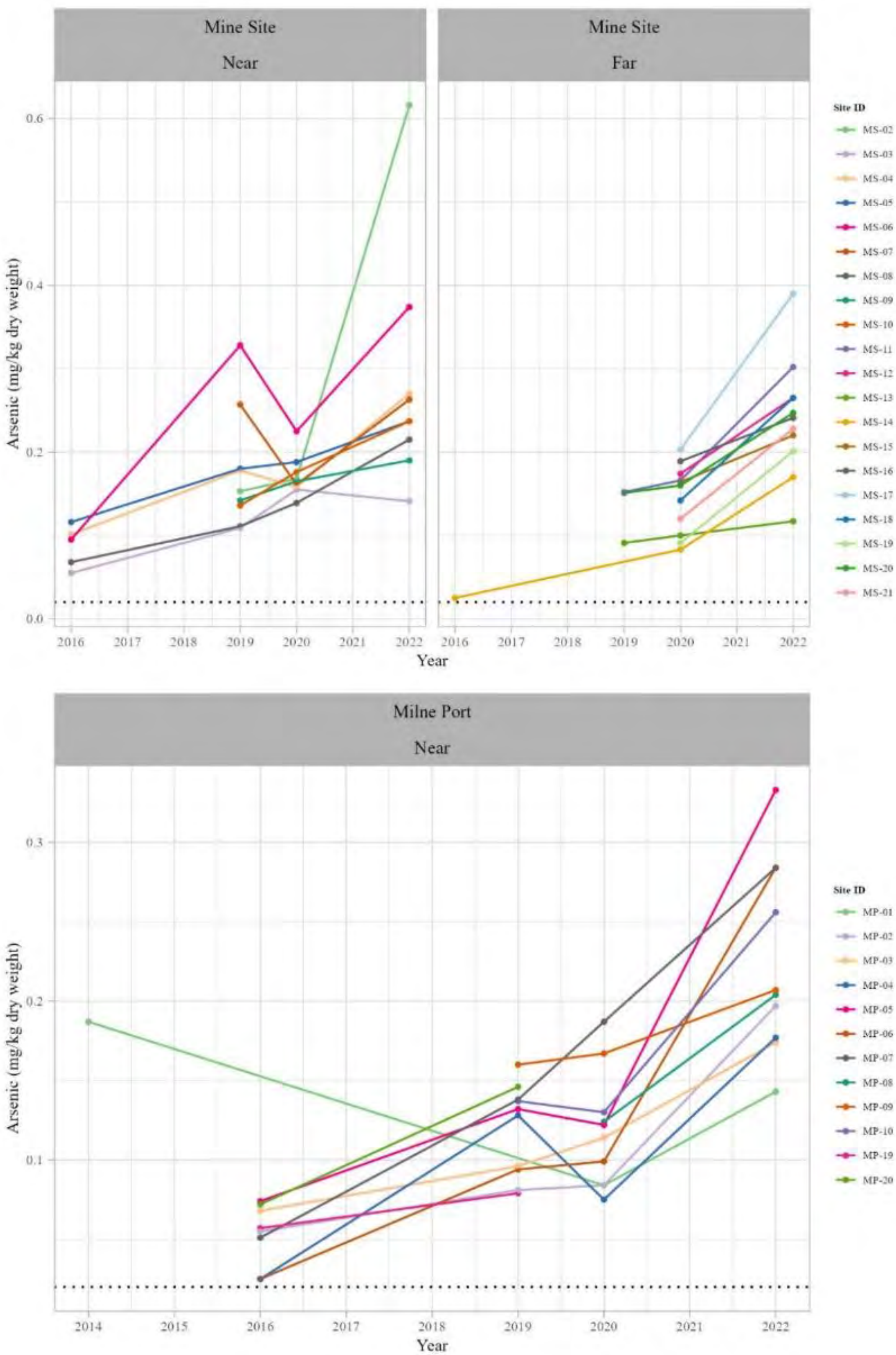


Figure 9-17. Year-over-year lichen-arsenic concentration at sites within Project area-distance combinations with mean significant increases compared to baseline conditions.
Site distances from potential development area consist of Near (0–100 m), Far (100–1,000 m), or Reference (>1,000 m) sites. Solid points show yearly sample concentration values. The black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

Cadmium (Cd) — Table 9-19 summarizes net changes in lichen-Cd concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-20 provides a further breakdown of lichen-Cd concentrations in relation to the RDL and applicable lichen indicator values. Figure 9-18 illustrates the distribution of lichen-Cd concentrations at the Project (2019, 2020, and 2021 values); Figure 9-19 shows the regression analysis for lichen-Cd concentrations in relation to distance from the Project.

Significant increases in Cadmium concentration in lichen were recorded at the Mine Site and along the Tote Road, prompting further evaluation of potential trends. Figure 9-20 shows the year-over-year lichen-Cd concentrations for the Mine Site-Far and Tote Road-Near. Upon closer analysis, all mean values were below the lower lichen-Cd indicator value; however, the dataset holds high variability and wide confidence intervals. These locations have been flagged for ongoing monitoring.

Table 9-19. The net change in lichen-cadmium concentrations in 2022.

Project Area	Near (0-100 m)				Far (100-1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Yellow = Statistically significant increase from baseline; mean concentration below lower lichen indicator value.

Table 9-20. Mean lichen-cadmium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Mine Site	Near	Baseline[1]	12	0.01	0.00	0.06	0.05	0.03	0.03	0.17	3/30	0
		2019	11	0.005	0.00	0.08	0.06	0.05	0.04	0.74	3/30	0
		2020	9	0.005	0.00	0.09	0.06	0.04	0.04	1.09	3/30	0
		2022	10	0.005	0.00	0.09	0.08	0.03	0.04	0.47	3/30	0
	Far	Baseline	4	0.01	0.00	0.04	0.04	0.00	0.03	0.04	3/30	0
		2019	4	0.005	0.00	0.05	0.06	0.01	0.04	0.06	3/30	0
		2020	11	0.005	0.00	0.06	0.06	0.03	0.03	0.10	3/30	0
		2022	11	0.005	0.00	0.07	0.07	0.03	0.04	0.12	3/30	0
	Reference	Baseline	13	0.01	0.00	0.12	0.11	0.10	0.04	0.26	3/30	0
		2019	5	0.005	0.00	0.11	0.12	0.07	0.07	0.19	3/30	0
		2020	4	0.005	0.00	0.15	0.18	0.06	0.07	0.23	3/30	0
		2022	4	0.005	0.00	0.15	0.18	0.05	0.07	0.21	3/30	0
Milne Port	Near	Baseline	13	0.01	0.00	0.04	0.04	0.01	0.02	0.09	3/30	0
		2019	10	0.005	0.00	0.04	0.04	0.00	0.03	0.05	3/30	0
		2020	10	0.005	0.00	0.04	0.04	0.01	0.02	0.05	3/30	0
		2022	10	0.005	0.00	0.04	0.04	0.01	0.03	0.05	3/30	0
	Far	Baseline	4	0.01	0.00	0.03	0.03	0.01	0.02	0.05	3/30	0
		2019	3	0.005	0.00	0.03	0.03	0.00	0.02	0.03	3/30	0
		2020	5	0.005	0.00	0.03	0.04	0.01	0.02	0.05	3/30	0
		2022	6	0.005	0.00	0.04	0.04	0.02	0.02	0.05	3/30	0
	Reference	Baseline	3	0.01	0.00	0.04	0.03	0.01	0.03	0.06	3/30	0
		2019	4	0.005	0.00	0.03	0.03	0.03	0.02	0.06	3/30	0
		2020	3	0.005	0.00	0.03	0.02	0.01	0.02	0.04	3/30	0
		2022	4	0.005	0.00	0.03	0.03	0.01	0.02	0.03	3/30	0

Table 9-20. Mean lichen-cadmium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Tote Road	Near	Baseline	14	0.01	0.00	0.04	0.04	0.02	0.03	0.10	3/30	0
		2019	12	0.005	0.00	0.09	0.08	0.04	0.06	0.19	3/30	0
		2020	10	0.005	0.00	0.09	0.11	0.08	0.04	0.18	3/30	0
		2022	7	0.005	0.00	0.08	0.08	0.05	0.04	0.13	3/30	0
	Far	Baseline	9	0.01	0.00	0.04	0.03	0.02	0.03	0.08	3/30	0
		2019	4	0.005	0.00	0.08	0.07	0.07	0.04	0.18	3/30	0
		2020	4	0.005	0.00	0.07	0.09	0.03	0.03	0.11	3/30	0
		2022	5	0.005	0.00	0.06	0.06	0.05	0.04	0.10	3/30	0
	Reference	Baseline	11	0.01	0.00	0.06	0.05	0.02	0.04	0.17	3/30	0
		2019	4	0.005	0.00	0.05	0.04	0.02	0.03	0.12	3/30	0
		2020	3	0.005	0.00	0.07	0.07	0.05	0.04	0.13	3/30	0
		2022	4	0.005	0.00	0.10	0.11	0.08	0.06	0.17	3/30	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

1 Baseline = baseline sampling during pre-construction for all years up to and including 2016.

2 Number of sample sites.

3 The percent of samples below the RDL is only comparable between years with the same RDL.

4 The indicator value is a metal concentration (mg/kg dry weight) selected from the best available scientific research for a similar or related lichen species and metal/metalloid, which may signal a change in vegetation health, such as reduced vigour or growth.

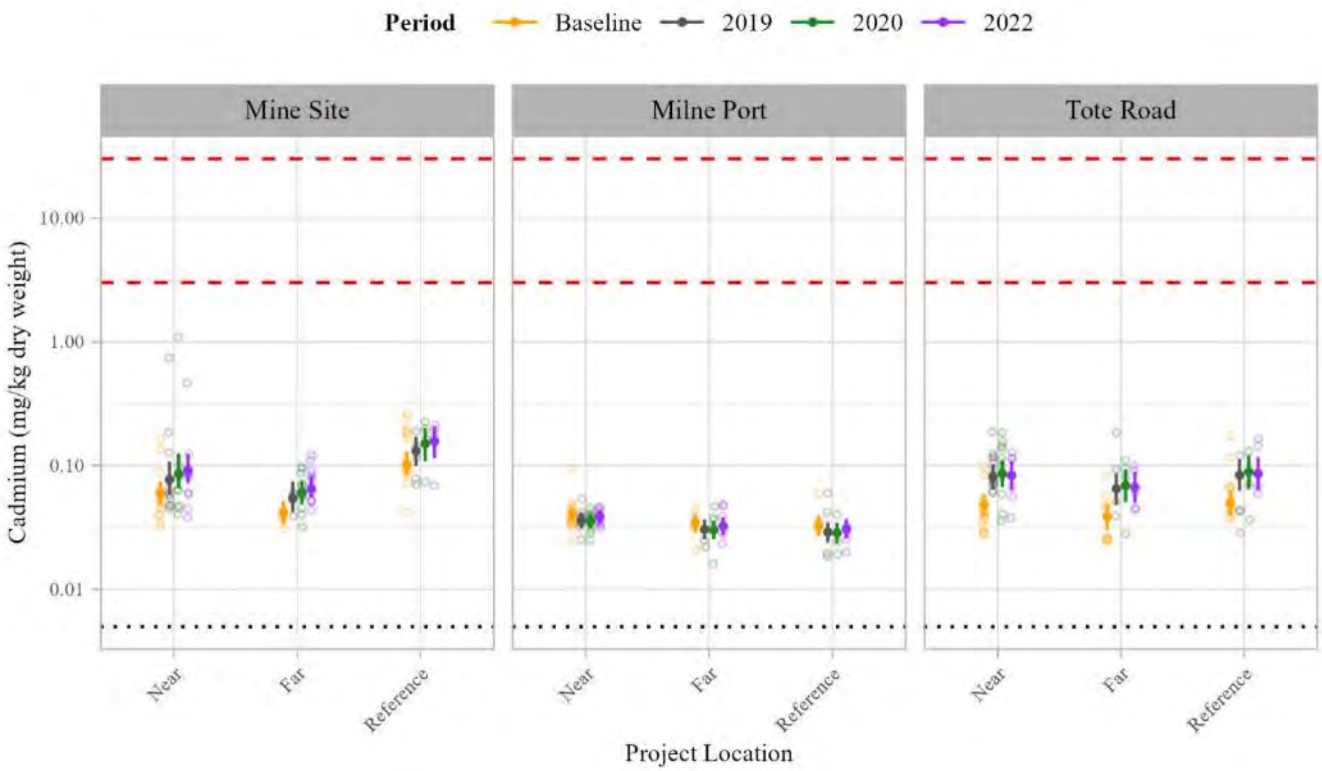


Figure 9-18. Distribution of lichen-cadmium concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed lines shows the lower and upper lichen indicator values (3 and 30 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.005 mg/kg).

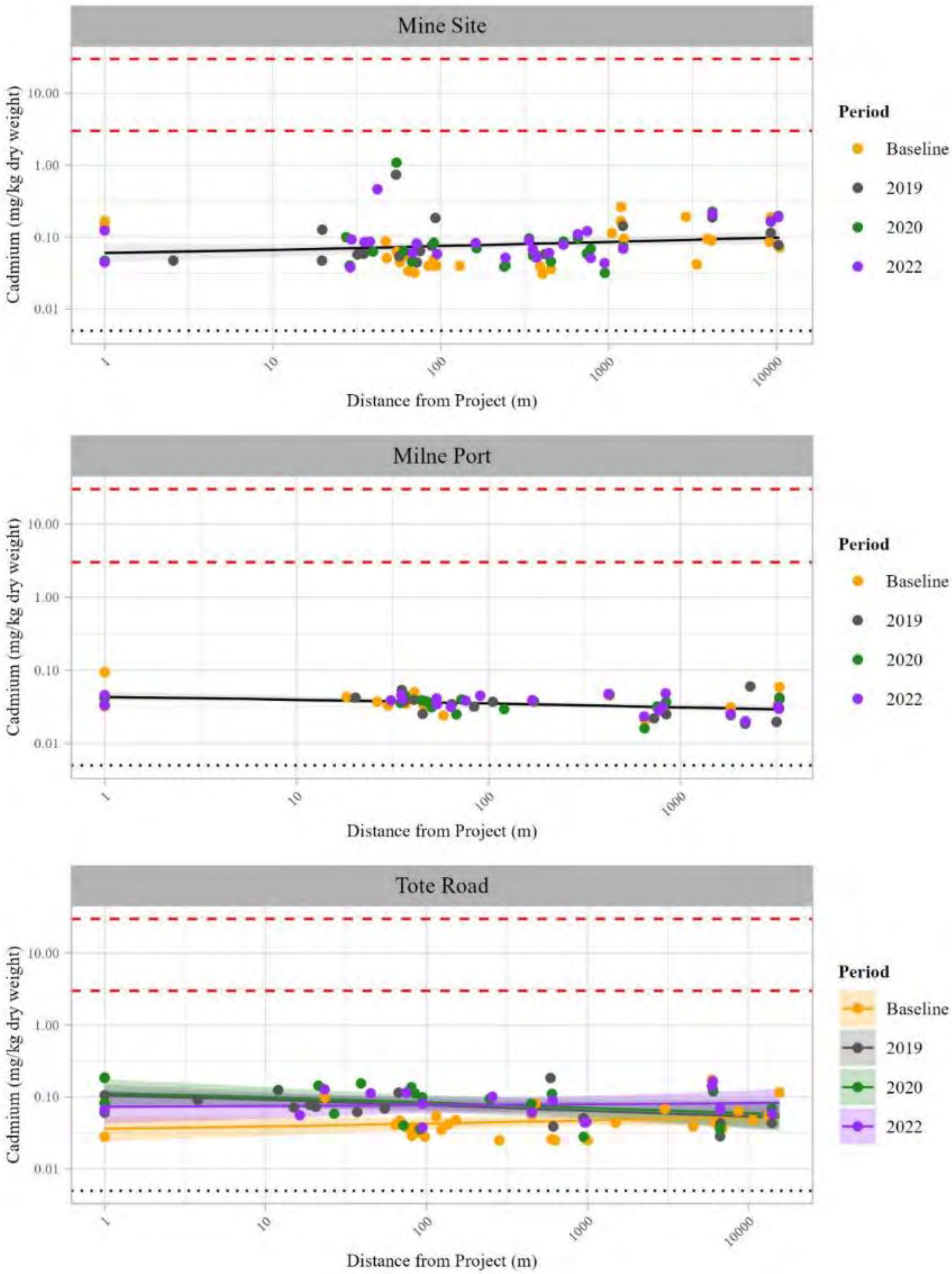


Figure 9-19. Regression analysis of the distribution of lichen-cadmium concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Each colour represents a sampling period; solid lines are mean concentrations and shaded areas are 95% confidence regions. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the lower and upper lichen indicator values (3 and 30 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.005 mg/kg).

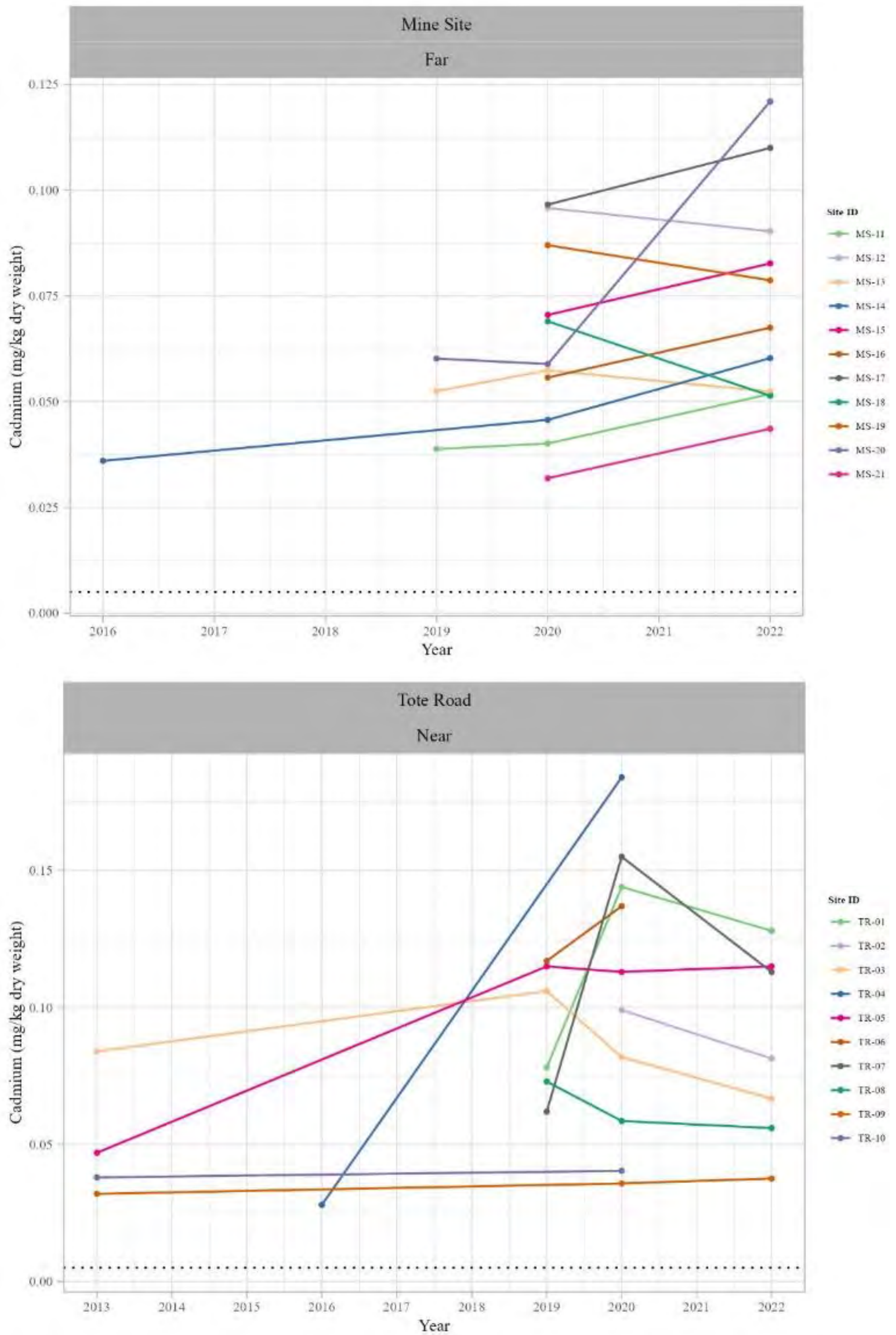


Figure 9-20. Year-over-year lichen-cadmium concentrations at sites within Project area-distance combinations with mean significant increases compared to baseline conditions.

Site distances from potential development area consist of Near (0–100 m), Far (100–1,000 m), or Reference (>1,000 m) sites. Solid points show yearly sample concentration values. The lower and upper lichen indicator values (3 and 30 mg/kg) are much greater than the sample concentrations and therefore not shown on the graph. The black dotted line shows the current year's minimum detection limit (0.005 mg/kg).

Copper (Cu) —Table 9-21 summarizes net changes in lichen-Cu concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-22 provides a further breakdown of lichen-Cu concentrations in relation to the RDL and applicable lichen indicator values. Figure 9-21 illustrates the distribution of lichen-Cu concentrations at the Project (2019, 2020, and 2022 values); Figure 9-22 shows the regression analysis for lichen-Cu concentrations in relation to distance from the Project.

Significant increases in Copper concentration in lichen were recorded at the Mine Site, Milne Port and along the Tote Road, prompting further evaluation of potential trends. Figure 9-23 shows the year-over-year lichen-Cu concentrations for the Mine Site, Milne Port and along the Tote Road. This includes sites MS-06 (Mine Site, Near) and TR-01 (Tote Road, Near) where concentrations have previously exceeded the lichen indicator value (but not in 2022). Figure 9-24 shows year-over-year lichen-Cu concentrations at MS-20 (Mine Site, Far) where the lichen indicator value was specifically exceeded in 2022. All exceedances are associated with high variability and wide confidence intervals. The increase in lichen-Cu concentrations at the Mine Site and along the Tote Road are associated with discrete 'spikes' in concentration.

Table 9-21. The net change in lichen-copper concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Yellow = Statistically significant increase from baseline; mean concentration below lower lichen indicator value.

Table 9-22. Mean lichen-copper concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Mine Site	Near	Baseline[1]	12	0.05	0.00	2.10	2.03	0.94	1.29	3.44	7/15	0
		2019[5]	11	0.1	0.00	3.11	2.88	1.23	1.89	12.70	7/15	9.09
		2020	9	0.1	0.00	2.52	2.42	0.20	1.51	4.58	7/15	0
		2022	10	0.1	0.00	3.86	3.79	2.73	2.16	6.90	7/15	0
	Far	Baseline	4	0.05	0.00	1.48	1.07	0.95	0.93	4.49	7/15	0
		2019	4	0.1	0.00	1.94	1.88	0.92	1.45	2.88	7/15	0
		2020	11	0.1	0.00	1.91	1.82	1.06	1.36	2.86	7/15	0
		2022[5]	11	0.1	0.00	3.06	3.14	1.03	1.89	8.72	7/15	9.09
	Reference	Baseline	13	0.05	0.00	1.28	1.14	0.43	0.81	3.18	7/15	0
		2019	5	0.1	0.00	1.12	1.09	0.45	0.84	1.64	7/15	0
		2020	4	0.1	0.00	1.14	1.01	0.52	0.77	2.20	7/15	0
		2022	4	0.1	0.00	1.47	1.42	0.44	1.17	2.01	7/15	0
Milne Port	Near	Baseline	13	0.05	0.00	0.99	0.84	0.41	0.68	2.12	7/15	0
		2019	10	0.1	0.00	1.08	1.10	0.21	0.91	1.41	7/15	0
		2020	10	0.1	0.00	1.10	1.09	0.14	0.91	1.48	7/15	0
		2022	10	0.1	0.00	1.90	1.75	0.43	1.60	2.58	7/15	0
	Far	Baseline	4	0.05	0.00	0.87	0.84	0.13	0.76	1.06	7/15	0
		2019	3	0.1	0.00	0.80	0.84	0.11	0.68	0.90	7/15	0
		2020	5	0.1	0.00	0.96	0.93	0.48	0.67	1.31	7/15	0
		2022	6	0.1	0.00	1.34	1.20	0.57	0.99	1.91	7/15	0
	Reference	Baseline	3	0.05	0.00	0.84	0.82	0.08	0.77	0.93	7/15	0
		2019	4	0.1	0.00	0.75	0.77	0.12	0.63	0.87	7/15	0
		2020	3	0.1	0.00	0.73	0.74	0.11	0.63	0.84	7/15	0
		2022	4	0.1	0.00	0.95	0.95	0.21	0.80	1.15	7/15	0

Table 9-22. Mean lichen-copper concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Tote Road	Near	Baseline	14	0.05	0.00	3.07	3.36	1.29	1.16	5.34	7/15	0
		2019[5]	12	0.1	0.00	4.87	4.34	1.76	3.32	8.94	7/15	8.33
		2020	10	0.1	0.00	2.68	2.59	0.87	2.08	4.00	7/15	0
		2022	7	0.1	0.00	3.00	3.16	0.65	2.51	3.53	7/15	0
	Far	Baseline	9	0.05	0.00	1.35	1.22	0.85	0.69	3.82	7/15	0
		2019	4	0.1	0.00	1.72	1.58	0.59	1.31	2.72	7/15	0
		2020	4	0.1	0.00	1.59	1.72	0.34	1.06	2.05	7/15	0
		2022	5	0.1	0.00	1.67	1.57	1.14	1.14	2.45	7/15	0
	Reference	Baseline	11	0.05	0.00	0.94	0.87	0.27	0.66	2.14	7/15	0
		2019	4	0.1	0.00	0.87	0.88	0.14	0.74	1.03	7/15	0
		2020	3	0.1	0.00	0.95	1.04	0.14	0.78	1.05	7/15	0
		2022	4	0.1	0.00	1.34	1.33	0.42	0.97	1.91	7/15	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

1 Baseline = baseline sampling during pre-construction for all years up to and including 2016.

2 Number of sample sites.

3 The percent of samples below the RDL is only comparable between years with the same RDL.

4 The indicator value is a metal concentration (mg/kg dry weight) selected from the best available scientific research for a similar or related lichen species and metal/metalloid, which may signal a change in vegetation health, such as reduced vigour or growth.

5 Exceedance of the lichen indicator value at individual site(s), and mean concentrations below the lichen indicator value. An exceedance occurred at sites MS-06 (Mine Site-Near), MS-20 (Mine Site-Far), and TR-01 (Tote Road-Near).

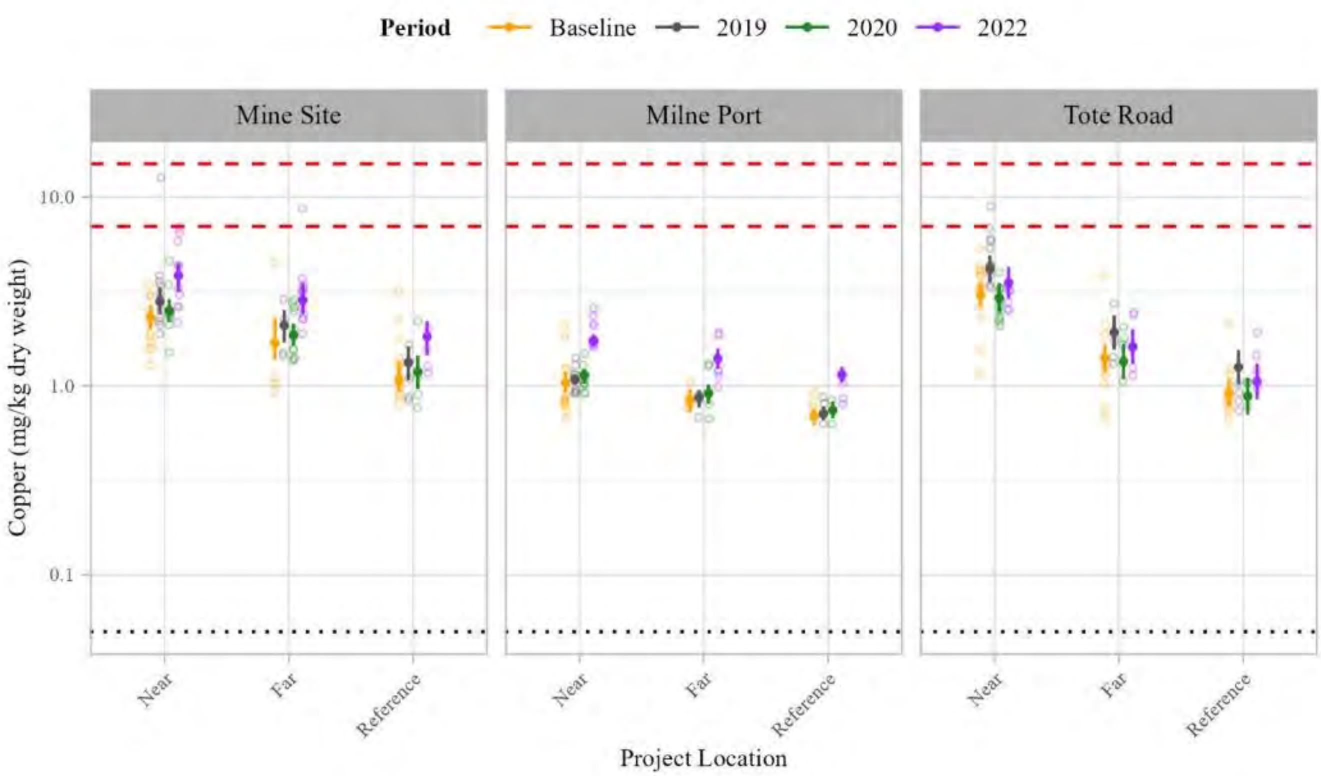


Figure 9-21. Distribution of lichen-copper concentrations in 2022.

Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the lower and upper lichen indicator values (7 and 15 mg/kg) and the black dotted line shows the current year's minimum detection limit (<0.1 mg/kg).

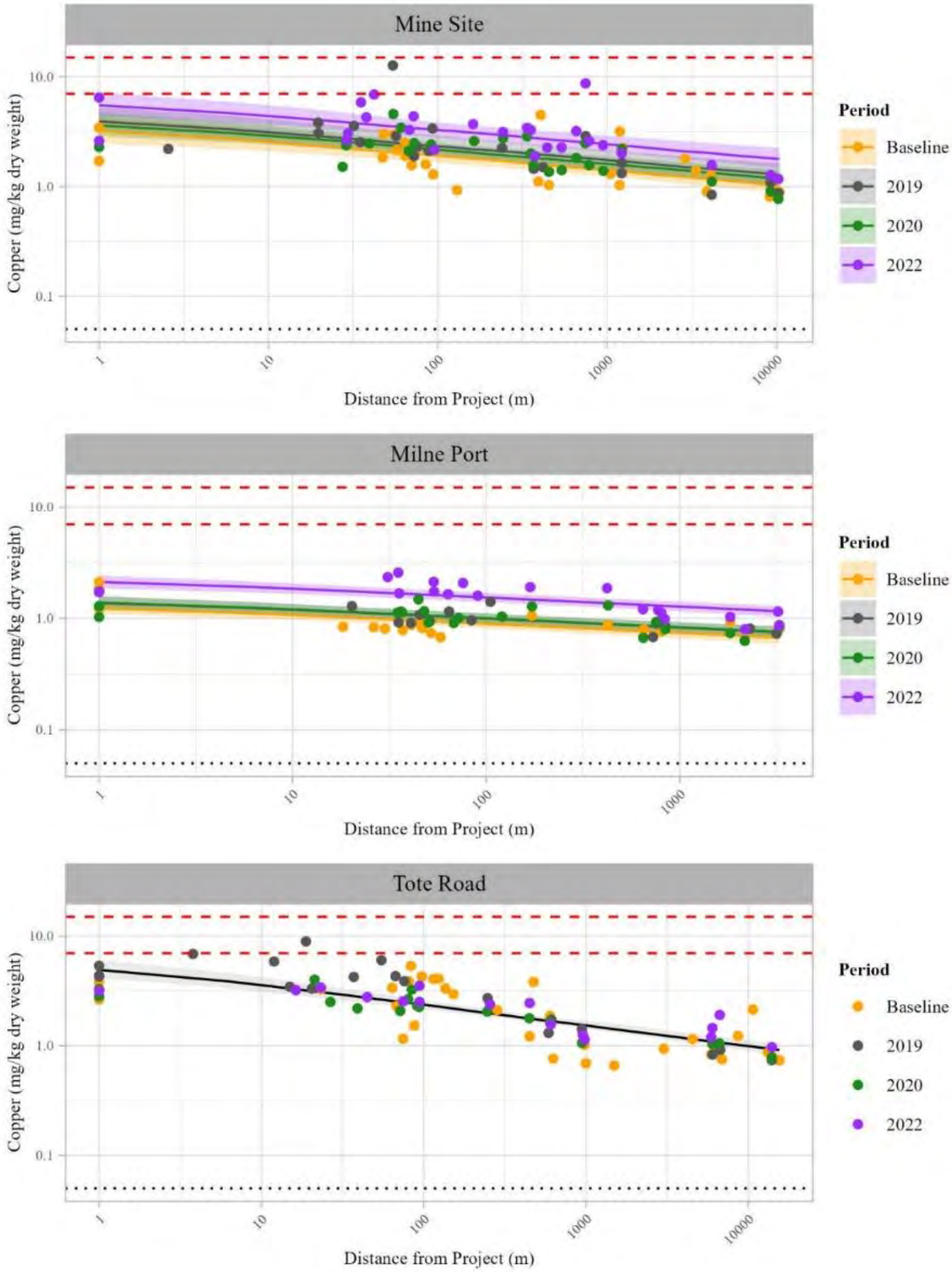


Figure 9-22. Regression analysis of the distribution of lichen-copper concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. The solid line shows mean concentrations and the shaded area is the 95% confidence region. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the lower and upper lichen indicator values (7 and 15 mg/kg) and the black dotted line shows the current year's minimum detection limit (<0.1 mg/kg).

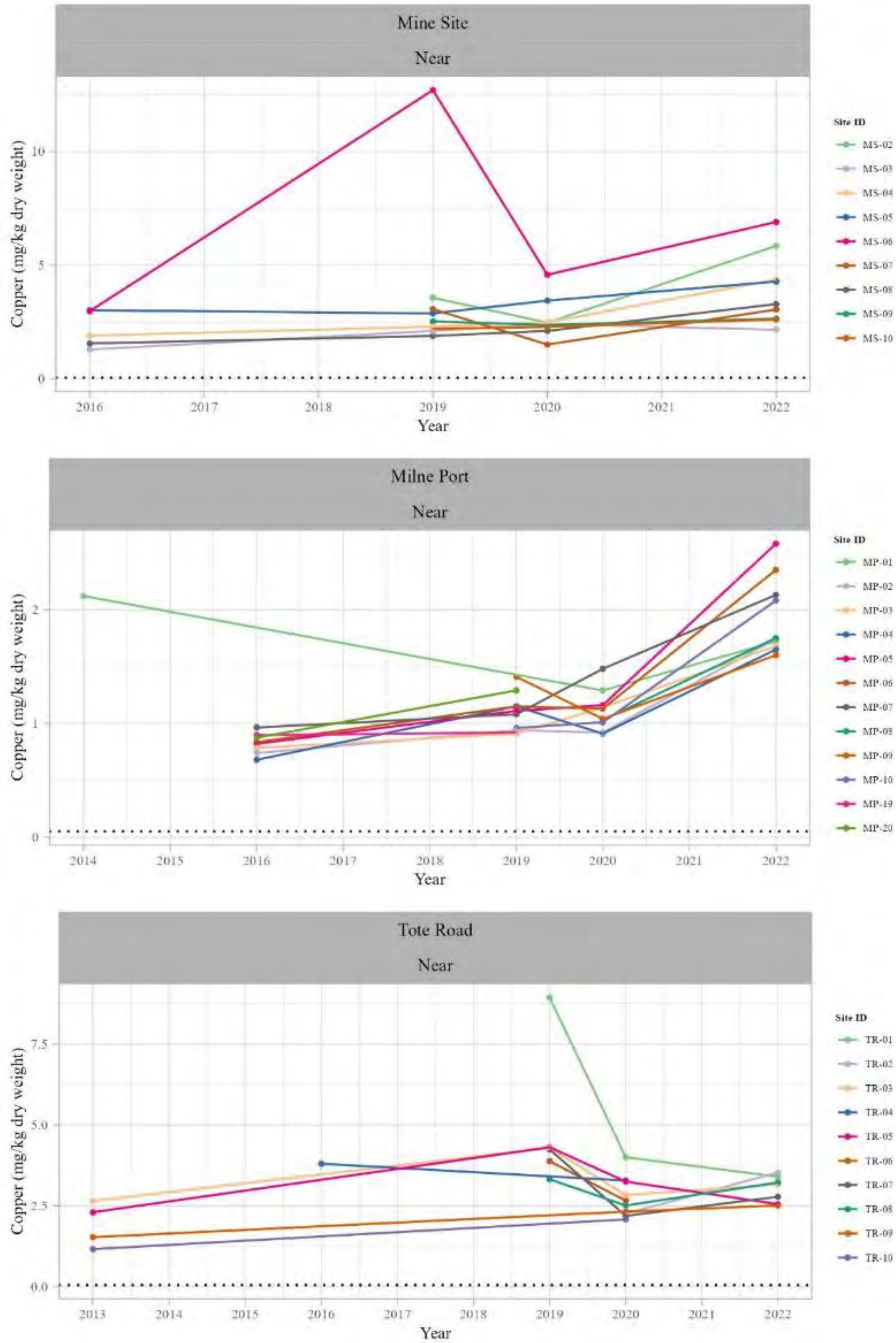


Figure 9-23. Year-over-year lichen-copper concentrations at sites within Project area-distance combinations with mean significant increases compared to baseline conditions.

Site distances from potential development area consist of Near (0–100 m), Far (100–1,000 m), or Reference (>1,000 m) sites. Solid points show yearly sample concentration values. The red dashed line shows the lower and upper lichen indicator values (7 and 15 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.1 mg/kg).

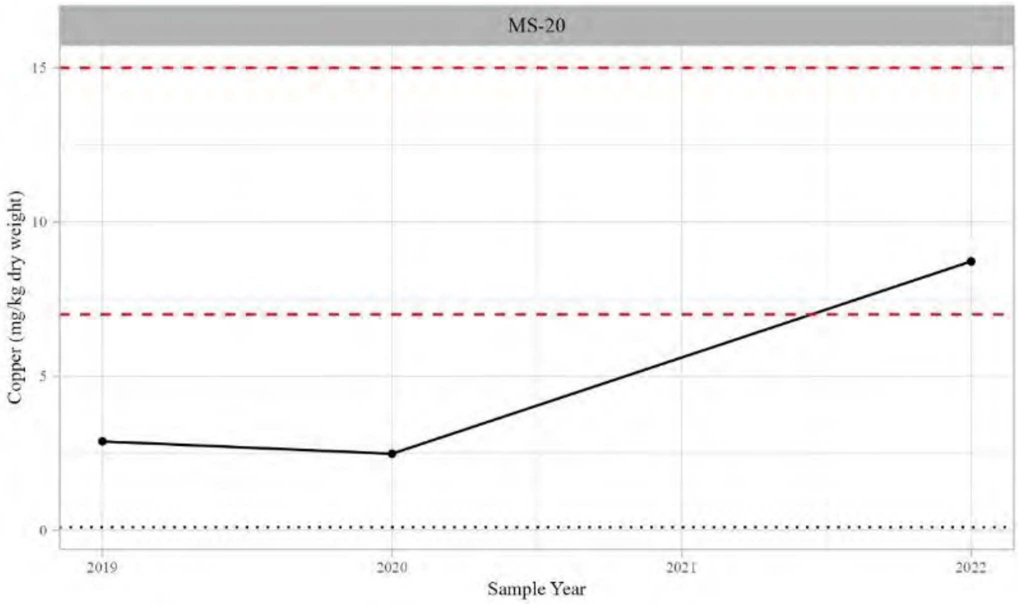


Figure 9-24. Year-over-year lichen-copper concentrations at MS-20 (Mine Site, Far: >100-1,000 m from potential development area).
Solid points show yearly sample concentration values. The red dashed line shows the lower and upper lichen indicator values (7 and 15 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.1 mg/kg).

Lead (Pb) — Table 9-23 summarizes net changes in lichen-Pb concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-24 provides a further breakdown of lichen-Pb concentrations in relation to the RDL and applicable lichen indicator values. Figure 9-25 illustrates the distribution of lichen-Pb concentrations at the Project (2019, 2020, and 2022 values), while Figure 9-26 shows the regression analysis of the distribution of lichen-Pb concentrations in relation to distance from the Project.

Significant increases in Lead concentration in lichen were recorded at the Mine Site, Milne Port and along the Tote Road, prompting further evaluation of potential trends. Figure 9-27 shows the year-over-year lichen-Pb concentrations for the Mine Site, Milne Port and along the Tote Road. This includes sites MS-02 and MS-06 at the Mine Site and sites TR-01, TR-03, TR-04, TR-05, TR-06, TR-07, TR-08, and TR-09 along the Tote Road where the lichen indicator value was exceeded. These exceedances and increases in lichen-Pb concentrations indicated a sustained/stable trend, albeit with moderate variability and wide confidence intervals. Figure 9-28 and Figure 9-29 show year-over-year lichen-Pb concentrations at MS-26 (Mine Site-Reference) and TR-11 (Tote Road-Far), respectively, where the lichen indicator value was exceeded. Overall, most lichen-Pb concentrations were below the lower lichen indicator value and were consistently low across sample sites.

Table 9-23. The net change in lichen-lead concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Yellow = Statistically significant increase from baseline; mean concentration below lower lichen indicator value.

Orange = Statistically significant increase from baseline; mean concentration above lower lichen indicator value.

Table 9-24. Mean lichen-lead concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Mine Site	Near	Baseline[1]	12	0.01	0.00	1.18	1.23	0.50	0.58	3.47	5/10	0
		2019	11	0.02	0.00	2.35	2.19	1.28	1.22	4.82	5/10	0
		2020	9	0.02	0.00	2.26	1.91	1.24	1.49	4.77	5/10	0
		2022[5]	10	0.02	0.00	2.94	2.61	3.33	1.46	7.47	5/10	30
	Far	Baseline	4	0.01	0.00	0.92	0.89	0.49	0.56	1.67	5/10	0
		2019	4	0.02	0.00	1.43	1.52	0.92	0.81	2.38	5/10	0
		2020	11	0.02	0.00	1.49	1.40	0.72	0.91	3.32	5/10	0
		2022	11	0.02	0.00	1.95	2.00	0.97	0.98	3.89	5/10	0
	Reference	Baseline[5]	13	0.01	0.00	1.28	1.41	1.95	0.28	6.71	5/10	7.69
		2019	5	0.02	0.00	0.95	0.82	0.98	0.44	2.11	5/10	0
		2020	4	0.02	0.00	0.95	1.05	0.29	0.48	1.53	5/10	0
		2022	4	0.02	0.00	0.99	1.19	0.42	0.50	1.37	5/10	0
Milne Port	Near	Baseline	13	0.01	0.00	1.07	0.93	0.37	0.53	2.60	5/10	0
		2019	10	0.02	0.00	1.69	1.60	0.50	1.01	2.71	5/10	0
		2020	10	0.02	0.00	1.79	1.66	0.86	1.11	3.18	5/10	0
		2022	10	0.02	0.00	2.20	2.00	0.77	1.46	3.96	5/10	0
	Far	Baseline	4	0.01	0.00	0.67	0.65	0.40	0.41	1.19	5/10	0
		2019	3	0.02	0.00	0.59	0.53	0.28	0.41	0.97	5/10	0
		2020	5	0.02	0.00	0.88	0.94	1.26	0.26	2.10	5/10	0
		2022	6	0.02	0.00	1.02	0.90	1.06	0.53	2.19	5/10	0
	Reference	Baseline	3	0.01	0.00	0.55	0.45	0.25	0.40	0.91	5/10	0
		2019	4	0.02	0.00	0.35	0.32	0.08	0.27	0.53	5/10	0
		2020	3	0.02	0.00	0.37	0.34	0.06	0.34	0.46	5/10	0
		2022	4	0.02	0.00	0.39	0.37	0.08	0.31	0.53	5/10	0

Table 9-24. Mean lichen-lead concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Tote Road	Near	Baseline	14	0.01	0.00	1.67	1.73	1.38	0.53	2.98	5/10	0
		2019[6]	12	0.02	0.00	6.48	6.18	1.62	4.05	15.30	5/10	83.33
		2020[6]	10	0.02	0.00	5.63	6.14	3.01	3.17	8.72	5/10	60
		2022[6]	7	0.02	0.00	5.74	5.53	1.44	3.59	9.77	5/10	71.43
	Far	Baseline	9	0.01	0.00	0.70	0.78	0.47	0.22	1.26	5/10	0
		2019	4	0.02	0.00	1.96	1.74	1.42	1.14	4.53	5/10	0
		2020[5]	4	0.02	0.00	2.35	2.85	1.17	0.73	5.15	5/10	25
		2022[5]	5	0.02	0.00	1.96	2.51	2.72	0.79	5.10	5/10	20
	Reference	Baseline	11	0.01	0.00	0.67	0.70	0.35	0.29	1.76	5/10	0
		2019	4	0.02	0.00	0.48	0.48	0.08	0.43	0.53	5/10	0
		2020	3	0.02	0.00	0.45	0.45	0.07	0.38	0.53	5/10	0
		2022	4	0.02	0.00	0.60	0.57	0.35	0.42	1.02	5/10	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

[1] Baseline = baseline sampling during pre-construction for all years up to and including 2016.

[2] Number of sample sites.

[3] The percent of samples below the RDL is only comparable between years with the same RDL.

[4] The indicator value is a metal concentration (mg/kg dry weight) selected from the best available scientific research for a similar or related lichen species and metal/metalloid, which may signal a change in vegetation health, such as reduced vigour or growth.

[5] Exceedance of the lichen indicator value at individual site(s), and mean concentrations below the lichen indicator value. An exceedance occurred at Mine Site-Near (MS-01, MS-02, and MS-06); Mine Site-Reference (MS-26); and Tote Road-Far (TR-11).

[6] Exceedance of the lichen indicator value at individual site(s), and mean concentrations above the lower lichen indicator value. An exceedance occurred at Tote Road-Near (TR-01, TR-03, TR-04, TR-05, TR-06, TR-07, TR-08, TR-22, TR-34, TR-35, TR-36, TR-37, and TR-39).

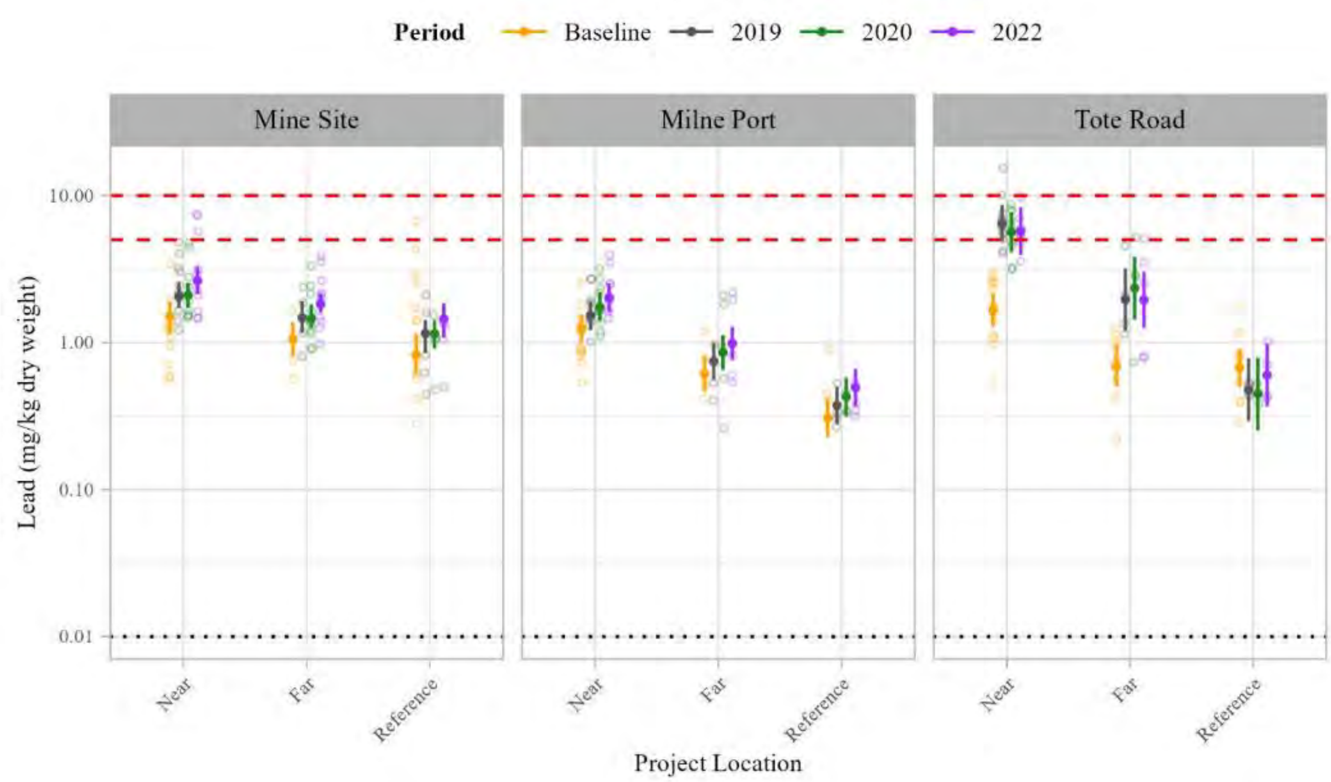


Figure 9-25. Distribution of lichen-lead concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the lower and upper lichen indicator values (5 and 10 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.01 mg/kg).

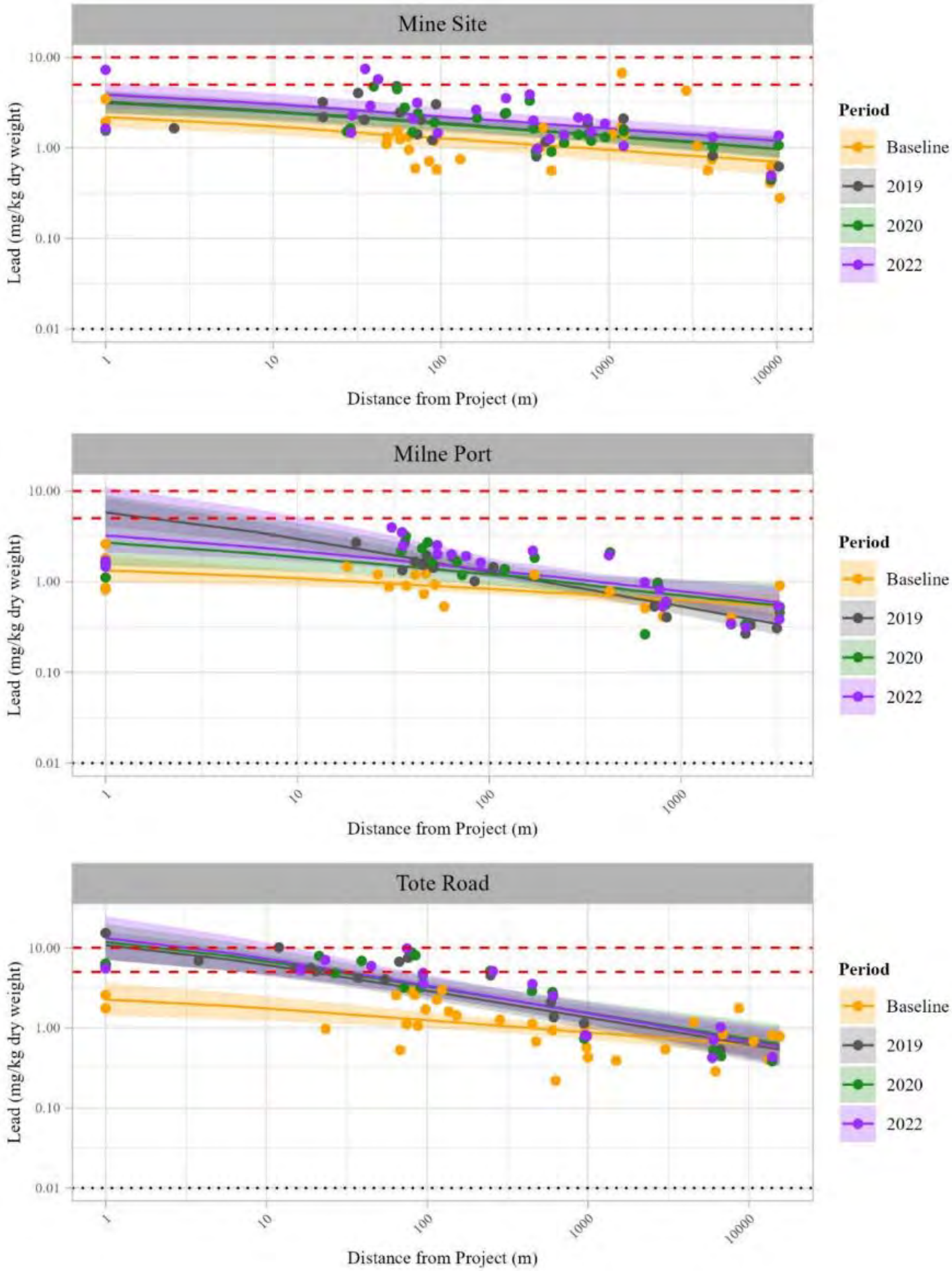


Figure 9-26. Regression analysis of the distribution of lichen-lead concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. The solid line shows mean concentrations and the shaded area is the 95% confidence region. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the lower and upper lichen indicator values (5 and 10 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.01 mg/kg).

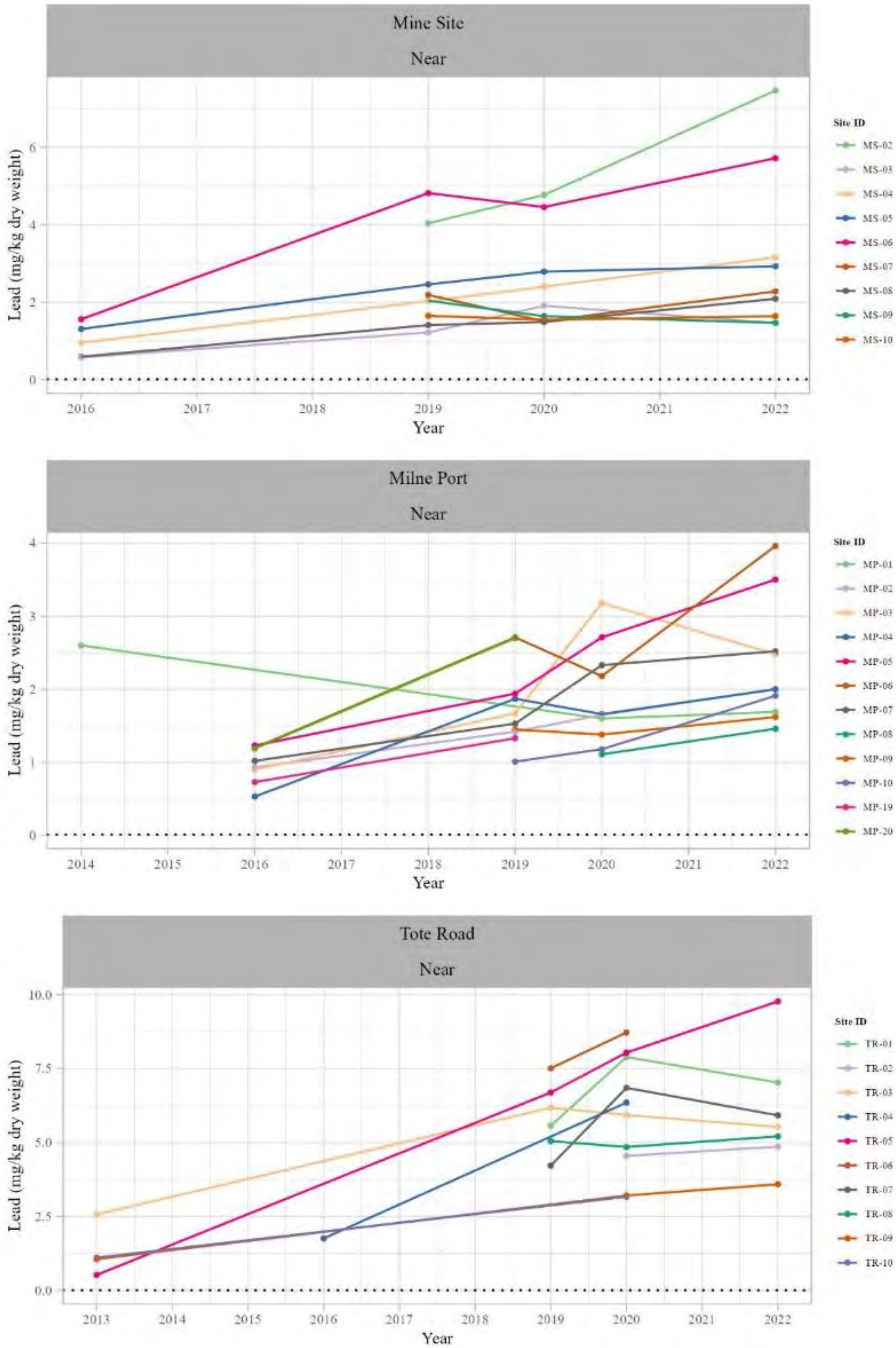


Figure 9-27. Year-over-year lichen-lead concentrations at sites within Project area-distance combinations with mean significant increases compared to baseline conditions.

Site distances from potential development area consist of Near (0–100 m), Far (100–1,000 m), or Reference (>1,000 m) sites. Solid points show yearly sample concentration values. The red dashed line shows the lower and upper lichen indicator values (5 and 10 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

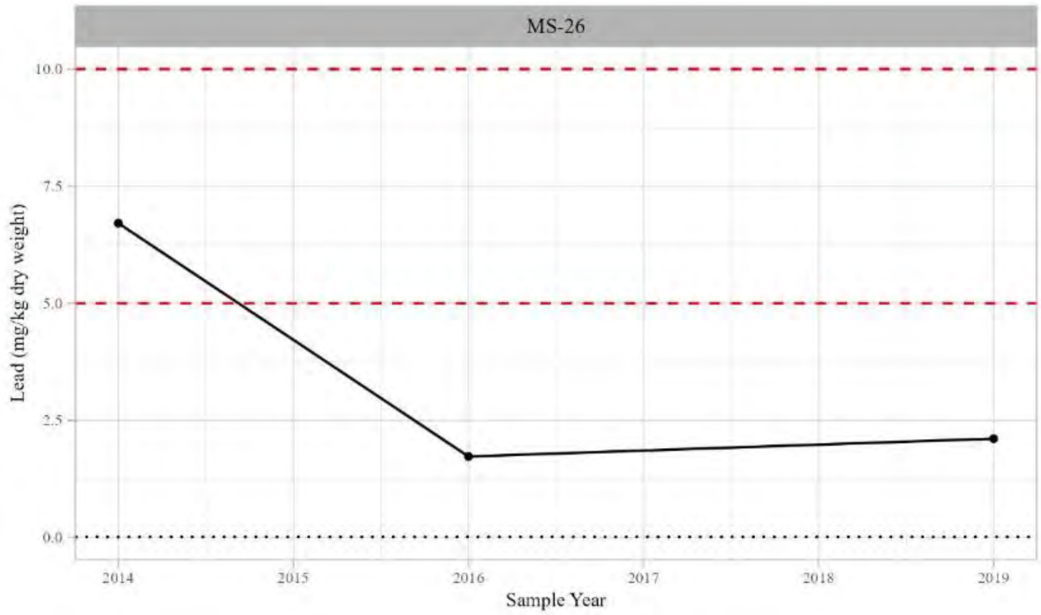


Figure 9-28. Year-over-year lichen-lead concentrations at MS-26 (Mine Site, Reference: >1,000 m from potential development area).

Solid points show yearly sample concentration values. The red dashed line shows the lower and upper lichen indicator values (5 and 10 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

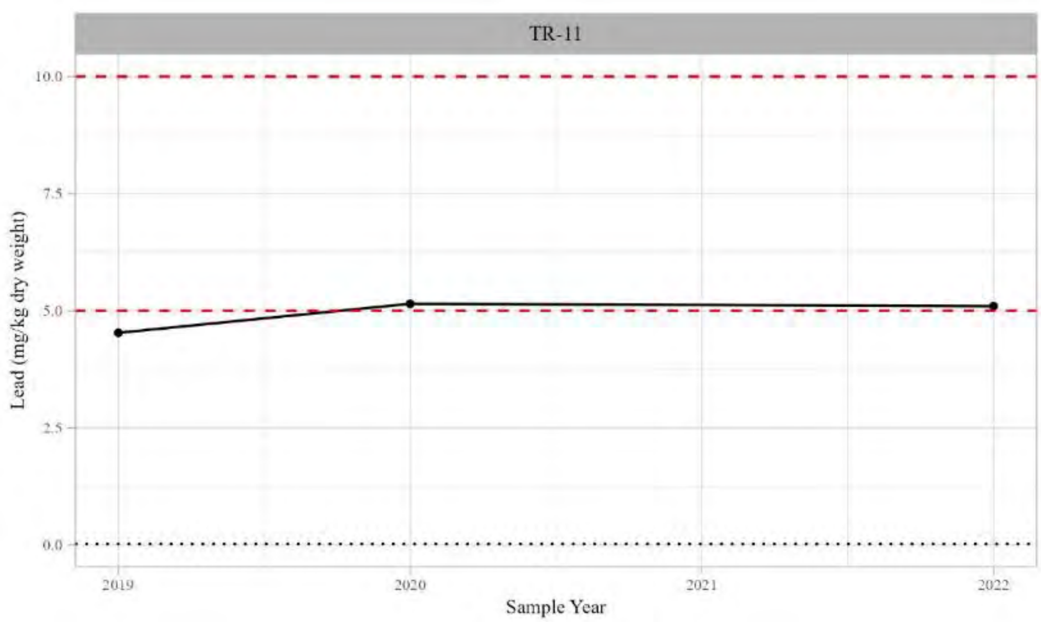


Figure 9-29. Year-over-year lichen-lead concentrations at TR-11 (Tote Road, Far: >100-1,000 m from potential development area).

Solid points show yearly sample concentration values. The red dashed lines shows the lower and upper lichen indicator values (5 and 10 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.02 mg/kg).

Selenium (Se) — Table 9-25 summarizes net changes in lichen-Se concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-26 provides a further breakdown of lichen-Se concentrations in relation to the RDL. Figure 9-30 illustrates the distribution of lichen-Se concentrations at the Project (2019, 2020, and 2022 values). Figure 9-31 shows the regression analysis for lichen-Se concentrations in relation to distance from the Project.

Significant increases in Selenium concentration in lichen were recorded at the Mine Site and along the Tote Road, prompting further evaluation of potential trends. Figure 9-32 shows the year-over-year lichen-Se concentrations for each site that comprises the Mine Site-Near, Mine Site-Far, and Tote Road-Reference category combinations (i.e., the Project area and sampling distance combinations where significant increases in lichen-Se concentrations were observed compared to baseline values). This increase is associated with high variability and wide confidence intervals. Although no threshold values are available for lichen-Se, most lichen-Se concentrations were consistently low across all sample sites and either at or below the RDL.

Table 9-25. The net change in lichen-selenium concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Yellow = Statistically significant increase from baseline.

Table 9-26. Mean lichen-selenium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Mine Site	Near	Baseline[1]	12	0.05	8.33	0.06	0.07	0.02	0.03	0.09	-	-
		2019	11	0.05	0.00	0.08	0.08	0.03	0.06	0.11	-	-
		2020	9	0.05	0.00	0.08	0.08	0.01	0.07	0.11	-	-
		2022	10	0.05	0.00	0.10	0.11	0.03	0.06	0.13	-	-
	Far	Baseline	4	0.05	75.00	0.04	0.04	0.03	0.03	0.07	-	-
		2019	4	0.05	0.00	0.07	0.07	0.01	0.06	0.08	-	-
		2020	11	0.05	9.09	0.07	0.08	0.02	0.03	0.11	-	-
		2022	11	0.05	0.00	0.09	0.09	0.01	0.07	0.11	-	-
	Reference	Baseline	13	0.05	15.38	0.07	0.08	0.04	0.03	0.20	-	-
		2019	5	0.05	0.00	0.09	0.09	0.02	0.07	0.12	-	-
		2020	4	0.05	0.00	0.08	0.08	0.02	0.07	0.11	-	-
		2022	4	0.05	0.00	0.08	0.08	0.01	0.07	0.11	-	-
Milne Port	Near	Baseline	13	0.05	7.69	0.07	0.07	0.02	0.03	0.14	-	-
		2019	10	0.05	0.00	0.07	0.07	0.01	0.05	0.08	-	-
		2020	10	0.05	10.00	0.06	0.07	0.01	0.03	0.09	-	-
		2022	10	0.05	0.00	0.08	0.08	0.01	0.06	0.09	-	-
	Far	Baseline	4	0.05	25.00	0.05	0.06	0.02	0.03	0.07	-	-
		2019	3	0.05	33.33	0.05	0.06	0.02	0.03	0.06	-	-
		2020	5	0.05	20.00	0.06	0.07	0.02	0.05	0.08	-	-
		2022	6	0.05	33.33	0.05	0.07	0.05	0.03	0.09	-	-
	Reference	Baseline	3	0.05	0.00	0.06	0.05	0.01	0.05	0.07	-	-
		2019	4	0.05	50.00	0.04	0.04	0.03	0.03	0.06	-	-
		2020	3	0.05	33.33	0.05	0.06	0.02	0.03	0.07	-	-
		2022	4	0.05	0.00	0.06	0.06	0.01	0.05	0.08	-	-

Table 9-26. Mean lichen-selenium concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Tote Road	Near	Baseline	14	0.05	0.00	0.07	0.07	0.02	0.05	0.08	-	-
		2019	12	0.05	8.33	0.06	0.07	0.01	0.03	0.08	-	-
		2020	10	0.05	0.00	0.07	0.07	0.02	0.06	0.09	-	-
		2022	7	0.05	0.00	0.07	0.08	0.01	0.06	0.08	-	-
	Far	Baseline	9	0.05	44.44	0.04	0.06	0.04	0.03	0.07	-	-
		2019	4	0.05	25.00	0.05	0.07	0.02	0.03	0.08	-	-
		2020	4	0.05	0.00	0.07	0.07	0.01	0.06	0.07	-	-
		2022	5	0.05	0.00	0.07	0.07	0.01	0.06	0.08	-	-
	Reference	Baseline	11	0.05	45.45	0.04	0.06	0.03	0.03	0.07	-	-
		2019	4	0.05	0.00	0.06	0.06	0.01	0.05	0.08	-	-
		2020	3	0.05	0.00	0.07	0.07	0.01	0.07	0.08	-	-
		2022	4	0.05	0.00	0.09	0.08	0.02	0.07	0.11	-	-

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

[1] Baseline = baseline sampling during pre-construction for all years up to and including 2016.

[2] Number of sample sites.

[3] The percent of samples below the RDL is only comparable between years with the same RDL.

[4] The indicator value is a metal concentration (mg/kg dry weight) selected from the best available scientific research for a similar or related lichen species and metal/metalloid, which may signal a change in vegetation health, such as reduced vigour or growth. No reference indicator value could be defined for selenium from an investigation of peer-reviewed literature.

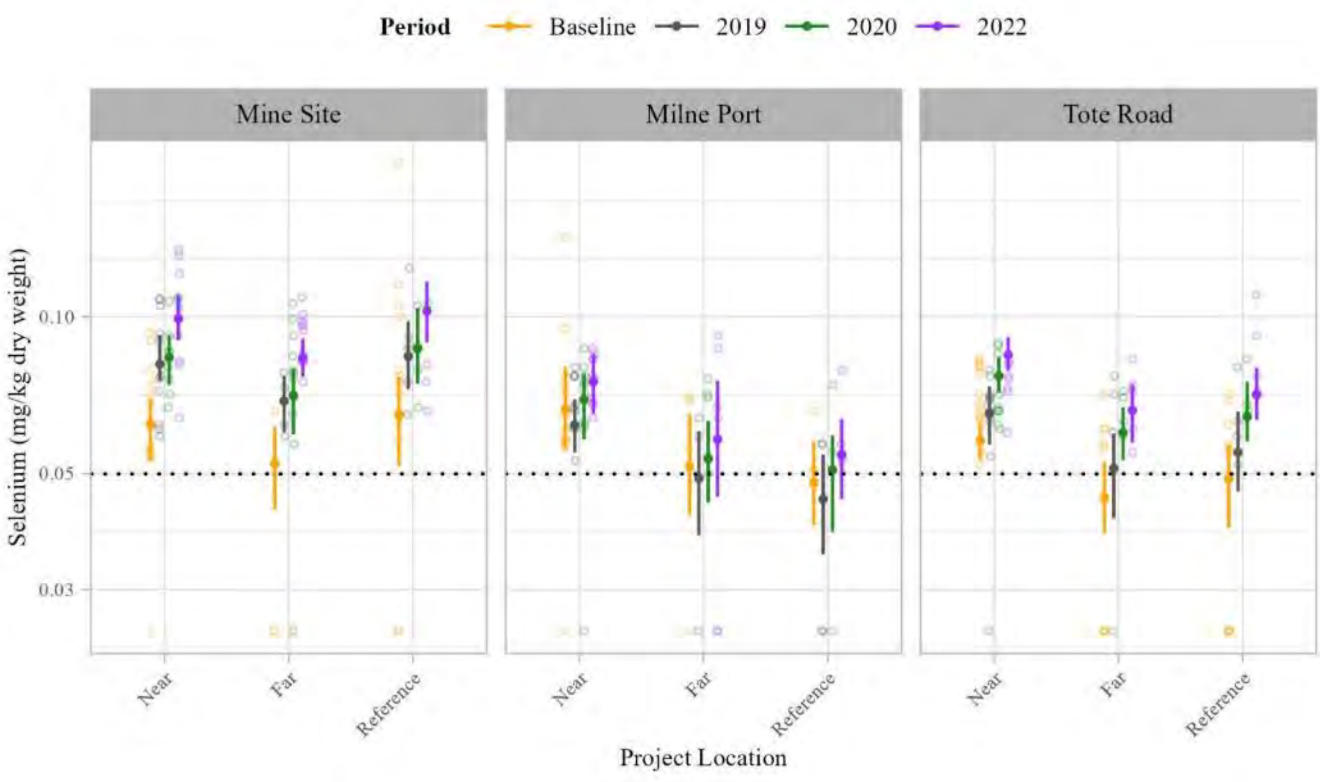


Figure 9-30. Distribution of lichen-selenium concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The black dotted line shows the current year's minimum detection limit (0.05 mg/kg).

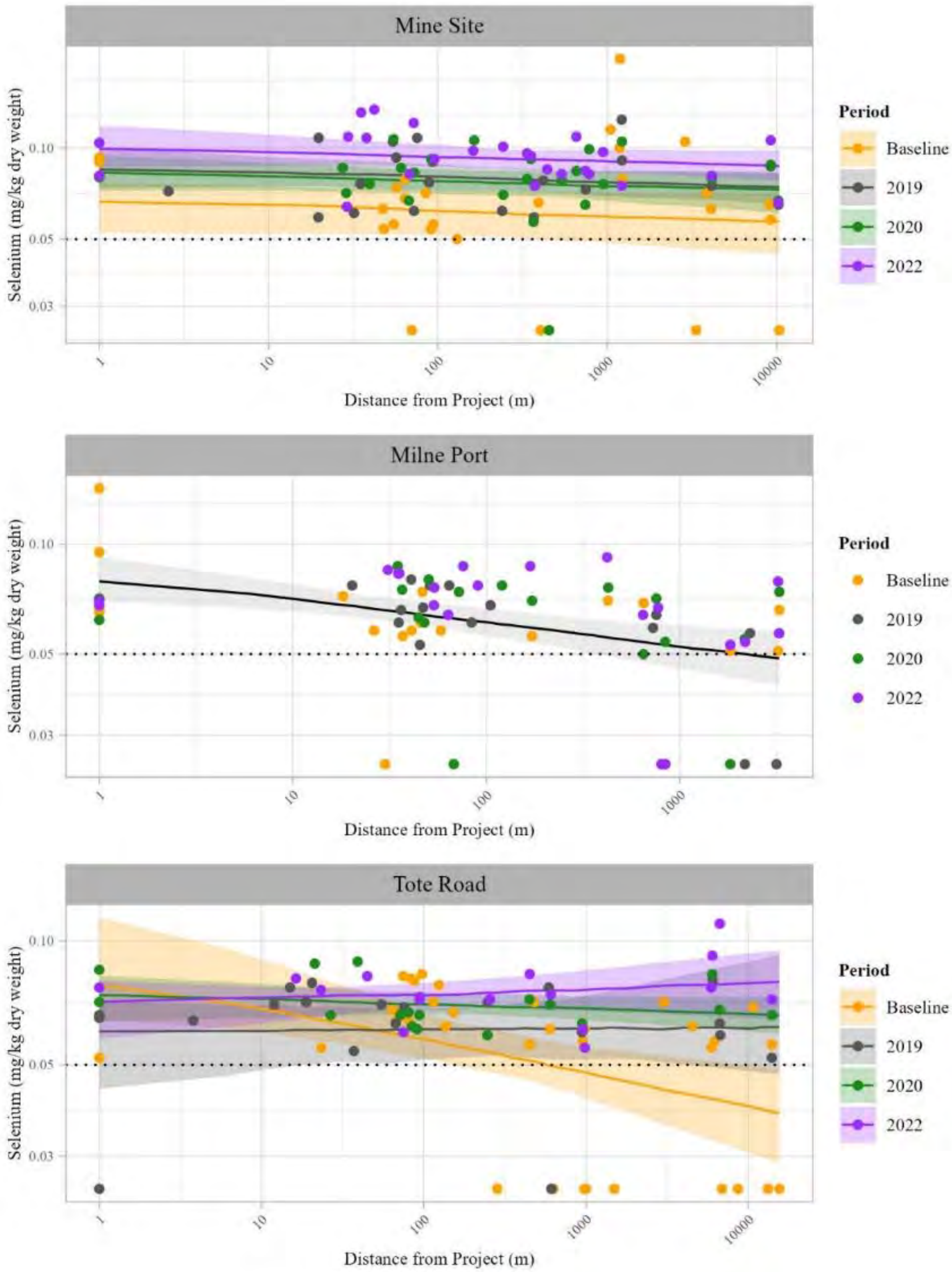


Figure 9-31. Regression analysis of the distribution of lichen-selenium concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. The solid line shows mean concentrations and the shaded area is the 95% confidence region. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The black dotted line shows the current year's minimum detection limit (0.05 mg/kg).

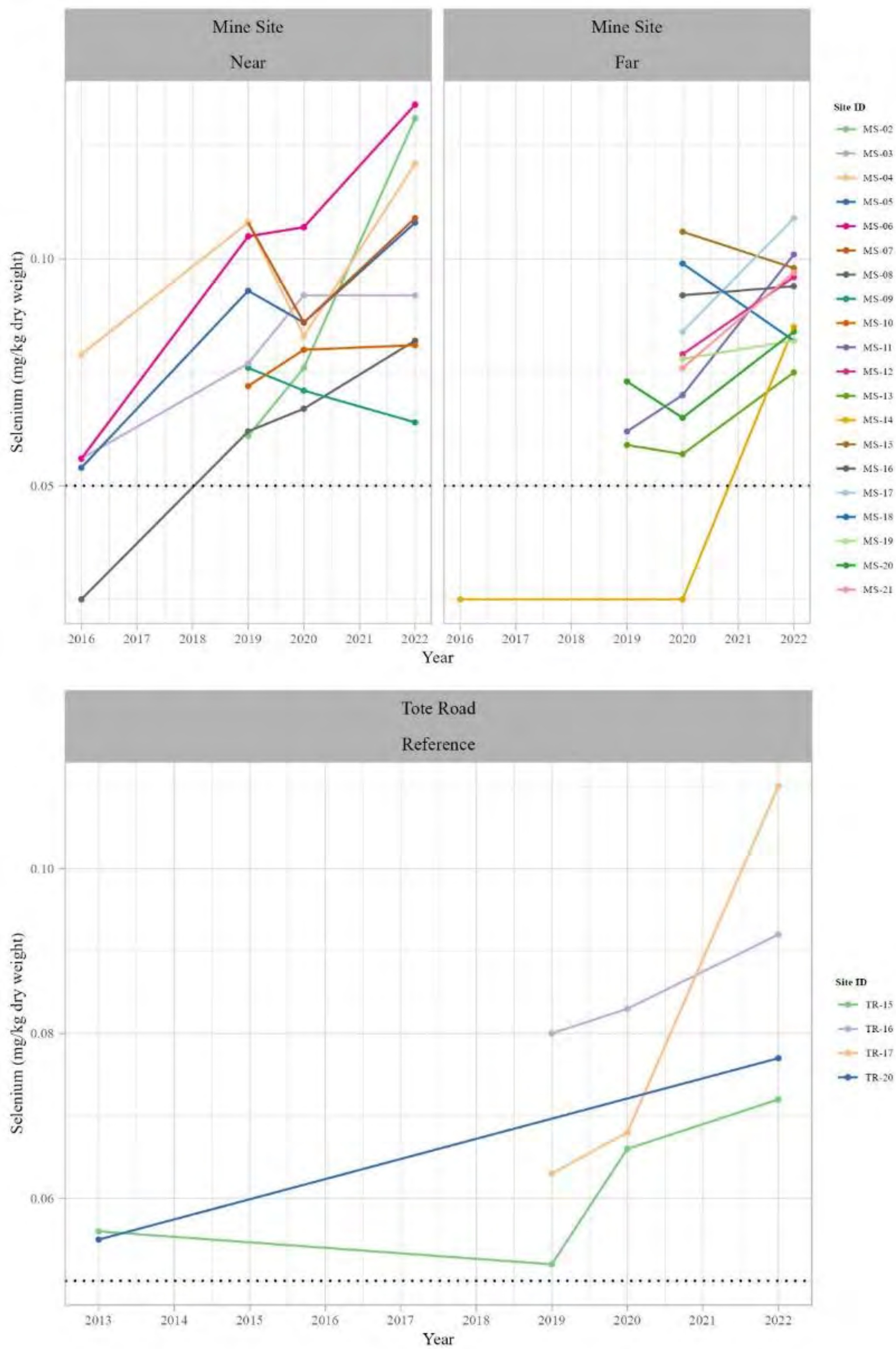


Figure 9-32. Year-over-year lichen-selenium concentrations at sites within Project area-distance combinations with mean significant increases compared to baseline conditions.
Site distances from potential development area consist of Near (0–100 m), Far (100–1,000 m), or Reference (>1,000 m) sites. Solid points show yearly sample concentration values. The black dotted line shows the current year's minimum detection limit (0.05 mg/kg).

Zinc (Zn) — Table 9-27 summarizes net changes in lichen-Zn concentrations (i.e., comparing 2019, 2020, and 2022 values with baseline conditions) across Project areas and sampling distances. Table 9-28 provides a further breakdown of lichen-Zn concentrations in relation to the RDL and applicable lichen indicator value. Figure 9-33 illustrates the distribution of lichen-Zn concentrations at the Project (2019, 2020, and 2022 values), while Figure 9-34 shows the regression analysis of the distribution of lichen-Zn concentrations. No significant increases in lichen-Zn concentrations were observed in any year. All values were below the lichen-Zn indicator value.

Table 9-27. The net change in lichen-zinc concentrations in 2022.

Project Area	Near (0–100 m)				Far (100–1,000 m)				Reference (>1,000 m)			
	Baseline	2019	2020	2022	Baseline	2019	2020	2022	Baseline	2019	2020	2022
Mine Site												
Milne Port												
Tote Road												

Gray = No change from baseline.

Table 9-28. Mean lichen-zinc concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Mine Site	Near	Baseline[1]	12	0.2	0.00	14.27	14.25	5.10	10.80	20.40	75	0
		2019	11	0.5	0.00	17.74	17.60	5.85	13.30	25.50	75	0
		2020	9	0.5	0.00	16.73	15.80	1.40	12.50	29.40	75	0
		2022	10	0.5	0.00	18.32	18.85	6.30	13.80	24.80	75	0
	Far	Baseline	4	0.2	0.00	11.18	10.65	3.93	9.08	15.50	75	0
		2019	4	0.5	0.00	14.99	14.25	4.53	12.30	20.50	75	0
		2020	11	0.5	0.00	15.72	16.00	4.60	10.10	22.10	75	0
		2022	11	0.5	0.00	18.65	18.80	3.45	14.50	24.30	75	0
	Reference	Baseline	13	0.2	0.00	17.08	18.00	5.40	9.82	29.10	75	0
		2019	5	0.5	0.00	19.12	19.00	4.20	13.70	27.50	75	0
		2020	4	0.5	0.00	25.00	27.60	10.70	14.40	36.20	75	0
		2022	4	0.5	0.00	24.77	29.40	5.43	13.00	33.50	75	0
Milne Port	Near	Baseline	13	0.2	0.00	10.34	10.40	2.60	7.16	16.20	75	0
		2019	10	0.5	0.00	9.49	9.29	1.37	7.97	11.60	75	0
		2020	10	0.5	0.00	10.03	9.89	1.80	7.92	13.50	75	0
		2022	10	0.5	0.00	12.95	13.25	2.80	10.90	14.70	75	0
	Far	Baseline	4	0.2	0.00	9.90	10.65	1.35	7.70	11.00	75	0
		2019	3	0.5	0.00	7.51	7.90	1.09	6.32	8.49	75	0
		2020	5	0.5	0.00	8.49	8.99	1.59	6.41	9.94	75	0
		2022	6	0.5	0.00	10.97	10.85	1.97	9.09	12.90	75	0
	Reference	Baseline	3	0.2	0.00	11.30	12.10	1.65	9.40	12.70	75	0
		2019	4	0.5	0.00	8.44	8.28	2.21	6.37	11.70	75	0
		2020	3	0.5	0.00	9.17	9.41	1.52	7.67	10.70	75	0
		2022	4	0.5	0.00	9.94	9.39	1.14	8.85	12.50	75	0

Table 9-28. Mean lichen-zinc concentrations (mg/kg) in 2022.

Area	Distance from PDA	Sampling Period	n[2]	RDL	Below RDL[3] (%)	Mean	Median	Inter-quartile Range	Min	Max	Indicator Value[4]	Above Indicator Value[4] (%)
Tote Road	Near	Baseline	14	0.2	0.00	16.74	17.95	3.38	8.57	28.80	75	0
		2019	12	0.5	0.00	19.78	20.70	4.73	14.40	24.30	75	0
		2020	10	0.5	0.00	16.90	17.50	6.33	12.60	21.40	75	0
		2022	7	0.5	0.00	21.29	22.70	5.15	16.20	27.10	75	0
	Far	Baseline	9	0.2	0.00	12.96	12.30	3.10	7.14	33.20	75	0
		2019	4	0.5	0.00	16.38	17.10	3.98	12.20	20.30	75	0
		2020	4	0.5	0.00	16.27	17.05	3.95	10.30	23.40	75	0
		2022	5	0.5	0.00	20.02	20.10	10.20	14.40	28.50	75	0
	Reference	Baseline	11	0.2	0.00	13.80	15.30	5.15	6.47	20.60	75	0
		2019	4	0.5	0.00	13.40	13.21	8.72	8.76	22.70	75	0
		2020	3	0.5	0.00	17.26	20.60	7.58	9.94	25.10	75	0
		2022	4	0.5	0.00	23.05	25.65	9.40	14.30	30.60	75	0

Notes: PDA = Potential Development Area; RDL = laboratory detection limit.

[1] Baseline = baseline sampling during pre-construction for all years up to and including 2016.

[2] Number of sample sites.

[3] The percent of samples below the RDL is only comparable between years with the same RDL.

[4] The indicator value is a metal concentration (mg/kg dry weight) selected from the best available scientific research for a similar or related lichen species and metal/metalloid, which may signal a change in vegetation health, such as reduced vigour or growth.

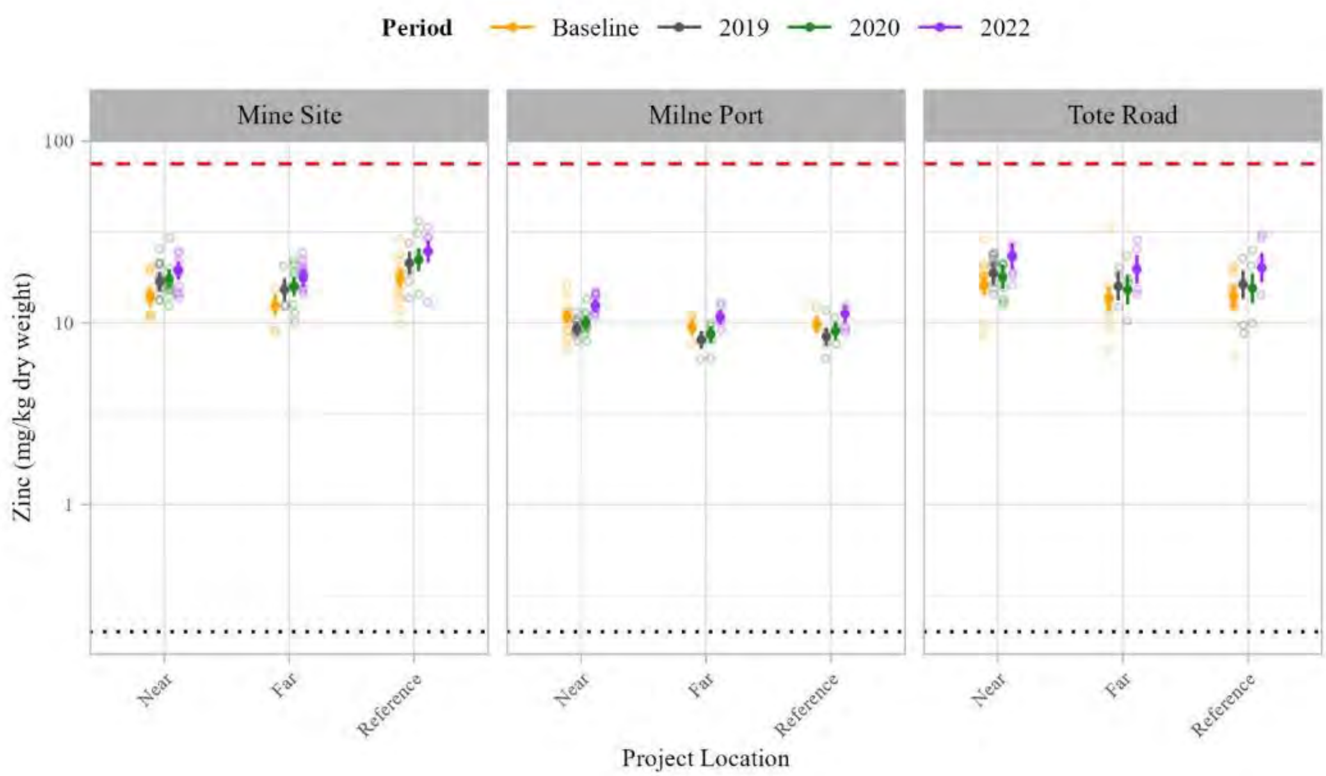


Figure 9-33. Distribution of lichen-zinc concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. Project location refers to the distance from the potential development area (Near: 0–100 m, Far: >100–1,000 m, and Reference: >1,000 m). Solid points with error bars show means (± 95% confidence interval) and open circles show individual sample values. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the lichen indicator value (75 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.5 mg/kg).

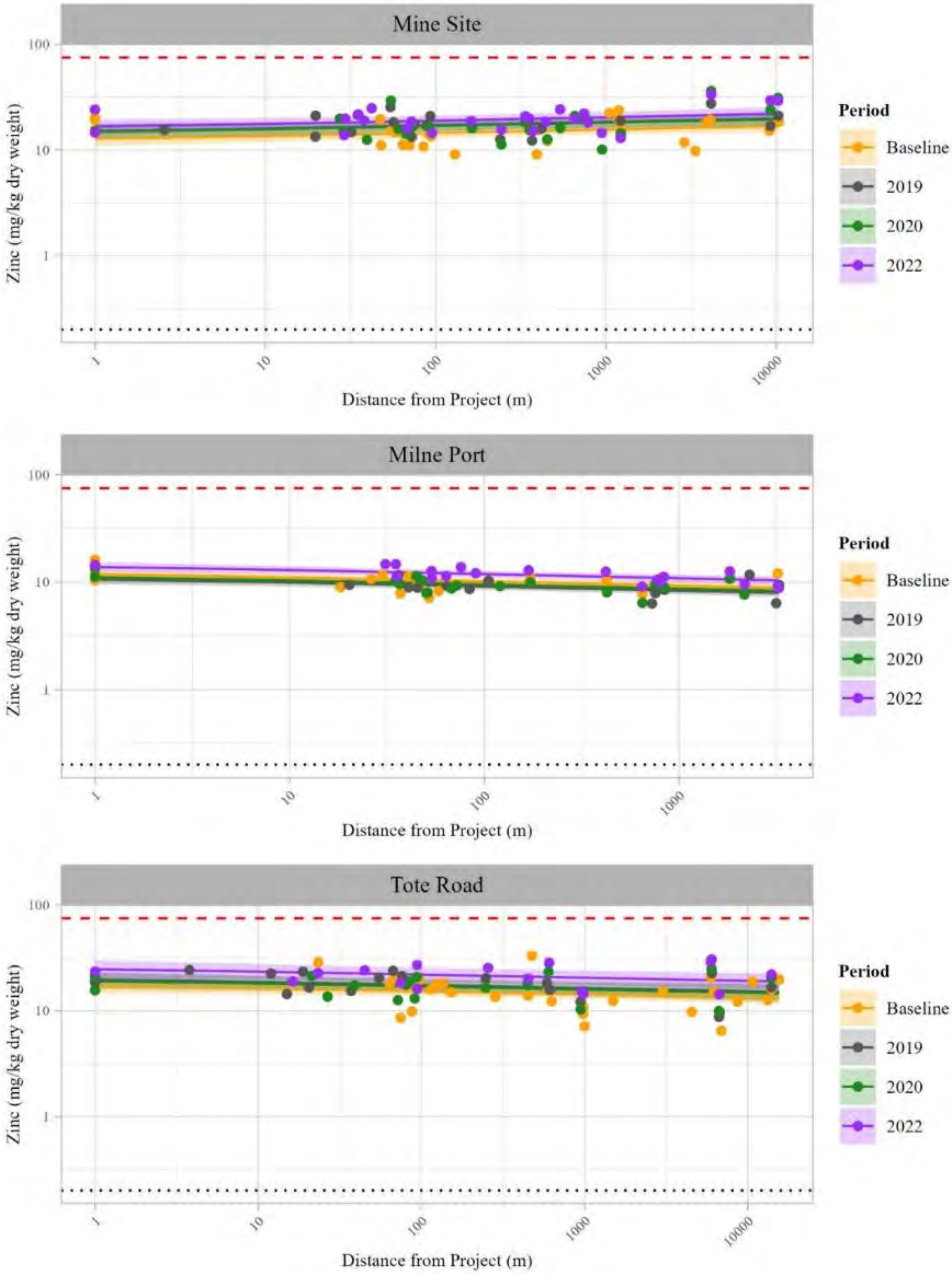


Figure 9-34. Regression analysis of the distribution of lichen-zinc concentrations in 2022.
Baseline years consist of 2012 to 2016 inclusive. The solid line shows mean concentrations and the shaded area is the 95% confidence region. Concentrations below the detection limit are displayed as half the corresponding year's detection limit. The red dashed line shows the lichen indicator value (75 mg/kg) and the black dotted line shows the current year's minimum detection limit (0.5 mg/kg).

9.1.2.3 Dust-deposited Metals on Lichen

The following paragraphs summarize analysis of dust-deposited metals on lichen calculated as indexes from concentrations of CoPCs from washed and unwashed samples. The intention is to better understand potential metal uptake pathways, differentiating metal uptake and sequestration (i.e., internalization) versus surficial deposition and surface metal binding. Overall, the concentrations of dust-deposited metals on lichen did not differ for any Project area-sampling distance combinations for any CoPCs except for As near the Mine Site. No unifying trend has been drawn from the analysis.

As — Mean dust-deposited As from sites near the Mine Site was 0.019 mg/kg (CI = 0.009 to 0.030), which was statistically different from zero (p=0.02). Mean dust-deposited As from all other Project area and sampling distance combinations were not statistically different from zero (Mine Site-Far: p=1; Mine Site-Reference: p=0.11; Milne Port: p=1; and Tote Road: p=1).

Cd — No statistical difference in dust-deposited Cd on lichen occurred for any Project area and sampling distance combinations (Mine Site: p=1; Milne Port: p=1; Tote Road-Near: p=0.21; and Tote Road-Far and Tote Road-Reference: p=1).

Cu — No statistical difference in dust-deposited Cu on lichen occurred for any Project area and sampling distance combinations (Mine Site-Near: p=0.07; Mine Site-Far and Mine Site-Reference: p=1; Milne Port: p=1; Tote Road-Near: p=0.34; and Tote Road-Far and Tote Road-Reference: p=1).

Pb — No statistical difference in dust-deposited Pb on lichen occurred for any Project area and sampling distance combinations (Mine Site: p=1; Milne Port: p=1; Tote Road-Near and Tote Road-Reference: p=1; and Tote Road-Far: p=0.85).

Se — No statistical difference in dust-deposited Se on lichen occurred for any Project area and sampling distance combinations (Mine Site: p=1; Milne Port: p=1; and Tote Road: p=1).

Zn — No statistical difference in dust-deposited Zn on lichen occurred for any Project area and sampling distance combinations (Mine Site: p=1; Milne Port-Near: p=0.68; Milne Port-Far: p=0.26; Milne Port-Reference: p=1; and Tote Road: p=1).

9.1.2.4 Relationship Between Metals in Dustfall Versus Soil-metals and Lichen-metals

The following subsections summarize analysis of the potential relationship between metals in dustfall versus soil-metals and lichen-metals, focussing on CoPCs. A summary of the statistical analyses is provided in Appendix D.

Generally, there was a significant negative relationship between metal concentrations in dustfall and metal concentrations in soil for all CoPCs except Cd, and for all CoPCs this appeared to be mediated by a significant positive relationship with soil pH. However, no unifying trend has been drawn from the analysis. The relationship between metal concentrations in dustfall and metal concentrations in lichen was less cohesive for all CoPCs, and indicated a significant positive relationship for As, Cu, and Pb, which was mediated by a significant negative relationship with distance to the PDA (i.e., lichen-metal and dustfall concentrations decreased with increasing distance from the PDA). No relationship was observed for Cd, Se, and Zn.

As — Examination of the data identified significant relationships between soil-As concentration and both As-dustfall deposition ($F_{1,47} = 31.80$, $P < 0.001$) and soil pH ($F_{1,47} = 94.96$, $P < 0.001$). No potential three-way interaction was observed (Figure 9-35). Figure 9-36 illustrates significant relationships between lichen-As concentration and both As-dustfall deposition ($F_{1,53} = 12.23$, $P < 0.001$) and distance to the PDA ($F_{1,53} = 27.36$, $P < 0.001$). No potential three-way interaction was observed.

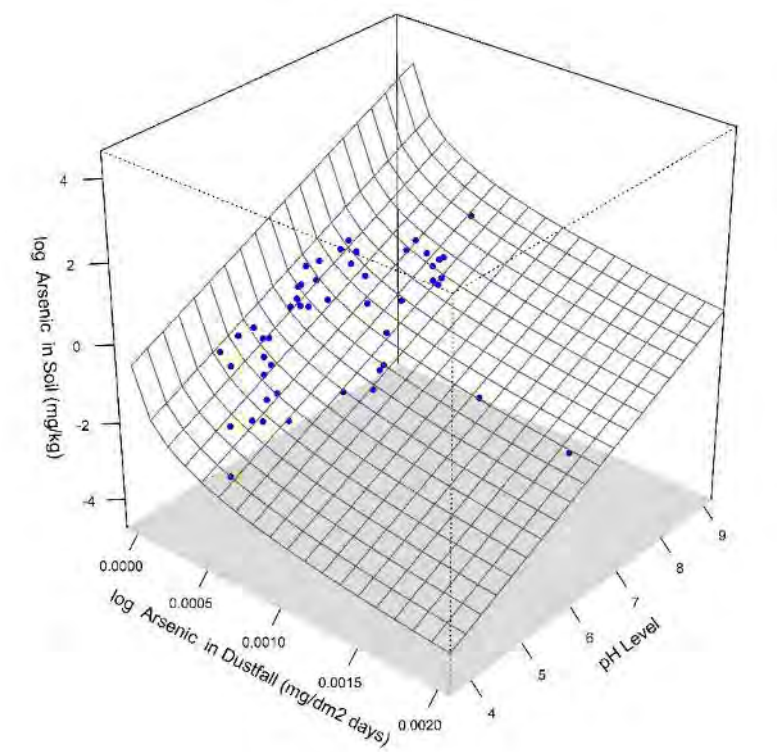


Figure 9-35. Relationship between As-dustfall deposition (mg/dm2 days), soil-As concentration (mg/kg), and soil pH.

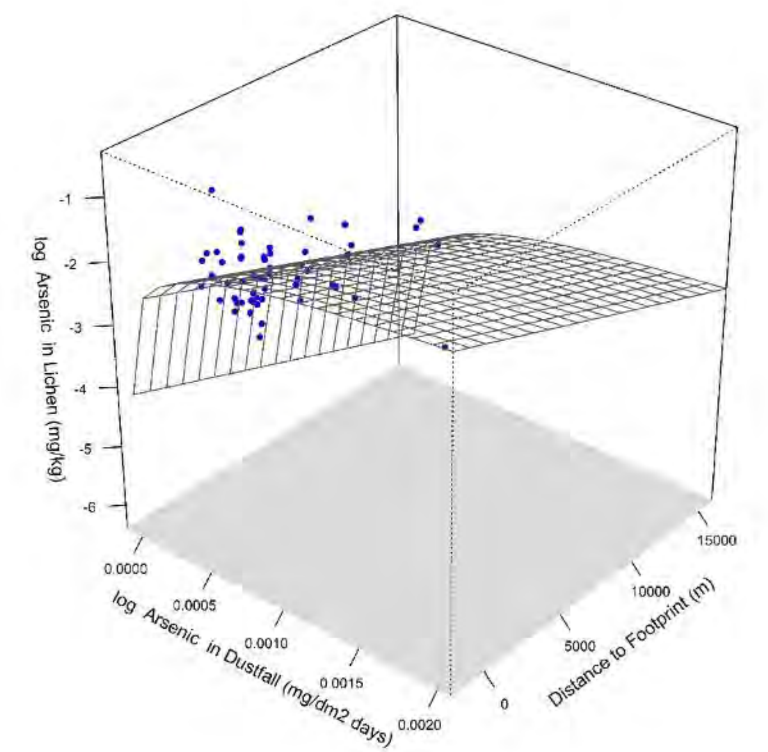


Figure 9-36. Relationship between As-dustfall deposition (mg/dm^2 days), lichen-As concentration (mg/kg), and distance to the Potential Development Area.

Cd — Examination of the data indicated no relationship between soil-Cd concentration and Cd-dustfall deposition ($F_{1,46}$ = 0.59, P = 0.44). A significant relationship was identified with soil pH ($F_{1,46}$ = 14.45, $P < 0.001$). No potential three-way interaction was observed (Figure 9-37). Figure 9-38 illustrates no relationship between lichen-Cd concentration and both Cd-dustfall deposition ($F_{1,54}$ = 0.48, P = 0.49) and distance to the PDA ($F_{1,53}$ = 1.11, P =0.30). No potential three-way interaction was observed.

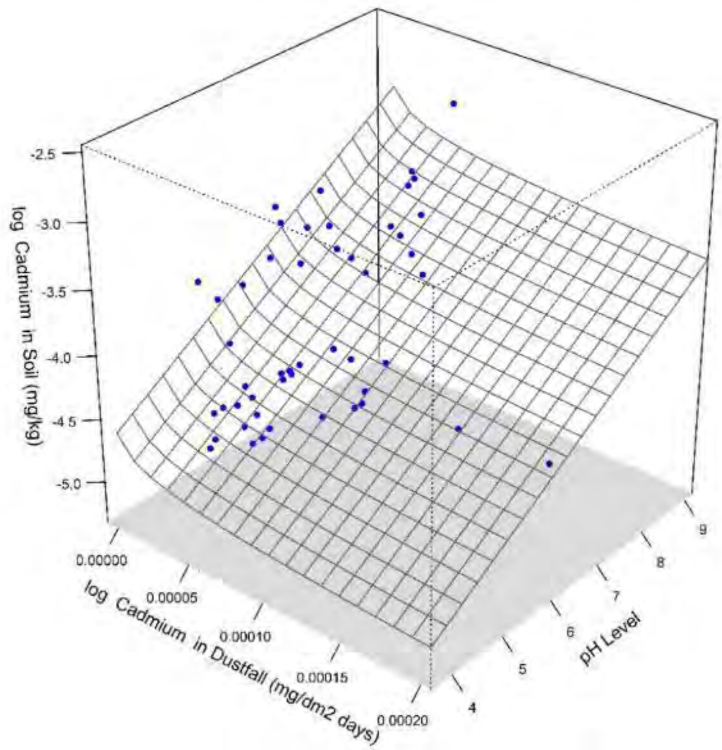


Figure 9-37. Relationship between Cd-dustfall deposition (mg/dm2 days), soil-Cd concentration (mg/kg), and soil pH.

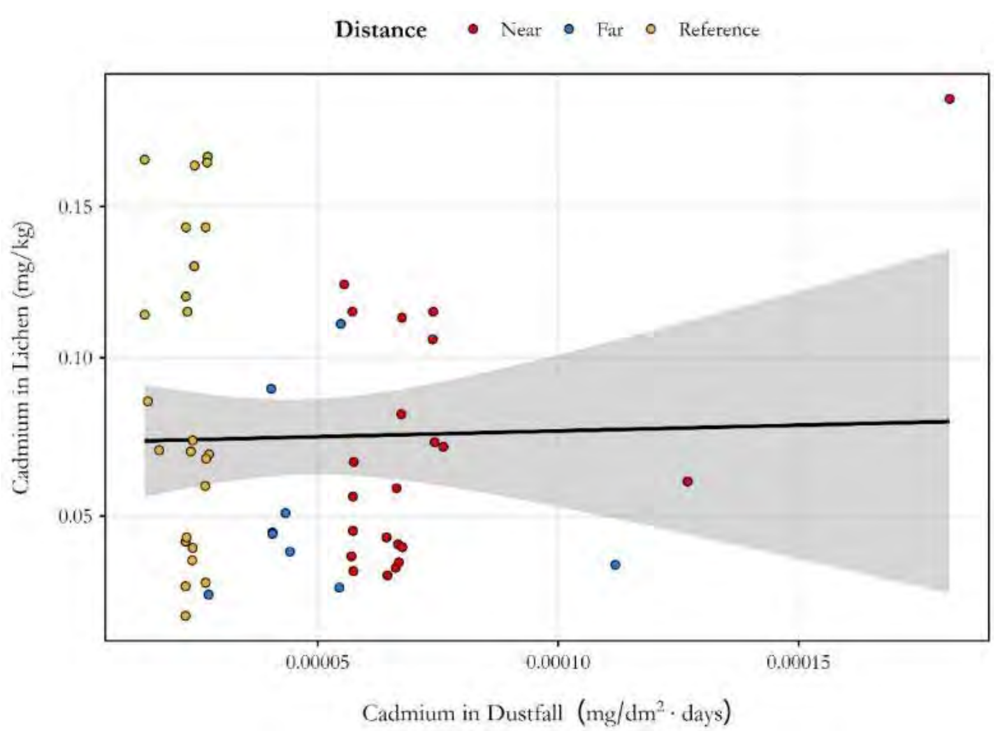


Figure 9-38. Relationship between Cd-dustfall deposition (mg/dm² days) and lichen-Cd concentration (mg/kg).

Cu — Examination of the data identified significant relationships between soil-Cu concentration and both Cu-dustfall deposition ($F_{1,46} = 23.28$, $P < 0.001$) and soil pH ($F_{1,46} = 35.73$, $P < 0.001$). No potential three-way interaction was observed (Figure 9-39). Figure 9-40 illustrates significant relationships between lichen-Cu concentration and both Cu-dustfall deposition ($F_{1,52} = 14.64$, $P < 0.001$) and distance to the PDA ($F_{1,52} = 7.80$, $P = 0.007$). A potential interaction between Cu-dustfall deposition and distance from the PDA was also observed ($F_{1,52} = 5.58$, $P = 0.02$).

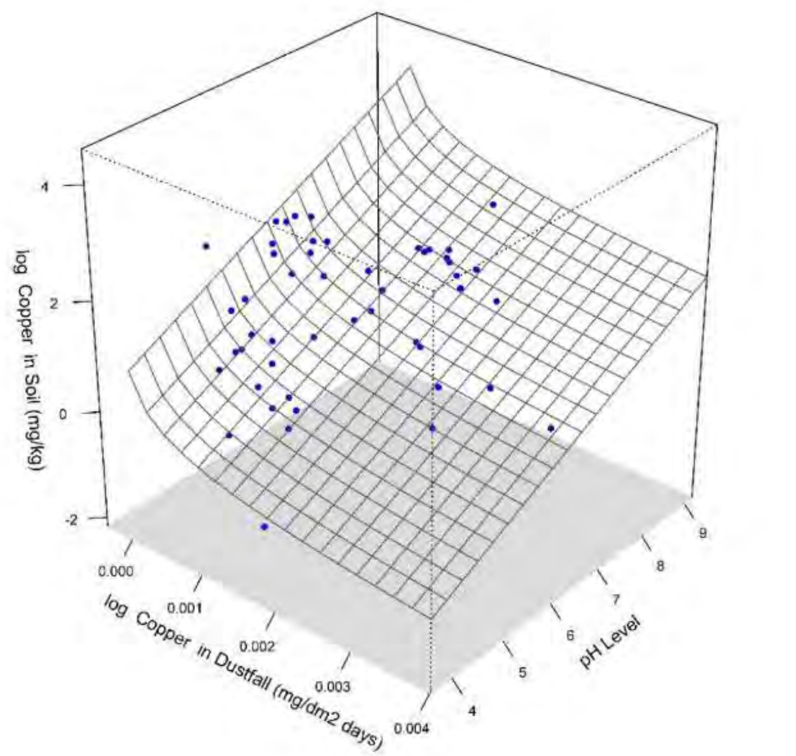


Figure 9-39. Relationship between Cu-dustfall deposition (mg/dm² days), soil-Cu concentration (mg/kg), and soil pH.

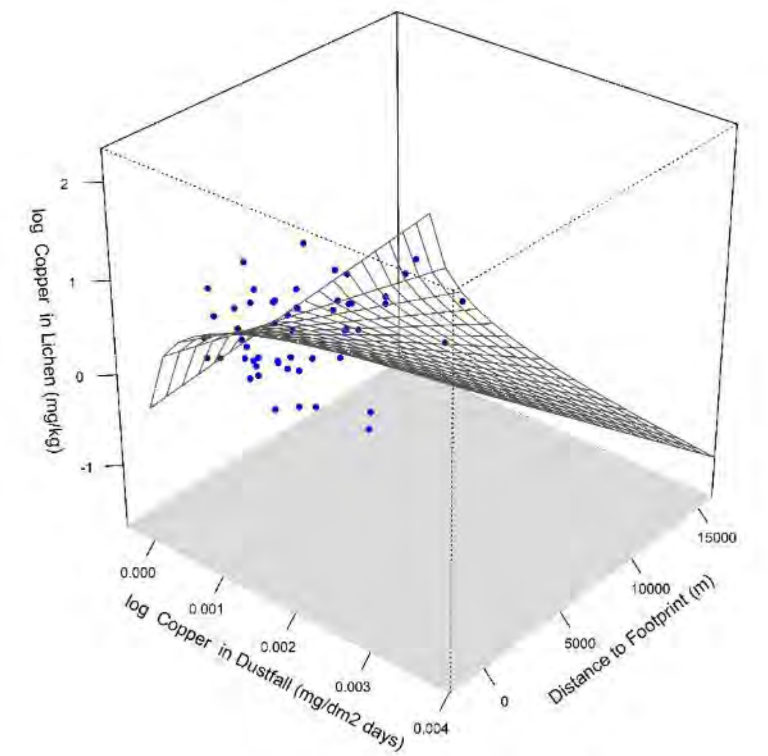


Figure 9-40. **Relationship between Cu-dustfall deposition (mg/dm² days), lichen-Cu concentration (mg/kg), and distance to the Potential Development Area.**

Pb — Examination of the data identified significant relationships between soil-Pb concentration and both Pb-dustfall deposition ($F_{1,44} = 9.08$, $P = 0.004$) and soil pH ($F_{1,44} = 26.78$, $P < 0.001$). No potential three-way interaction was observed (Figure 9-41). Figure 9-42 illustrates a significant relationship between lichen-Pb concentration and Pb-dustfall deposition ($F_{1,50} = 80.59$, $P < 0.001$) and a potential relationship with distance to the PDA ($F_{1,50} = 5.10$, $P = 0.03$). A potential interaction between Pb-dustfall deposition and distance to the PDA was also observed ($F_{1,50} = 4.10$, $P = 0.048$).

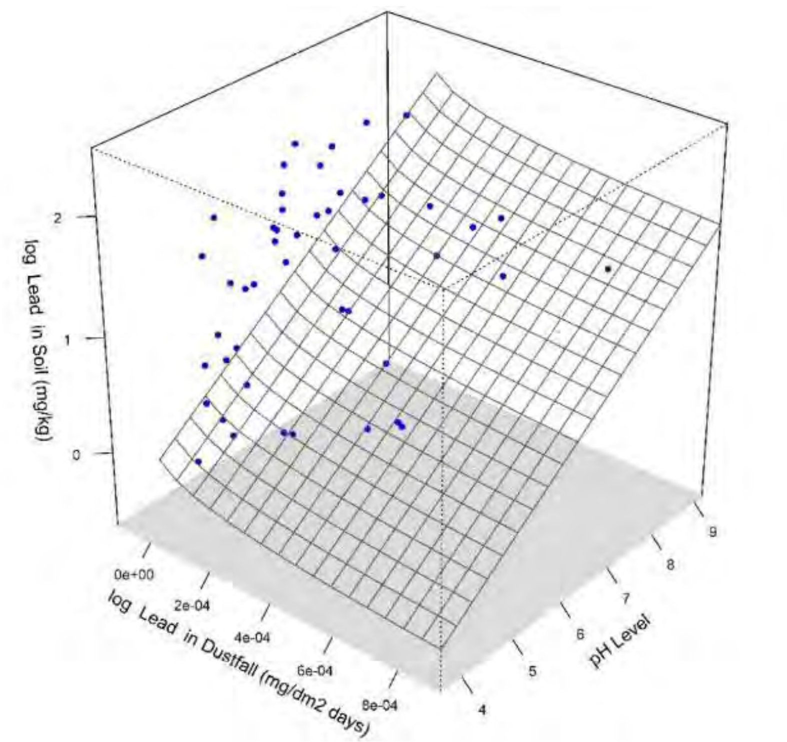


Figure 9-41. **Relationship between Pb-dustfall deposition (mg/dm2 days), soil-Pb concentration (mg/kg), and soil pH.**

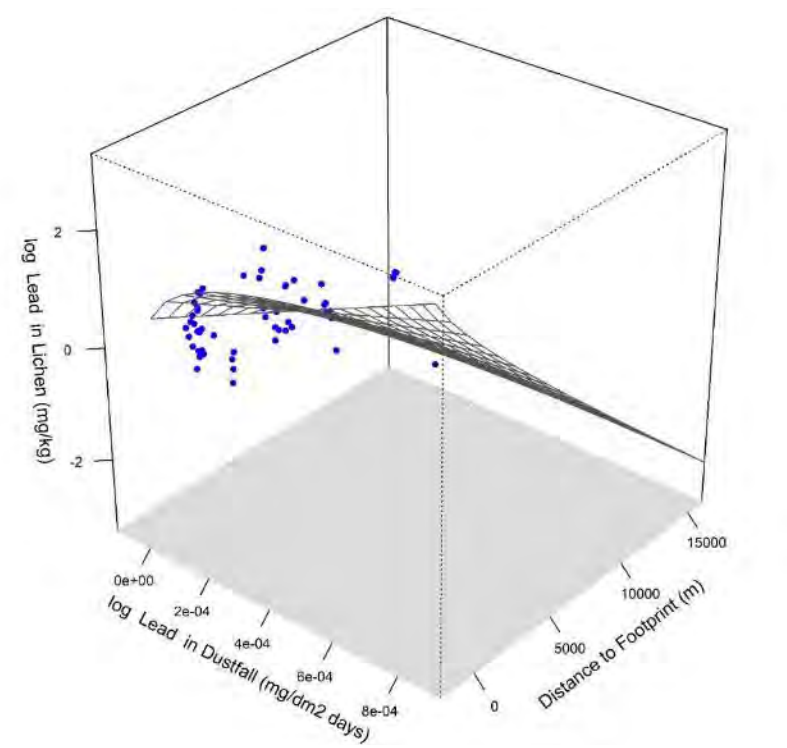


Figure 9-42. **Relationship between Pb-dustfall deposition (mg/dm^2 days), lichen-Pb concentration (mg/kg), and distance to the Potential Development Area.**

Se — Data for Se-dustfall deposition and soil-Se concentration were below or near the detection limit. This resulted in a truncated dataset that did not meet the assumptions of parametric analysis. No apparent trends were identified (Figure 9-43) and no formal analyses were completed. Figure 9-44 illustrates no relationship between lichen-Se concentration and both Se-dustfall deposition ($F_{1,54} = 1.77$, $P = 0.19$) and distance to the PDA ($F_{1,53} = 0.007$, $P = 0.93$). No potential three-way interaction was observed.

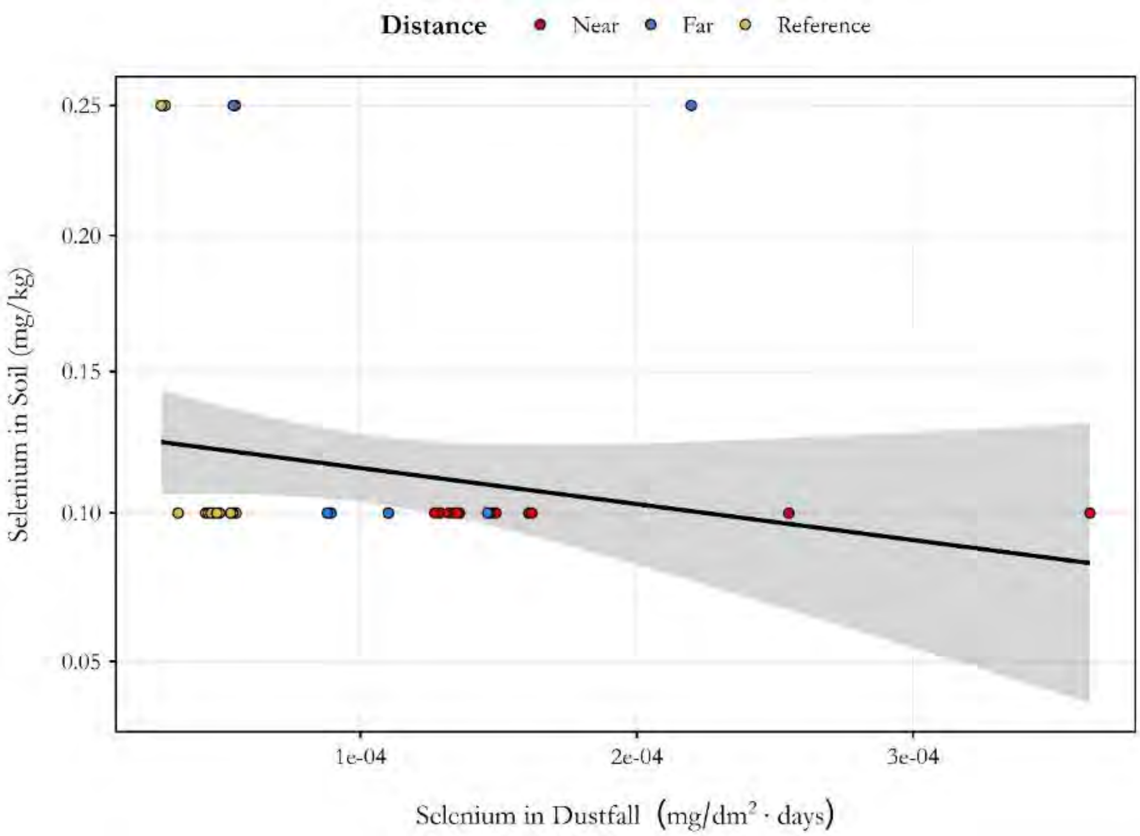


Figure 9-43. Relationship between Se-dustfall deposition (mg/dm² days) and soil-Se concentration (mg/kg).

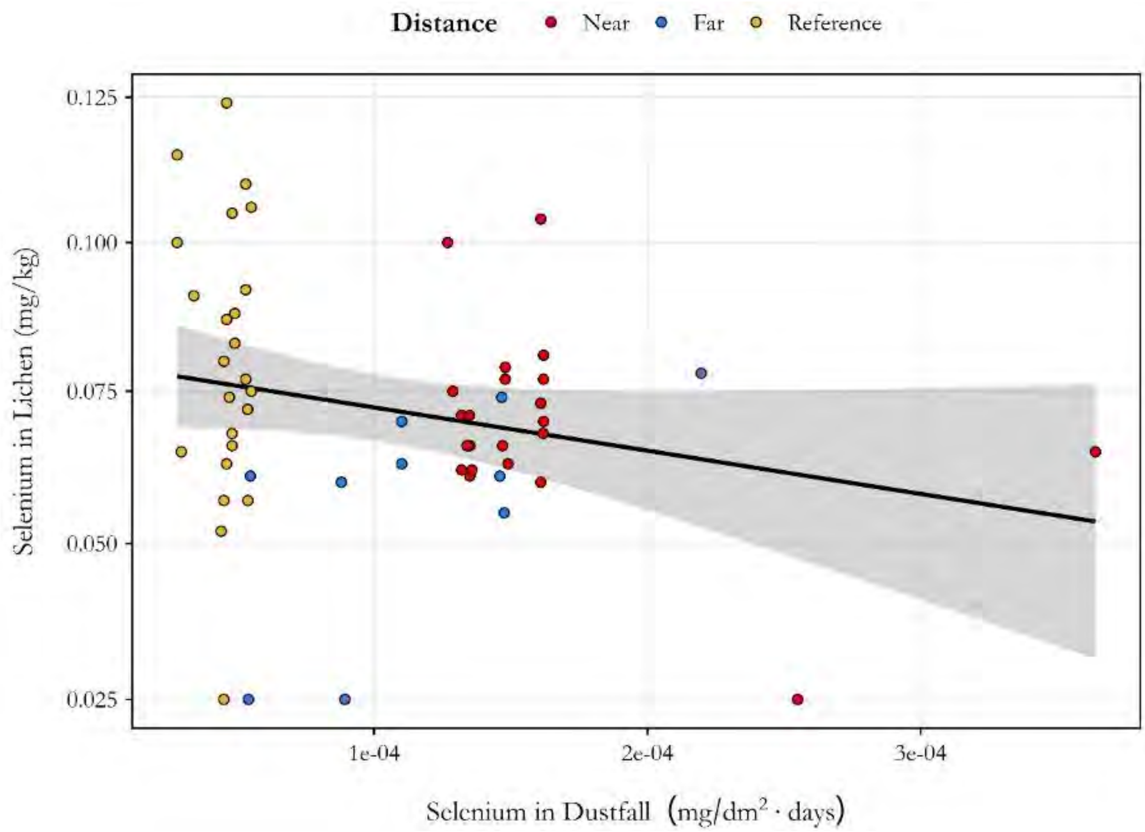


Figure 9-44. Relationship between Se-dustfall deposition (mg/dm² days) and lichen-Se concentration (mg/kg).

Zn — Examination of the data identified significant relationships between soil-Zn concentration and both Zn-dustfall deposition ($F_{1,45} = 9.03$, $P = 0.004$) and soil pH ($F_{1,45} = 20.87$, $P < 0.001$). No potential three-way interaction was observed (Figure 9-45). Figure 9-46 illustrates no relationship between lichen-Zn concentration and both Zn-dustfall deposition ($F_{1,53} = 0.03$, $P = 0.87$) and distance to the PDA ($F_{1,53} = 0.22$, $P = 0.18$). No potential three-way interaction was observed.

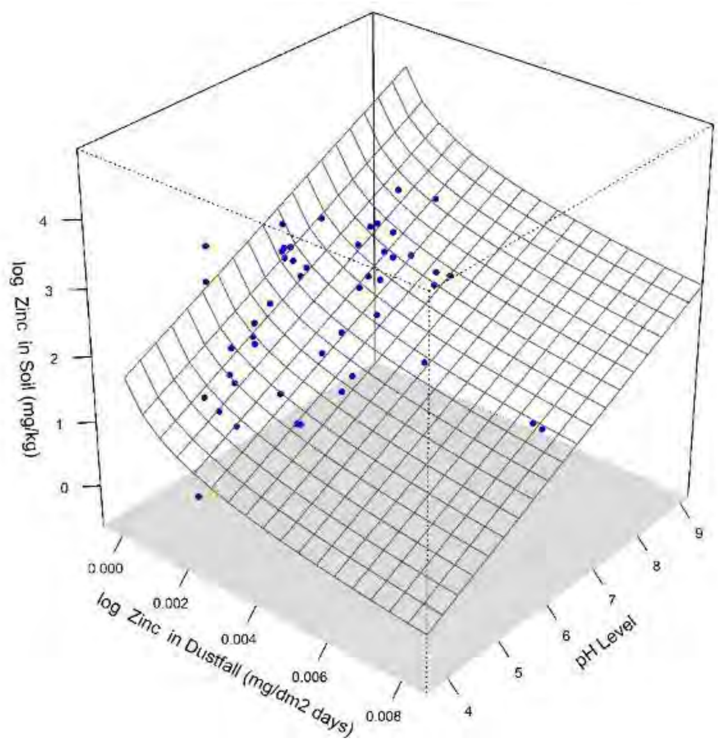


Figure 9-45. Relationship between Zn-dustfall deposition (mg/dm2 days), soil-Zn concentration (mg/kg), and soil pH.

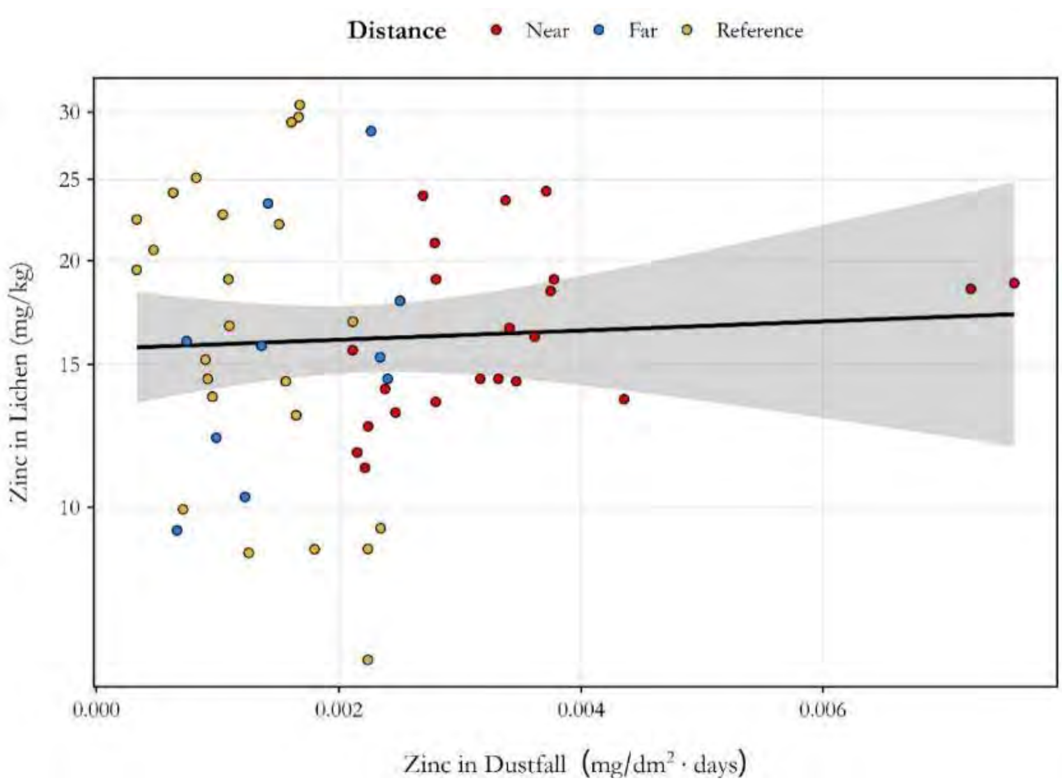


Figure 9-46 Relationship between Zn-dustfall deposition (mg/dm² days) and lichen-Zn concentration (mg/kg).

9.2 VEGETATION SUMMARY

Soil-metal Concentrations — Soil-metal concentrations at the Project predominantly indicated no significant change or were significantly lower in relation to baseline values. Values were below or within an acceptable range for soil-metal concentrations.

Lichen-metal Concentrations — Many mean lichen-metals concentrations across Project areas and sample distances showed no significant changes in relation to baseline values. However, some discrete increases in CoPCs in soil (i.e., copper, zinc) and lichen (i.e., arsenic, cadmium, copper, lead, selenium) were recorded at the Mine Site, Milne Port and along the Tote Road, with some individual values at or above indicator values. Whereas some increases and exceedances were attributed to occasional 'spikes' in metal concentration and sample variability, other increases in CoPCs appear to be due to proximity to Project operations. Should these values continue to increase or result in continued (year-over-year) exceedances of threshold values, it may be necessary to re-evaluate and refine potential triggers and corrective actions.

Dust-deposited Metals on Lichen — Concentrations of dust-deposited metals on lichen did not differ for any Project area-sampling distance combinations for any CoPCs, except for As near the Mine Site. No unifying trend has been drawn from the analysis.

Relationship Between Metals in Dustfall versus Soil-metals and Lichen-metals — Generally, there was a significant negative relationship between metal concentrations in dustfall and metal concentrations in soil for all CoPCs except Cd. For all CoPCs, this appeared to be mediated by a significant positive relationship with soil pH. No unifying trend has been drawn from the analysis.

10 MAMMALS

Using multiple indicators and approaches, surveillance monitoring of mammals at the Mary River Project (the Project) is intended to better understand, predict, and mitigate potential mammal interactions within and/or near the Potential Development Area (PDA).

Caribou—a keystone species in the north Baffin Island ecosystem—is recognized as a key wildlife indicator because of its ecological and social significance. However, north Baffin caribou are currently at a low point in their 60 to 80-year population cycle (Government of Nunavut 2019), and caribou observations are recorded infrequently, incidentaly or during surveys. The current survey approaches and frequency are appropriate for low caribou densities; if/when caribou densities increase the frequency of survey will be increased correspondingly.

10.1 SNOW TRACK SURVEYS

The following Project Conditions (PCs) address concerns regarding potential caribou crossings of linear features (i.e., train or vehicle traffic) and constraining of wildlife movement across roadways (Nunavut Impact Review Board 2020):

- **PC #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."*
- **PC #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."*

To address these PCs, snow track surveys were conducted from March to November 2022. Surveys focussed on the surveillance of potential wildlife movement (including caribou and other species) near roadways and documentation of behavioural response to human activities near the Project.

10.1.1 METHODS

The purpose of snow track surveys is to monitor the patterns of movement and response of caribou and other wildlife to Project-related activities based on their observable tracks in proximity to roadways. Snow track surveys were conducted within 24 to 48 hours following a fresh snowfall. Surveys were led by two or three Baffinland Iron Mines Corporation (Baffinland) personnel along the Tote Road from a light truck at a speed of ~30 km/hr. If/when wildlife tracks were suspected, personnel would further investigate on-foot to confirm the identity of the species and follow the tracks (to or from the roadway) to document the patterns of movement, behaviour, and habitat use (if/where possible). The following information was recorded:

- geo-referencing (latitude and longitude) at the location of the tracks/wildlife crossing;
- species identity;
- number of distinct sets of tracks (i.e., group size);
- description of the pattern of movement (e.g., deflected, travelled along, or crossing the road);
- height of the snowbank measured at either the crossing point or likely point of deflection (i.e., the point where the animal redirected its path away from the road); and,
- site photo-documentation and other miscellaneous survey observations (if/where applicable).

Potential factors influencing the data capture and species identification may include deterioration of snow conditions (i.e., from sun or wind) and visibility for initial detection, all of which are noted during each survey and given a conditions score or poor (limited visibility), good (visibility adequate, some limitiations), or excellent (no limitations on visability).

10.1.2 RESULTS AND DISCUSSIONS

A total of 80 tracks were observed during four surveys after recent snowfall conducted between March and November 2022[15]. Of the total tracks recorded, 69 were deemed to be 'fresh tracks' belonging to Arctic fox (*Vulpes lagopus*), red fox (*Vulpes vulpes*), Arctic hare (*Lepus arcticus*), Ptarmigan (*Lagopus* sp.). Based on 2022 snow track survey results (Figure 10-1), 11% of recorded Ptarmigan, 33% of hare, and 5% of foxes deflected from the road, whereas 44% of Ptarmigan, 33% of hare, and 37% of foxes travelled along the Tote Road. The remaining 45% of Ptarmigan, 34% of hare, and 58% of foxes crossed the Tote Road. Overall, only 6% of tracks were recorded as deflections from the Tote Road.

Representative site survey conditions and observed tracks are shown in Photo 10-1 to Photo 10-4. Observed track locations of tracks and their heading in relation to the Tote Road are presented in Map 10-1. Snow track surveys will continue annually after snowfalls and will be conducted more frequently if/when caribou should be observed near the Project—to be informed by other monitoring inputs including HOL monitoring data, incidental monitoring data, and/or other observations.

March 22, 2022 — The survey was completed approximately 32 hours after a snowfall with excellent visibility, good tracking conditions, and mild winds for the survey duration. Snow cover was consistently high along the length of the Tote Road. Wind speeds recorded at the Project in the 12 hours leading up to the survey were light to moderate, about 6 km/h, which likely limited the snow's re-distribution after the snowfall, allowing for high confidence in detection and age estimation of observed tracks. Surveyors observed 29 fresh and distinct sets of tracks during the March survey. Fox tracks accounted for 24 of the total tracks, with two thirds occurring on the west side of the Tote Road. The remaining five tracks belonged to Ptarmigan that were predominantly located on the west side of the Tote Road (except for one). Of the 24 tracks, only three were

[15] On 22 March, 2 April, 22 October, and 9/10 November 2022.

observed to deflect from the Tote Road (two fox; one Ptarmigan); all other tracks were either travelling along or crossing the Tote Road. No signs of caribou or other mammal tracks were observed.

April 2, 2022 — The survey was completed approximately 28 hours after a snowfall with excellent visibility and tracking conditions, and moderate winds for the survey duration. Snow cover was consistently high along the length of the Tote Road. Surveyors observed 26 fresh, distinct sets of tracks during the April survey on both sides of the Tote Road; all but two were fox tracks, with Ptarmigan comprising the other sets of tracks. Both Ptarmigan tracks were observed crossing the Tote Road. Most of the fox tracks crossed the road, with no deflections noted. No signs of caribou or other mammal tracks were observed.

October 22, 2022 — The survey was completed approximately 24 hours after a snowfall with good visibility, good tracking conditions, and moderate winds for the survey duration. Snow cover was consistently high along the length of the Tote Road. Five fresh and distinct sets of fox tracks were observed, predominantly on the west side of the Tote Road (except for one). A single fox track was observed to deflect from the Tote Road, two travelled alongside and two crossed. No signs of caribou or other mammal tracks were observed.

November 9/10, 2022 — The survey was started approximately 36 hours after a snowfall, resulting in excellent tracking conditions with light winds. Surveyors observed 18 distinct sets of tracks with half of them considered as fresh. Five of the tracks were identified as fox, three were hare and one was a Ptarmigan. Only one set of hare tracks deflected from the Tote Road, all other species traveled along, or crossed the Tote Road. No signs of caribou or other mammal tracks were observed.

Inter-annual Trend — No caribou, wolf or other large mammal tracks were observed during snow tracking surveys conducted between 2014 and 2022. Species track composition was similar to previous years, but with a slight decline in overall numbers of hare and Ptarmigan and a large increase in fox tracks (Figure 10-2).

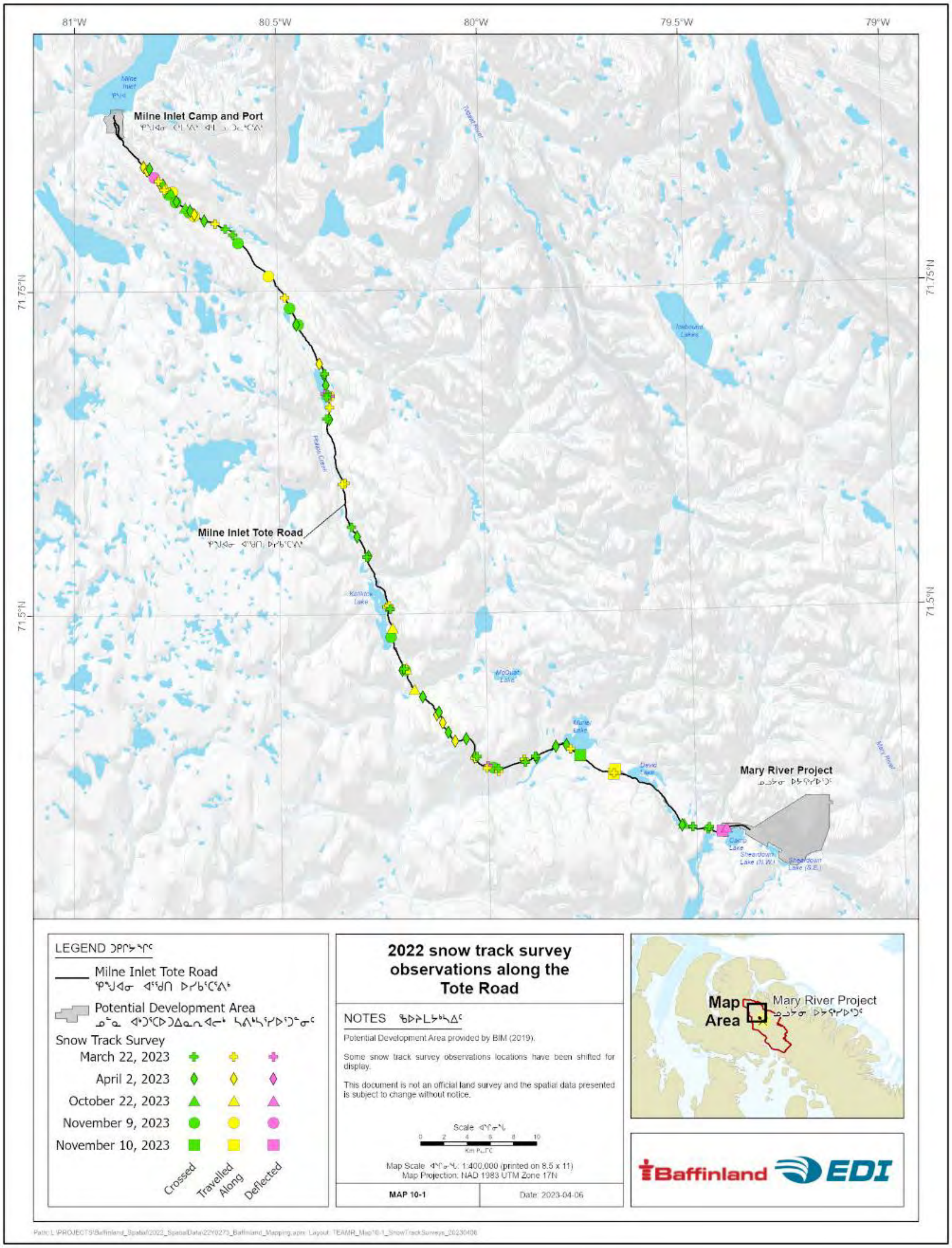

81°W
80.5°W
80°W
79.5°W
79°W
71.75°N
71.5°N
Milne Inlet Camp and Port
Milne Inlet Tote Road
Mary River Project
LEGEND
Milne Inlet Tote Road
Potential Development Area
Snow Track Survey
March 22, 2023
April 2, 2023
October 22, 2023
November 9, 2023
November 10, 2023
Crossed
Travelled Along
Deflected
2022 snow track survey observations along the Tote Road
NOTES
Potential Development Area provided by BIM (2019).
Some snow track survey observations locations have been shifted for display.
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
0 2 4 6 8 10
Km
Map Scale: 1:400,000 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N
MAP 10-1
Date: 2023-04-06
Map Area
Mary River Project
Baffinland
EDI

Photo 10-1. Fox track at KM 72.5 (March 22, 2022).

Photo 10-2. Ptarmigan track at KM 42 (March 22, 2022).

Photo 10-3. Fox track crossing the Tote Road at KM 12.5 (April 2, 2022).

Photo 10-4. Ptarmigan track deflecting from the Tote Road at KM 34 (March 22, 2022).

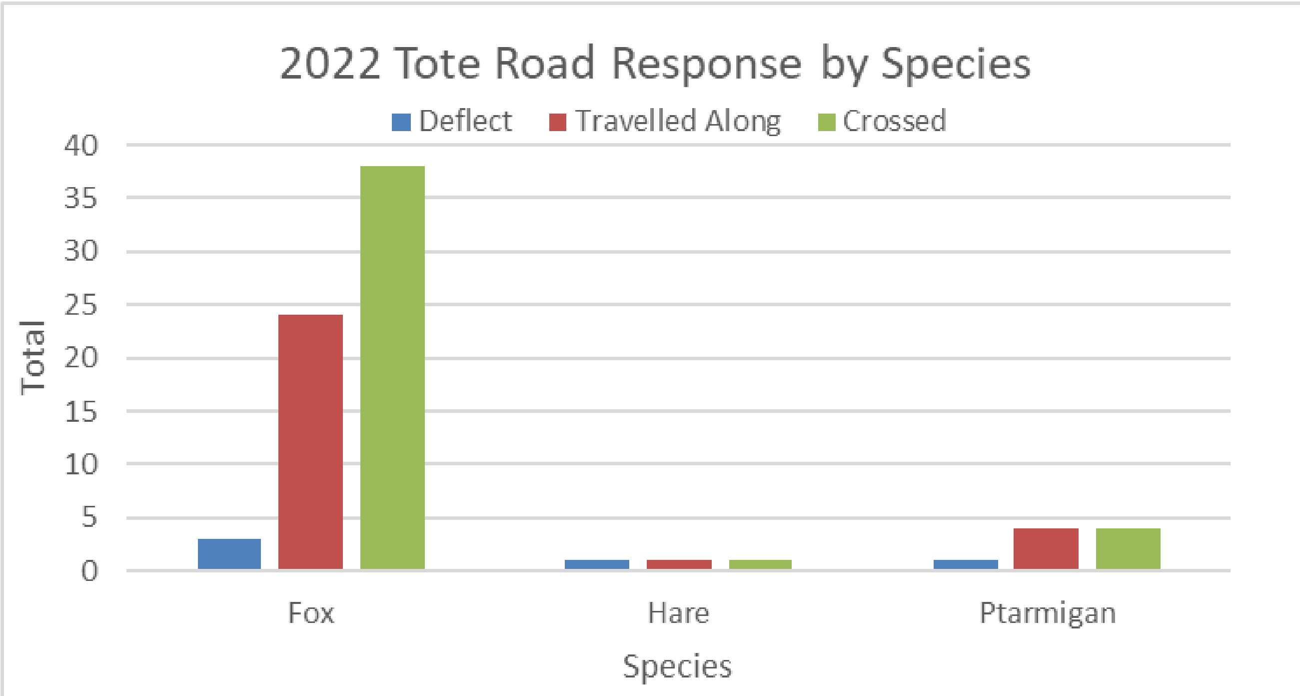


Figure 10-1. 2022 Tote Road snow track response based on species.

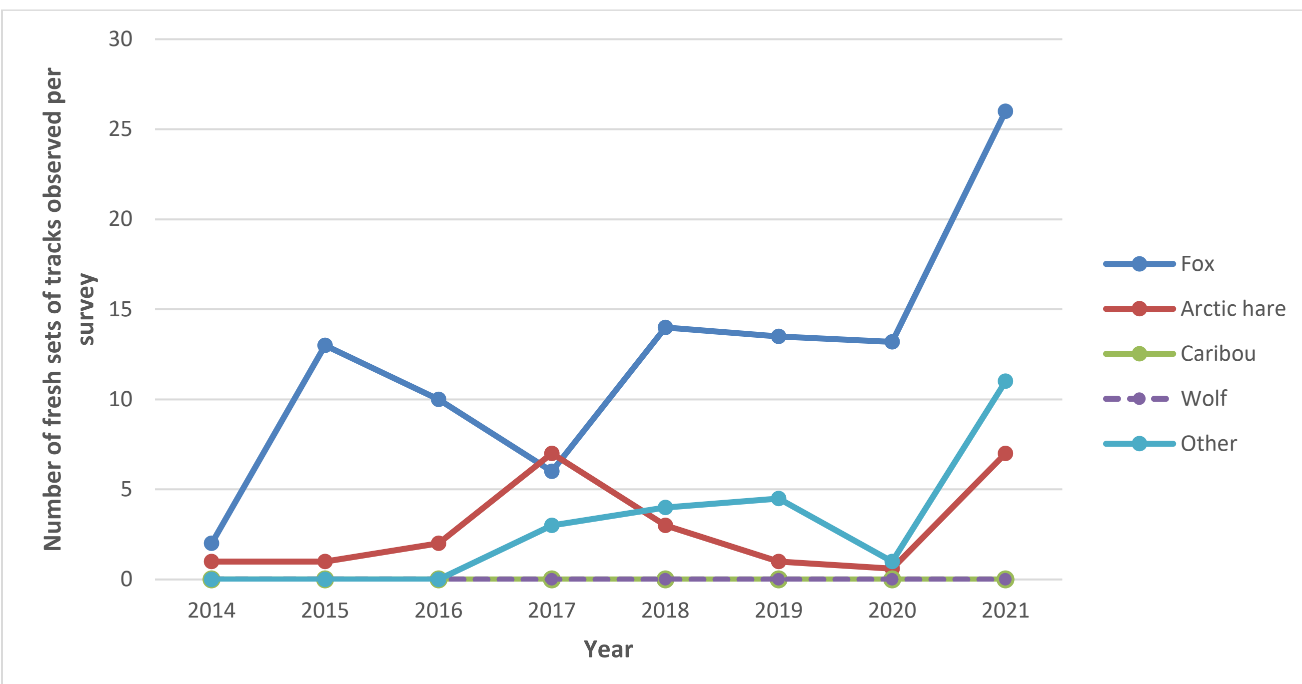


Figure 10-2. 2022 inter-annual trends — snow track survey (2014 to 2022).
"Fox" includes both red and arctic as it is difficult to distinguish based only on track. 'Other' species refer to Ptarmigan and small mammals such as lemmings and ermine.

10.2 SNOWBANK HEIGHT MONITORING

The following PCs address uncertainty in the Final Environmental Impact Statement (FEIS; Baffinland Iron Mines Corporation 2012) and Early Revenue Program (ERP) FEIS (Baffinland Iron Mines Corporation 2013a) concerning caribou movement (Nunavut Impact Review Board 2020):

- **PC #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."*
- **PC #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 PCs, Baffinland committed to various mitigation measures to facilitate effective caribou crossings of the Tote Road and reduce potential barriers to caribou movement. Mitigation measures include snowbank management by (1) maintaining the snowbank heights <100 cm along roadways and (2) smoothing/contouring the snowbanks on the edges of roadways to reduce the probability of drifting snow. These mitigations were designed to minimize obstacles to caribou crossing the transportation corridor and improve driver visibility to reduce potential wildlife-vehicle collisions. In conjunction with the snow track surveys (Section 10.1), snowbank height monitoring was implemented to verify that these mitigation measures are being applied to the Project.

10.2.1 METHODS

Snowbank height monitoring for 2022 was conducted monthly for one day in January, February, March, April, October, November, and December 2022. During each survey, Baffinland personnel measured snowbank heights at up to 50 randomized kilometre marker locations along the Tote Road (e.g., KM5.8, KM16, KM42), being mindful of safety and access[16]. In response to input from the Terrestrial Environment Working Group (TEWG), survey locations were regularly refreshed to eliminate potential survey biases, and better capture/verify snowbank conditions along the Tote Road. At each survey location, Baffinland personnel captured two snowbank height measurements (east- and west-side snowbanks), photo-documented site conditions and recorded any other relevant information (Photo 10-5 to Photo 10-7). Up to a total of 100 measurements were captured during each monitoring survey and deemed either 'compliant' (<100 cm) or 'non-compliant' (>100 cm).

10.2.2 RESULTS AND DISCUSSIONS

Snowbank measurements across all surveys ranged from 0 to 701 cm in height. Compliance of snowbank height ranged from 67 to 100% (per survey) and averaged 91% for all surveys combined (Table 10-1). Mean snowbank heights per survey typically ranged between 19 to 87 cm. Snowbank heights commonly increase

[16] Occasionally, measurements could not be recorded due to low visibility by ore haul truck drivers and/or high traffic at the given location. Safety concerns are the primary reason for not stopping at a survy location (i.e. narrow road that would not allow for vehicle to pull over and ore haul trucks to pass safely.

throughout winter because of cumulative snowfall. To reduce snowbank height and drifting, efforts are made to 'feather' (i.e., push back and redistribute) large snow piles after substantial snowfalls (Photo 10-7). Generally, snowbanks exceeding the 100 cm height threshold (Figure 10-3) were at locations where snow could not be adequately redistributed for safety and/or operational reasons (e.g., steep or uneven topography, constraining road segments).

Inter-annual Trend — Most snowbank height measurements between 2014 and 2022 complied with the 100 cm height limit. Compliance with snowbank height was similar for 2014 to 2016, and 2018 to 2022, ranging between 80% to 97%, with the 2017 measurements having the lowest overall compliance rate at 66% (Figure 10-4).

Table 10-1. 2022 Tote Road snowbank height monitoring.

Survey Date	Number of Measurements	Compliances	Exceedances	Percent Compliance
January 25, 2022	79	78	1	99%
February 14, 2022	82	79	3	96%
March 19, 2022	79	77	2	97%
April 18, 2022	83	77	6	93%
October 18, 2022	78	78	0	100%
November 9, 2022	86	73	13	85%
December 30, 2022[17]	81	54	27	67%
2022 Total	**568**	**516**	**52**	**91%**

[17] Reduced compliance likely a combined result of reduced capacity after Phase II NIRB decision, and increased frequency of snowstorms resulting in road closures and inability to clear snow and manage snowbanks.

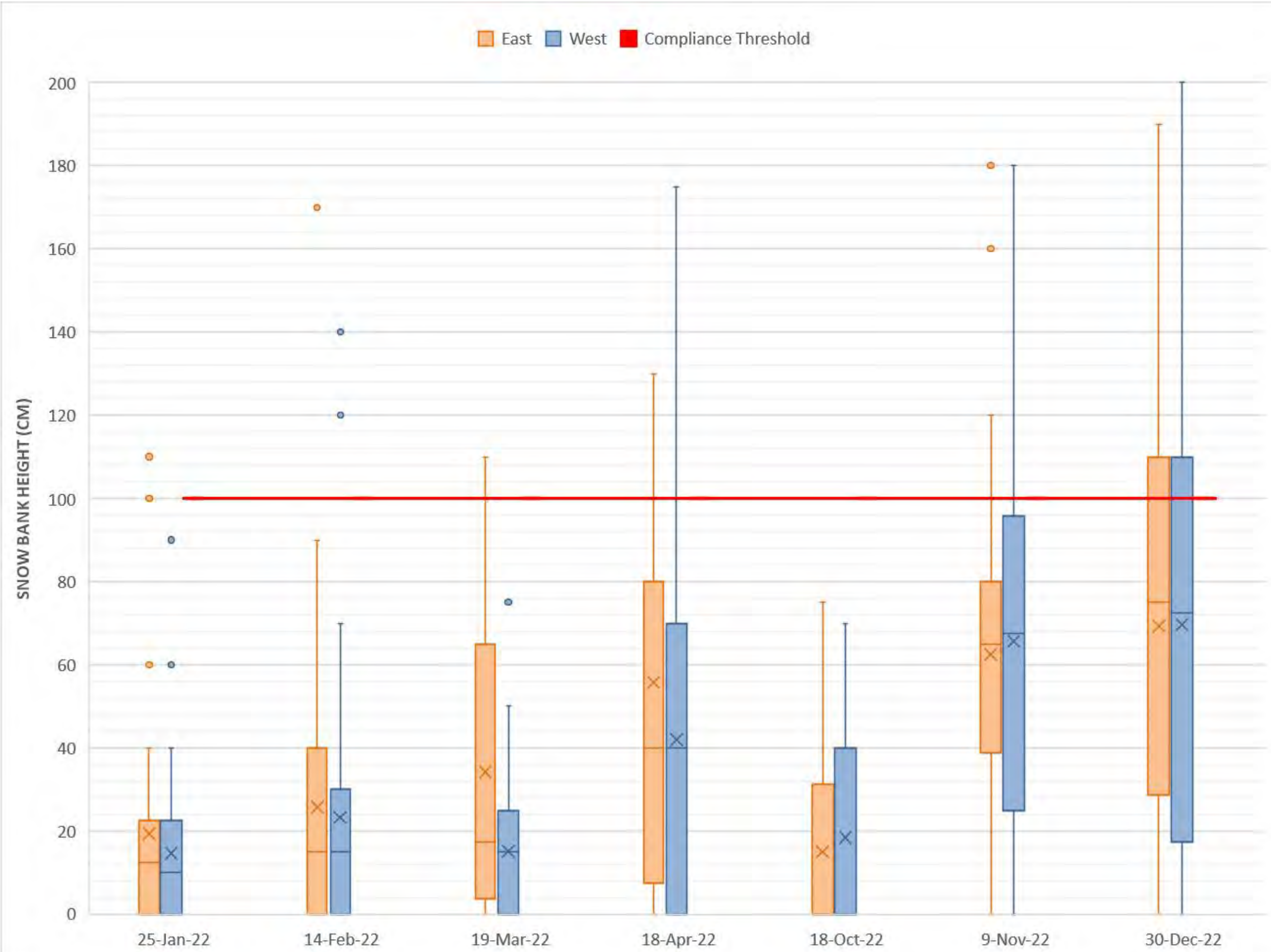


Figure 10-3. 2022 snowbank height monitoring time series and distribution for snowbank heights.
X represents the mean snowbank height for each survey. The horizontal line represents the median. The box represents the first and third quartiles. The whiskers represent the minimum and maximum values within 1.5 times the interquartile range.

Photo 10-5. Non-compliant snowbank (138cm) at KM 93 (February 14, 2022).

Photo 10-6. Compliant snowbank (9cm) at KM 55 with signs of snowbank management (feathering) on April 19, 2022.

Photo 10-7. Snowbank management (in progress) to facilitate wildlife crossing and improve driver visibility (December 27, 2021).

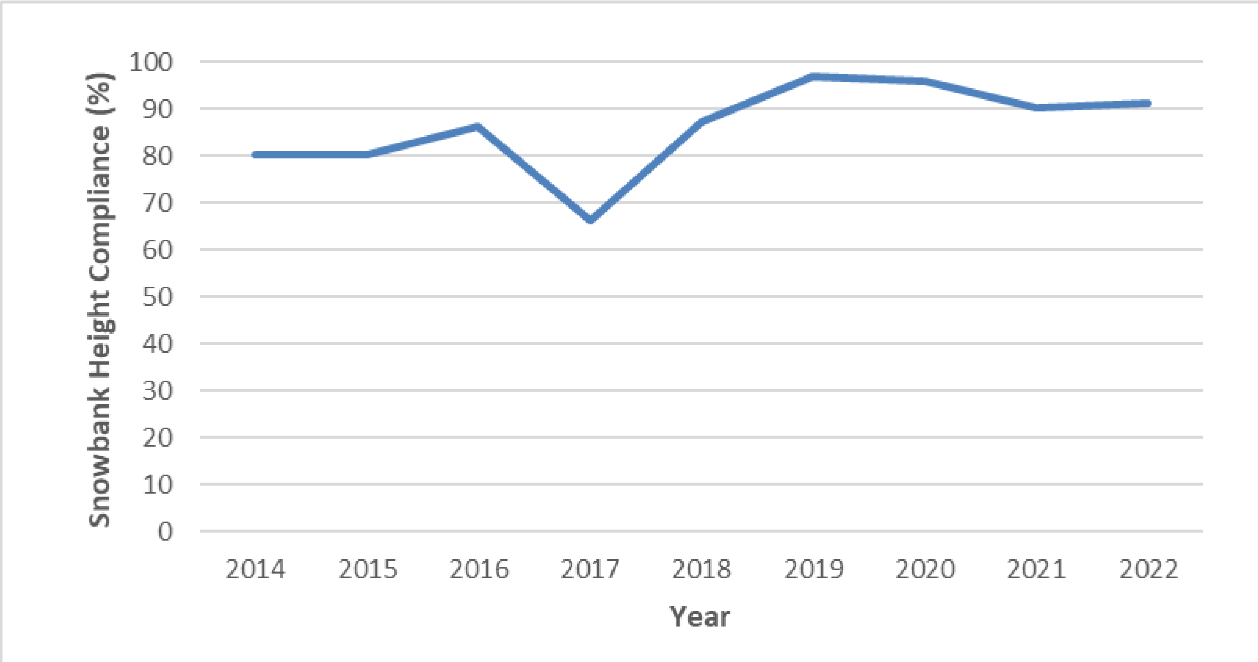


Figure 10-4. 2022 Inter-annual trends — snowbank height compliance monitoring (2014 to 2022).

10.3 HEIGHT OF LAND SURVEYS

The following PCs were developed to monitor and mitigate potential disturbance to caribou calving near or interacting with the Project (Nunavut Impact Review Board 2020):

- **PC #53b** *"Monitoring and mitigation measures at points where the railway, roads, trails, and flight paths pass through caribou calving areas, particularly during caribou calving times."*
- **PC #54b** *"Monitoring for caribou presence and behavior during railway and Tote Road construction."*
- **PC #58b** *"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."*

To address these PCs, HOL surveys were initiated in 2013 to study caribou habitat use and behavioural reactions to human activities near the Project footprint—particularly during the calving season (i.e., May and June). Behaviour sampling can provide insight into responses to environmental stimuli (Martin and Bateson 1993). The HOL surveys are intended to examine if/how caribou (especially cows with calves) respond to Project-related activities and infrastructure. North Baffin caribou are currently at a low point in their 60 to 80-year population cycle (Government of Nunavut 2019), and caribou observations during surveys or recorded incidentally are infrequent. The HOL surveys will support long-term surveillance monitoring of caribou behaviour throughout the life of the Project and provide information to verify predicted Project-related effects on caribou movement and habitat use.

10.3.1 METHODS

The HOL survey methods were developed in consultation with the TEWG (specifically the Mittimatalik Hunters and Trappers Organization [MHTO]) and incorporated Inuit Qaujimajatuqangit into strategies for detecting caribou (EDI Environmental Dynamics Inc. 2019). The HOL surveys comprise observations from a high point of land (i.e., to increase the observable area) for a prescribed amount of time using binoculars and a spotting scope. The objective is to detect and record caribou and their proximity to Project infrastructure. The 2022 HOL surveys were conducted in early summer (June 3 to 12, 2022) to observe caribou during the calving period; opportunistic late-winter surveys were not conducted in 2022.

Surveys were conducted at pre-established HOL stations (1 to 24) distributed throughout the Project footprint, typically at the highest points of the landscape, to optimize the viewshed (Map 10-2). Project components (e.g., the Tote Road, accommodation complexes, Deposit No. 1) were visible from each station; however, a 360-degree viewshed was seldom achieved due to obstruction from landscape/terrain. The locations of the stations were selected based on strategic positioning along the Project footprint, elevation gain (i.e., for improved viewshed), and accessibility during spring conditions. Since the initiation of HOL surveys, Stations 1 to 16 are generally accessed on foot, whereas Stations 17 to 24 are generally accessed via helicopter (e.g., due to waterbodies, terrain, and travel distances).

Two qualified biologists from EDI Environmental Dynamics Inc. (EDI) conducted the 2022 surveys with the participation of Baffinland personnel and two Inuit assistants. The survey procedure involved one observer scanning the viewshed with a spotting scope (i.e., focusing on the distant landscape) and three observers scanning the viewshed with binoculars (i.e., focusing on the intermediate and near landscape). EDI conducted a minimum of two surveys at each HOL station for at least 40 minutes per survey. Using digital, tablet-based forms, the following information was recorded:

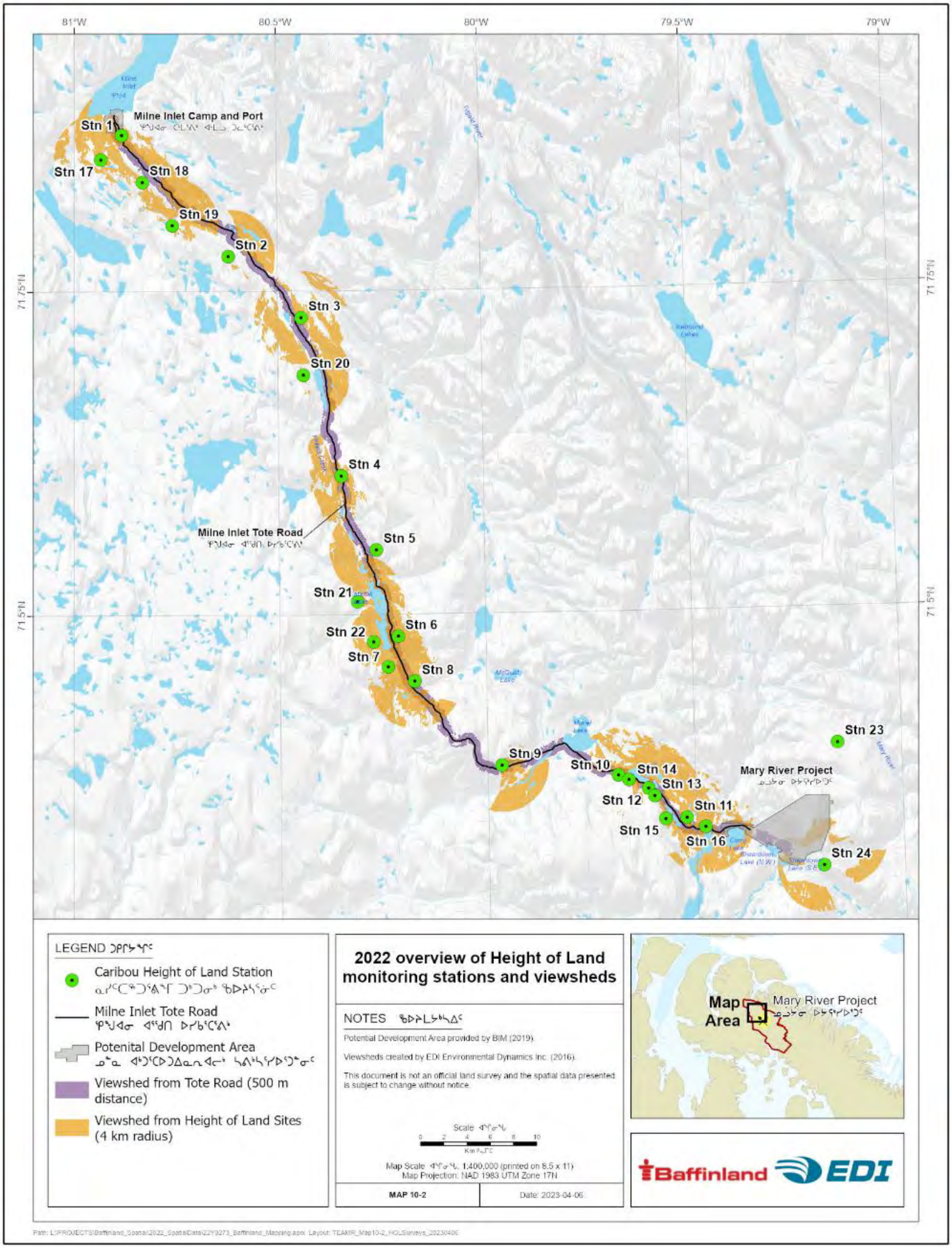
- station number (with georeferencing);
- location description (direction from road, aspect, terrain, other identifying features);
- general habitat description (vegetation and soil, if/where possible);
- presence of snow cover on landscape;
- photograph numbers (taken from multiple cardinal directions); and,
- survey observation timeframe (start/end times).

If caribou were observed, the survey team would monitor behaviour following established protocols described in the 2013 Annual Monitoring Report (Baffinland Iron Mines Corporation 2019). Depending on the number of caribou, observations would be made as either a focal or scan sample (Martin and Bateson 1993). Activity categories (e.g., walking, foraging, running, bedded) would be assigned and tallied at two-minute intervals for scan sampling. For the focal sample, activity observations would be recorded at two-minute intervals; Project-related activities or events (e.g., truck travel along the Tote Road) would also be recorded to document any unique responses. Distances and directions of the observed individual or group to and from Project infrastructure were estimated (if/where applicable) and ground-truth using a GPS.

Modifications to Survey Procedures

In 2016, viewshed modelling and mapping were completed to determine the amount of viewable area at each HOL survey station. A total of 227 km² were surveyed within the viewshed area, with viewshed ranging from 5 to 22 km² at each HOL station (Map 10-2). Refer to Section 4.3.1 of the 2016 Annual Monitoring Report for a detailed description of viewshed modelling and mapping (EDI Environmental Dynamics Inc. 2017).

During the June 2019 TEWG meeting, the MHTO suggested that HOL station locations should be re-evaluated to incorporate historic migration and calving patterns and any new information relevant to HOL goals and methodologies. In 2020, the survey time was increased (as it is presently) by conducting at least two station visits for 40 minutes (previously 20 minutes). To date, Baffinland has not been able to confirm with the MHTO alternate locations for the HOL stations but will continue to consult with MHTO representatives on the program via the TEWG and other engagement methods.


Milne Inlet Camp and Port
Stn 1
Stn 17
Stn 18
Stn 19
Stn 2
Stn 3
Stn 20
Stn 4
Milne Inlet Tote Road
Stn 5
Stn 21
Stn 22
Stn 6
Stn 7
Stn 8
Stn 9
Stn 10
Stn 14
Stn 13
Stn 12
Stn 11
Stn 15
Stn 16
Stn 23
Stn 24
Mary River Project
81°W
80.5°W
80°W
79.5°W
79°W
71.75°N
71.5°N
LEGEND
Caribou Height of Land Station
Milne Inlet Tote Road
Potenital Development Area
Viewshed from Tote Road (500 m distance)
Viewshed from Height of Land Sites (4 km radius)
2022 overview of Height of Land monitoring stations and viewsheds
NOTES
Potential Development Area provided by BIM (2019).
Viewsheds created by EDI Environmental Dynamics Inc. (2016).
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
Map Scale 1:400,000 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N
MAP 10-2
Date: 2023-04-06
Map Area
Mary River Project
Baffinland
EDI

10.3.2 RESULTS AND DISCUSSIONS

No caribou were observed during HOL surveys in 2022. No caribou tracks or other indicators (i.e., fecal matter, hair, evidence of foraging such as cratering) of caribou were observed during surveys or en route to survey stations. While no caribou were observed during HOL surveys, two caribou were observed incidentally on June 11 by Baffinland Environment Staff while conducting other Project-related activities. Two caribou were observed grazing approximately 350 m east of the Tote Road at KM82 from 10:49 – 11:17 AM. The crew did not have binoculars or a spotting scope for observation but still documented conditions and behaviour while within an observable range. The caribou did not show any obvious responses or distress from vehicle traffic on the Tote Road.

In total, 36 hours of HOL surveys were conducted with a minimum 40 minutes of survey time per station during the first survey and 50 minutes of survey time per station during the second survey. Surveys were completed in early summer (June 3 to 12, 2022) during the peak calving season. Each HOL station was visited on two occasions. Due to weather, logistic constraints and safety considerations, all HOL station access was achieved exclusively by helicopter in 2022.

Visibility conditions during the HOL surveys had 'excellent' clear viewing conditions during all surveys. Temperatures during the surveys ranged from 1 to 5°C, with intermittent snow cover (ranging from 30 to 100%) across the landscape.

Inter-annual Trend — No caribou were observed in the PDA during HOL surveys in 2022; consistent with results from 2014-2022 (Figure 10-5). Caribou were last seen during HOL surveys in 2013. This trend has been consistent (year-over-year) despite changes to survey procedures (i.e., increased survey time/effort) and supplementary/ancillary data capture (e.g., via deployment of remote cameras).

As mentioned, the current caribou ecology on North Baffin Island (i.e., having low population numbers and low movement) is a primary factor contributing to a lack of caribou observations.

Caribou densities in the region would need to be considerably higher to evaluate potential change in caribou behaviour and/or habitat use due to the Project (EDI Environmental Dynamics Inc. 2022b). In the interim, HOL surveys provide important data on individual-level caribou response to Project interactions and inform potential mitigations.

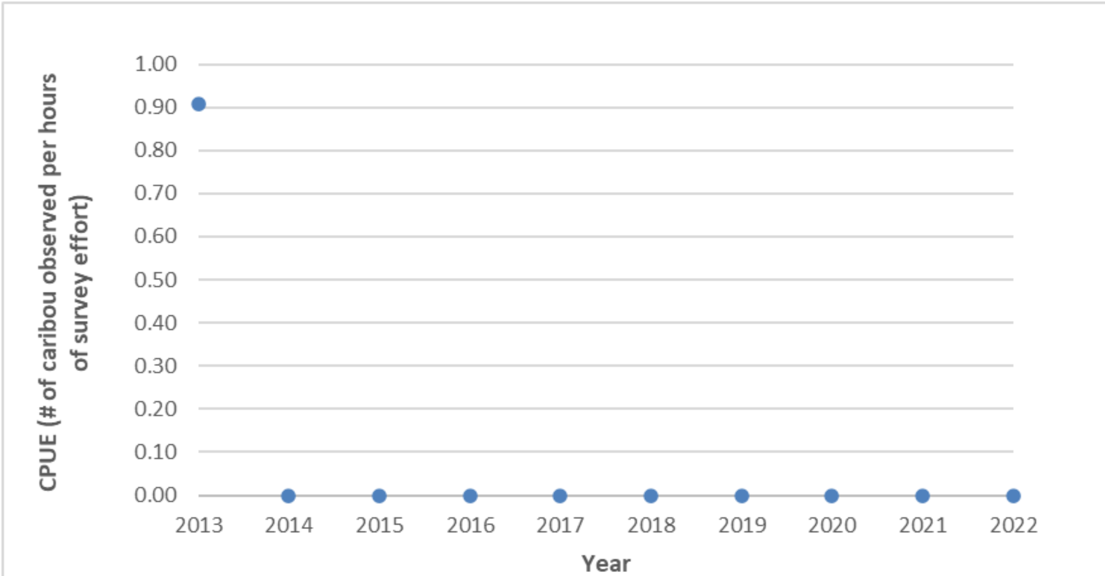


Figure 10-5. 2022 inter-annual trends — Height of Land survey (2013 to 2022 — post baseline).
Note: CPUE = Catch per unit effort, i.e., number of caribou observed per hour of survey effort.

10.4 REMOTE CAMERAS

The following PCs were developed to address concerns regarding potential caribou crossings of linear features (i.e., train or vehicle traffic) and constraining of wildlife movement across roadways (Nunavut Impact Review Board 2020):

- **PC #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."*

To address this PC—and comments/recommendations from the MHTO and other TEWG members to increase the capacity for wildlife surveillance at the Project—a remote camera monitoring program was initiated in the summer of 2021. The program involves the deployment of remote cameras at HOL stations (described in Section 10.3) to supplement data capture and evaluation of caribou movement at the Project. Remote cameras provide a continuous observation alternative from mid-October 2021 to early June 2022.

10.4.1 METHODS

In the summer of 2021, EDI and Baffinland personnel deployed 12 Reconyx HP2x HyperFire 2 Professional Cover IR remote cameras (two per site/station) at strategic locations corresponding with HOL survey stations (sites 1, 3, 4, 6, 10, and 16; Map 10-2) to optimize wildlife observations along the Tote Road. Remote camera stations are shown on Map 10-2; photo documentation of the camera stations (site conditions and installations) is provided in Appendix E.

Cameras were distributed within an open landscape with relatively few obstacles. Wildlife in the area do not have set definitive trails they use, which makes it challenging to predict higher use access areas for wildlife movement that would improve the ability of cameras to record larger wildlife species. Due to the large field of view, the quality of images and detectability deteriorates further from the camera, reducing the ability to identify and locate wildlife in the distance accurately.

Baffinland personnel were responsible for camera care and maintenance (i.e., battery and SD card exchanges). The remote camera sites were accessed via helicopter, vehicle, or foot. Most cameras were established within 500 m of an access trail or road. Cameras were installed using a rock drill to anchor the units to the ground using a steel/rebar tripod and affixed with steel clamps. Cameras were set approximately chest high and positioned to capture an optimal viewshed. Cameras were programmed[18] before deployment and tested/checked onsite (after installation) to verify proper function and viewshed.

After initial deployment in 2021 cameras were checked and maintained in the fall of 2021 to swap batteries and SD cards, and apply any necessary realignment. On October 16, 2021, Baffinland personnel revisited each camera station. Baffinland staff returned to Baffin-5, Baffin-9, and Baffin-11 on January 30, 2022. Cameras were checked again in June 2022, in conjunction with HOL surveys by on-site EDI staff. In January 2023, ten of the twelve cameras were visited to swap batteries and SD cards.

Data were relayed to EDI personnel for photo analysis of any/all wildlife observations focusing on caribou and large carnivores; wildlife activities were carefully investigated and documented. The following information was recorded for each wildlife observation: species identity, age, sex (if/where possible), number of individuals, start/end time, and general comments.

Cameras are to be periodically checked (2 - 4 times annually) to provide controls for camera malfunctions, realignment and servicing of batteries and SD cards. Efforts will be made to schedule checks at regular intervals to prevent large scale data loss and at times that are conducive to site personel for logistic and safety reasons (i.e. extreme cold temperatures, and distance from vehicles during winter).

10.4.2 RESULTS AND DISCUSSIONS

Over 190,000 photos were captured from the 12 cameras between October 2021 and December 31, 2022. Table 10-2 summarizes the remote camera data returns at each HOL/camera station. Active days refer to the number of days with a viable photolog/capture; non-active days refer to periods in which the camera was not operational and/or the viewshed was blocked by snow, frost or fog. As temperatures dropped, more frequent and prolonged incidents of fog or frost were observed on the cameras. Active days ranged from 45 to 410

[18] The Reconyx HP2X HyperFire 2 Professional Covert IR cameras are motion and infrared triggered and were set to take three consecutive photos when activated ('Rapidfire' mode) with no delay between triggered events. The cameras were programmed to capture time-lapse photos each hour, 24 hours per day, to document baseline environmental conditions and surrounding landscape; each photo was 'timestamped' (time/date/temperature).

days. Variability in the data capture was attributed to obstructions of the field of view (e.g., due to blowing snow, ice crystals or fog) or camera stoppage (e.g., loss of power or exceedance of information storage capacity).

The occurrence rate between October 2021 and end of December 2022 for wildlife was highest overall at Baffin-6 site (73.33 individuals/100 camera days) (Figure 10-6). The lowest occurrence rate of wildlife occurred at Baffin-3 (0.49 individuals/100 camera days) with only two observations noted. Baffin-1, and Baffin-9 cameras did not record any wildlife occurrences for the deployment duration. Baffin-6's high occurrence rate is likely attributed to three camera events that observed 10 geese in individual images, increasing that site's relative abundance. The overall low occurrence rates across all cameras are likely a factor of weather conditions (fog, blowing snow) that prevent clear images, or deterred wildlife movement altogether, combined with cyclical lows in species population.

A total of 70 wildlife detections were captured across all combined cameras. Seven species of mammals and birds were identified from the 12 remote camera sites. As seen in Figure 10-7, the highest number of wildlife observations were of unknown/unidentified birds (88 individuals), Goose species (55), Arctic fox (16 individuals), Arctic hare (11 individuals), Rough-legged Hawk (5 individuals), Ptarmigan (5 individuals) and Raven (1 individual). The observation of smaller mammals and birds is consistent with snow track and HOL surveys from 2022 and in previous years (Figure 10-1) No carnivores (wolves or bears) or ungulates (caribou) were captured in photos taken by the remote cameras. Larger carnivores or ungulates are not commonly seen on site, and, therefore, have a low probability of being detected on remote cameras.

Baffin-11 and Baffin-2 cameras recorded the highest species diversity, with four different species recorded on camera (Figure 10-8). Baffin-1, and Baffin-9 cameras did not record any wildlife occurrences for the deployment duration. Baffin-8, and Baffin-12 also recorded images of wildlife tracks. Tracks were presumed to be Arctic hare, Ptarmigan, or small mammal species based on shape and spacing.

Baffin-1, Baffin-4, Baffin-6, and Baffin-7 cameras stopped recording images before camera servicing in June. While Baffin-6 stopped recording images end of June 2022, and Baffin-1 and Baffin-5 do not have associated images from June to December 2022 as cameras were unable to be retrieved and serviced in early 2023 due to safety considerations. Cameras were triggered by passing vehicles, likely resulting in prematurely draining batteries and or maxing out the storage capacity of the SD cards.

Table 10-2. 2022 remote camera survey summary of remote camera data returns.

Site Name	Camera ID	Year 2: Start Date	Year 2: End Date	Active Days[19]	Days Field of View Obstructed[16]	# Species Recorded	# Photos	Notes
HOL 6	Baffin-1	October 16, 2021	January 30, 2022	45	61	0	2,621	Camera malfunction after January 30, 2022. June-Dec data not retrieved due to safety considerations at time of retrieval.
HOL 16	Baffin-2	October 16, 2021	December 31, 2022	381	59	4	12,034	—
HOL 1	Baffin-3	October 16, 2021	December 31, 2022	411	33	1	20,470	—
HOL 1	Baffin-4	October 16, 2021	December 31, 2022	178	34	3	21,111	SD card malfunction, no data Jan-June 2022
HOL 6	Baffin-5	January 30, 2022	June 5, 2022	118	8	1	3,036	June-Dec data not retrieved due to safety considerations at time of retrieval
HOL 16	Baffin-6	October 16, 2021	June 24, 2022	90	46	3	60,760	Excessive triggers form road traffic drained batteries/maxed storage capacity.
HOL 3	Baffin-7	October 16, 2021	December 31, 2022	232	40	2	7,178	Battery failure December 16, 2021. No data until June 3, 2022.
HOL 4	Baffin-8	October 16, 2021	December 31, 2022	345	95	1	12,064	The camera angle shifted slightly during deployment.
HOL10	Baffin-9	January 30, 2022	December 31, 2022	268	66	0	8,898	Reviewed images until January 30, 2022.
HOL 4	Baffin-10	October 16, 2021	December 31, 2022	346	94	3	24,786	—
HOL 10	Baffin-11	January 30, 2022	December 31, 2022	299	35	4	9,241	—
HOL 3	Baffin-12	October 16, 2021	December 31, 2022	351	93	2	11,437	—

[19] Since previous camera analysis review in 2021 TEAMR.

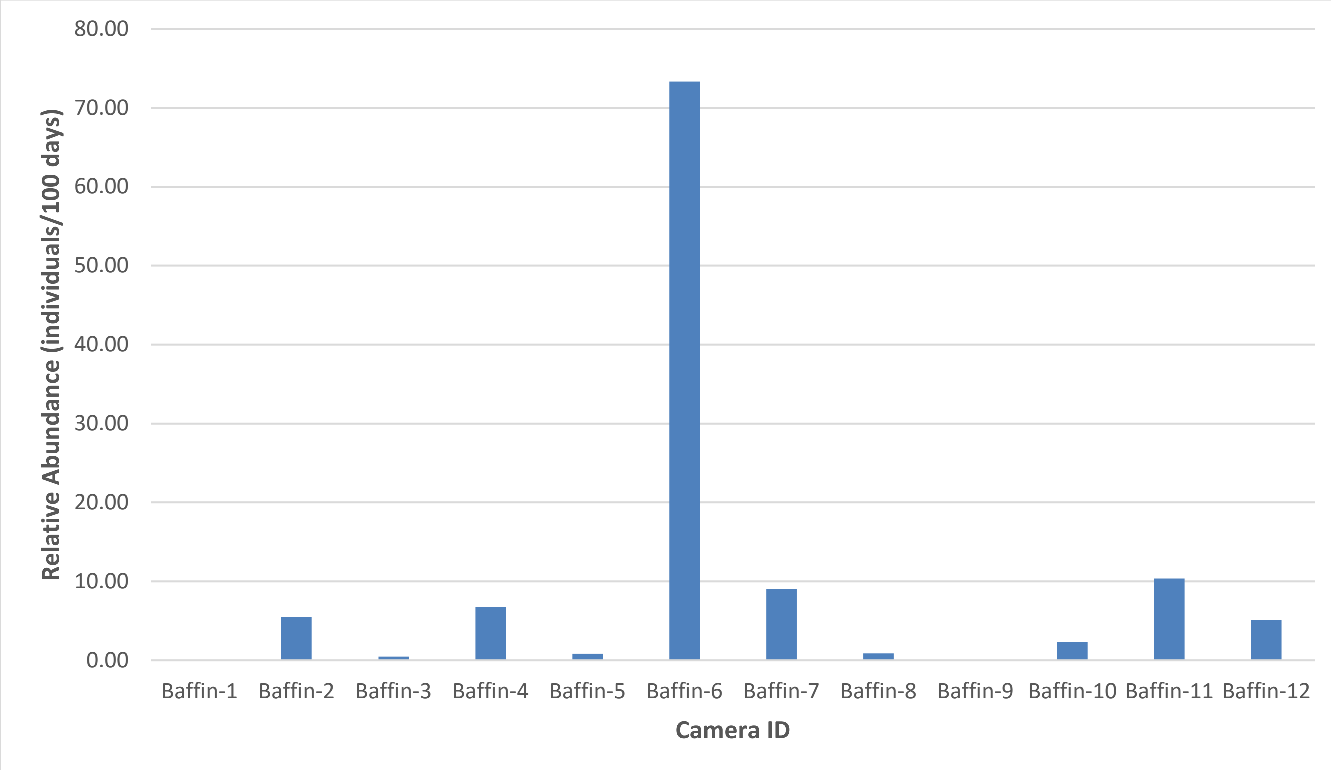


Figure 10-6. Camera occurrence rates for Baffinland Cameras between October 2021 and June 2022.

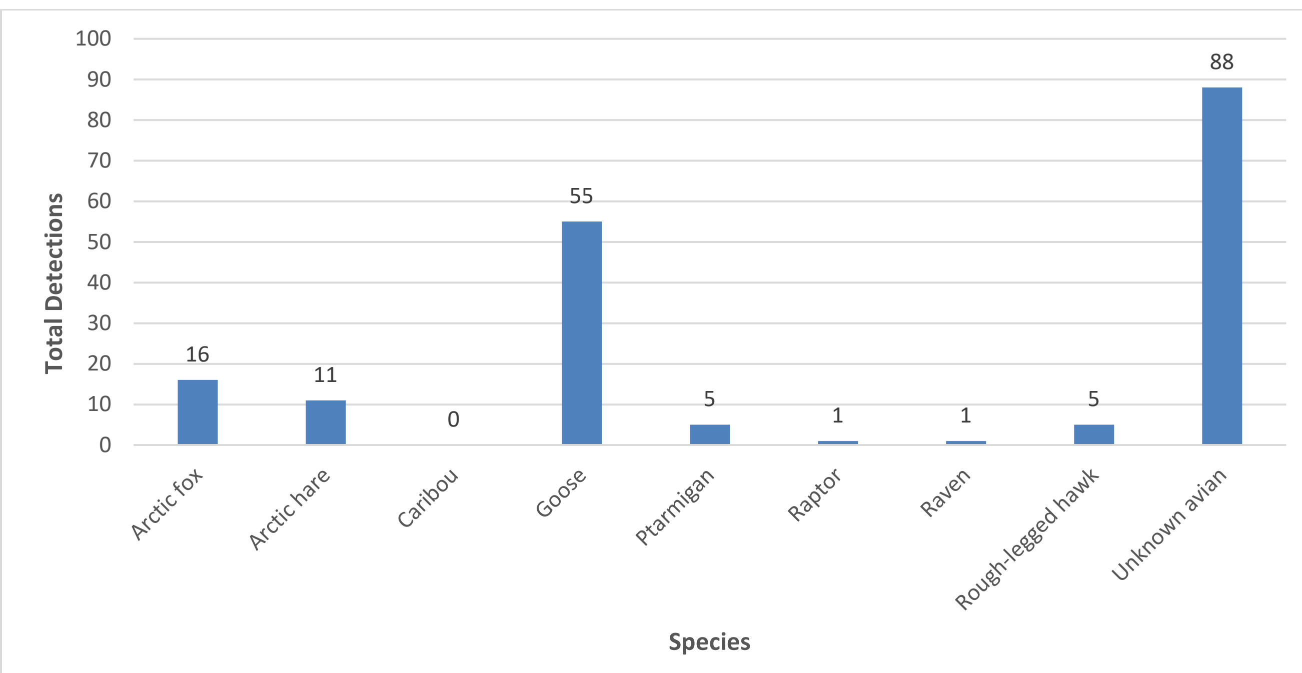


Figure 10-7. October 2021 to June 2022 remote camera survey, total wildlife observations per species.

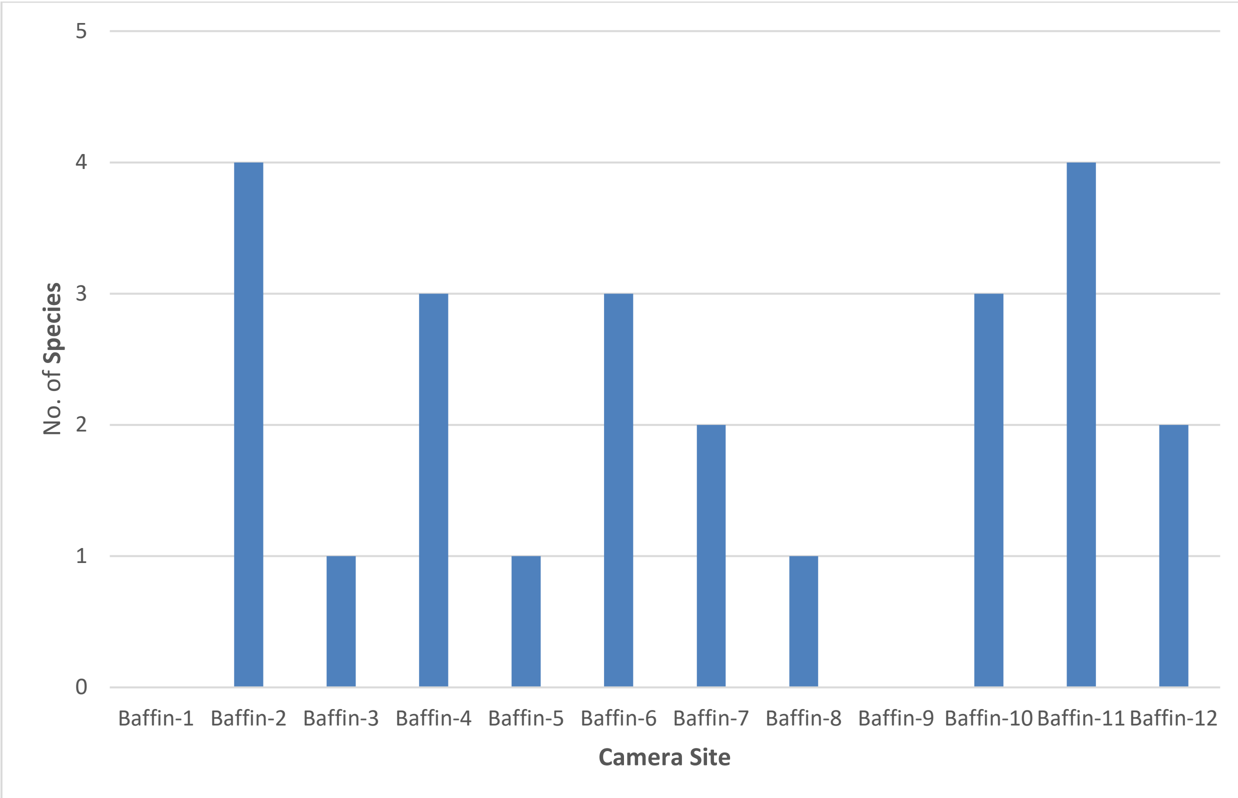


Figure 10-8. October 2021 to June 2022 Remote camera survey total species observations per Height of Land/camera station.

Photo 10-8. Arctic fox seen on Baffin-7 camera.

10.5 INCIDENTAL OBSERVATIONS

Incidental wildlife observations are recorded by on site personnel via wildlife logs posted in a variety or areas. These logs are indicators of wildlife species that occur in proximity to Project infrastructure or areas where exploration or monitoring may be occurring. Table 10-3 summarizes 2022 incidental wildlife observations.

Caribou — A total of 57 caribou were recorded from six separate observations between May 19 and August 26, 2022. Two of the observations were made near the Mary River area. Two caribou were observed at the KM108 laydown along the Tote Road on May 19, 2022, and one grazing near site infastructure on May 21, 2022. Most of the caribou were observed in exploration areas southeast of the Project in summer. Based on available documentation of incidental observations, six caribou were suspected to be male, four caribou were suspected to be female, and the remaining individuals were unclassified.

Birds — A total of 35 bird species were recorded on incidental wildlife logs in 2022. Examples of the most common species reported include: Snow Bunting (*Plectrophenax nivalis*), Lapland Longspur (*Calcarius lapponicus*), Peregrine Falcon (*Falco peregrinus tundrius*), Rough-legged Hawk (*Buteo lagopus*), Snowy Owl (*Bubo scandiacus*), Common Raven (*Corvus corax),* Ptarmigan (*Lagopus* sp.), Sandhill Crane (*Grus canadensis*), Long-tailed Duck (*Clangula hyemalis*), Common Loon (*Gavia immer*), Yellow-billed Loon (*Gavia adamsii*), Cackling Goose (*Branta* *hutchinsii*), Canada Goose (*Branta canadensis*), Snow Goose (*Chen caerulescens*), Long-tailed Duck (*Clangula hyemalis*), and Glaucous Gull (*Larus hyperboreus*).

Table 10-3. 2022 incidental observations – wildlife species observations in the Potential Development Area (Mary River, Tote Road, Milne Port) and Remote Areas (based on wildlife logs).

Common Name	Scientific Name	Number of Observations			
		Mary River	Tote Road	Milne Port	Remote Areas
Arctic hare	*Lepus arcticus*	12	2	5	0
Arctic fox	*Vulpes lagopus*	63	40	31	7
Red fox	*Vulpes*	10	8	0	0
Fox sp.	*Vulpes* sp.	88	15	8	0
Ermine	*Mustela ermine*	1	1	1	3
Caribou	*Rangifer tarandus groenlandicus*	1	2	0	54

10.6 HUNTER AND VISITOR LOG

Baffinland Security monitors land use and the presence of land users in the Project area via hunter and visitor logs that document travel or hunting within the Project area. This is an indirect and incomplete land use record given that individuals are only required to populate the visitor logs if/when interacting with or using Baffinland facilities.

Five hundred and forty-one individual entries were recorded at the Mine Site Camp (224 individuals in 53 groups) and Milne Port Accommodations Complex (317 individuals in 85 groups) between January 1, 2022, and December 31, 2022. Group sizes ranged from 1 to 15 individuals. These hunter/visitors were typically hunting, travelling, stopping for food/fuel, or having vehicles serviced (Figure 10-9, Figure 10-10). Baffinland provided food, beverages, transportation, tools, supplies, fuel and mechanical assistance to hunters and visitors, if requested and safe. Overall log numbers decreased from 2021, but are similar to 2018, and above counts before the start of the COVID pandemic.

In 2022, Baffinland assisted in five separate Search-and-Rescue (SAR) incidents (July 8, July 13, September 27, September 28, and December 11, 2022) for people reported missing or in distress. The rescue was often due to ATV/snowmobile mechanical breakdown. In most cases, Baffinland provided aircraft support, staging, fuel, food, and accommodations.

Inter-annual Trend — The number of visitors recorded has increased since 2014. It shows substantial fluctuations from 2019 to 2022 (Figure 10-11), coinciding with the COVID pandemic. The number of visitors each year often represents repeat groups at the start and end of their trips, making multiple trips within the year. Given that hunter and visitor registration is not mandatory, values do not represent all potential land users at the Project.

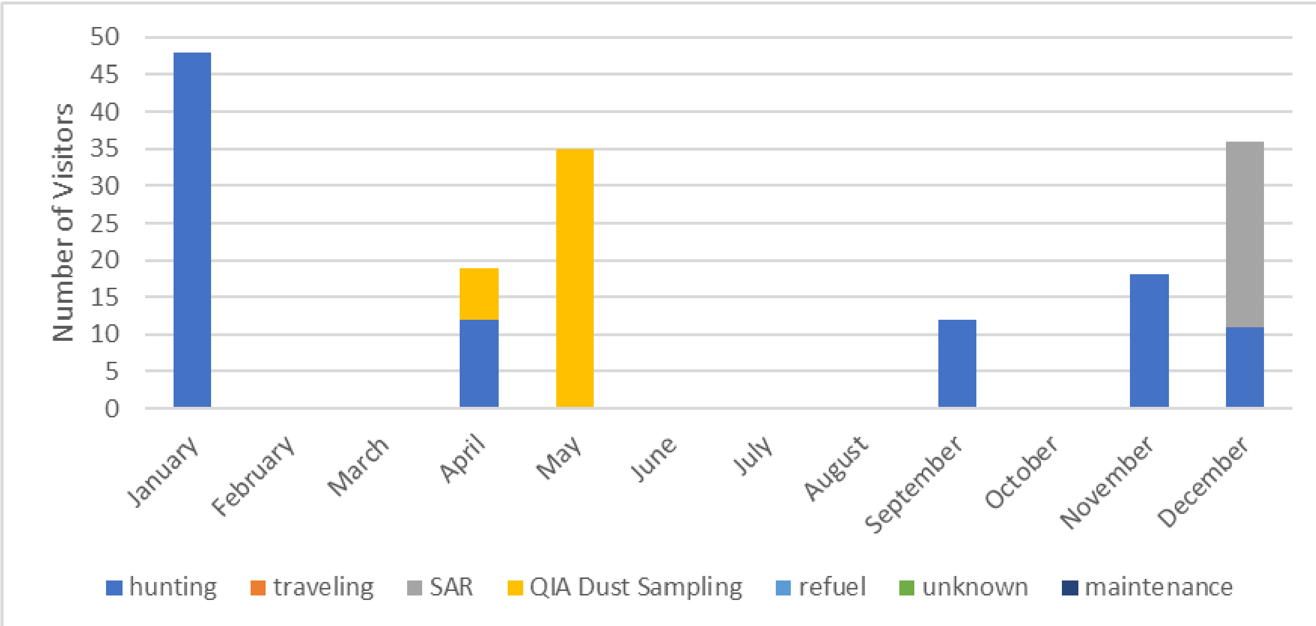


Figure 10-9. Mary River (mine site camp) visitor breakdown by month with check-in rationale.

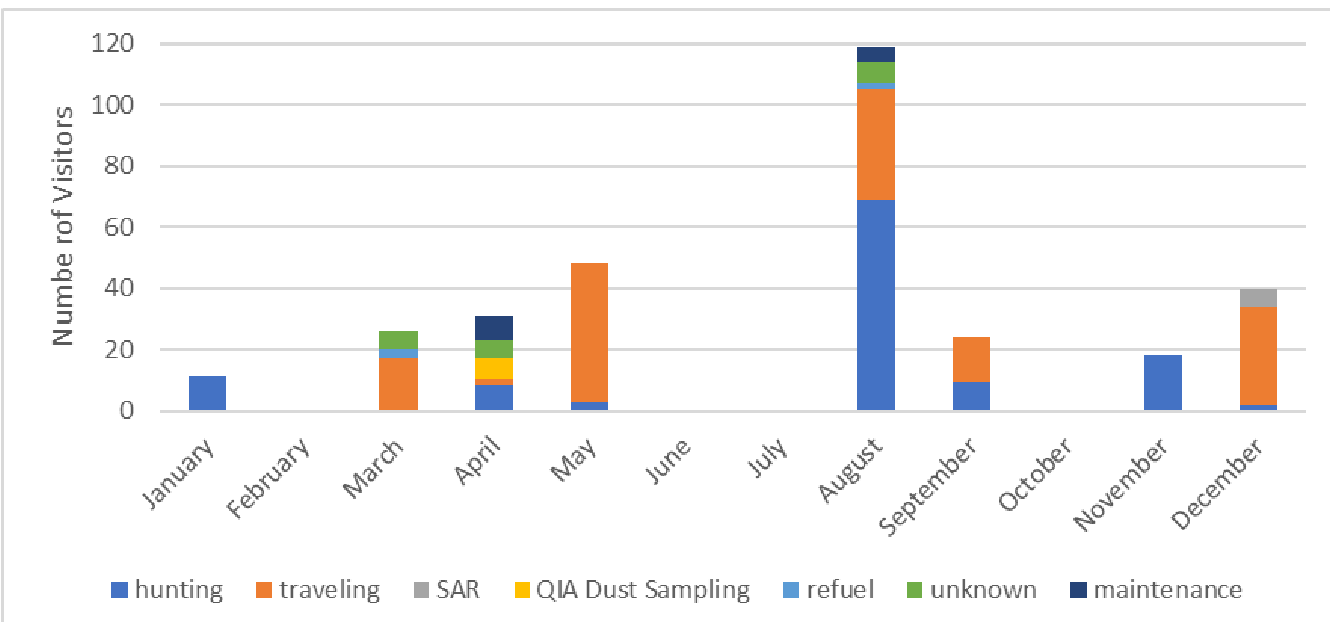


Figure 10-10. Milne Port visitor breakdown by month with check-in rationale.

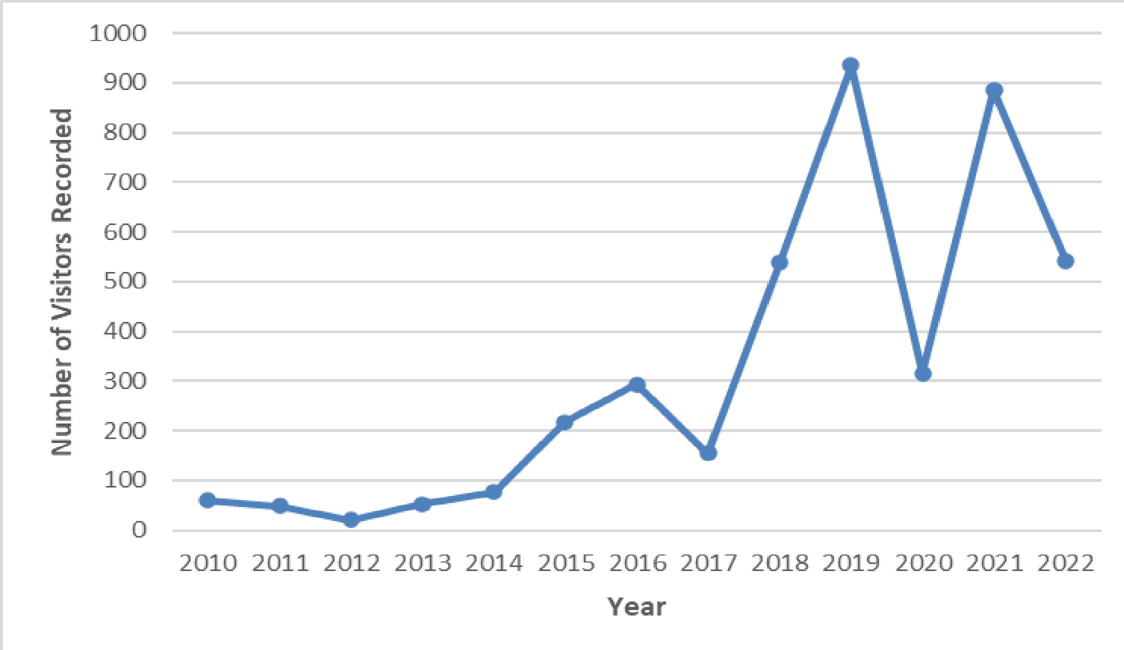


Figure 10-11. 2022 Inter-annual trends in visitors recorded in hunter and visitor logs (2010 to 2022).
** the COVID-19 pandemic resulted in little to no Inuit participation to minimize its spread.*

10.7 MAMMAL SUMMARY

Ground-based surveys continue to monitor potential wildlife interactions with the Project. These include snow track surveys, snowbank height surveys, HOL surveys, remote camera monitoring and incidental sighting reports from on-site personnel. The following are key findings from 2022 monitoring activities at the Project on mammals.

- Four snow tracking surveys were conducted in 2022. No caribou, wolf or other large mammal tracks were observed in surveys; Arctic fox, red fox, and Ptarmigan tracks were observed in greater numbers compared to other small mammals such as Arctic hare. Only 6% of observed tracks were noted to deflect from the Tote Road.
- Snowbank height monitoring was conducted between January and December 2022. An average of 91% compliance with the 100 cm snowbank height threshold was recorded in 2022. Since 2020, survey locations have used randomized kilometre locations instead of repeated kilometre locations to improve representativeness and reduce bias.
- Height of Land surveys were conducted during the caribou calving season (early June 2022). All HOL stations were visited twice between June 3 and 12, 2022. The total observation time was 36 hours, while the average observation time per station was 45 minutes. No caribou were observed during these surveys in 2022. The last time a caribou was observed in 2013.
- Three incidental observations of caribou occurred within the PDA. A total of 54 caribou were noted outside the PDA.

- Remote cameras documented a combination of birds (Ptarmigan, raptors, songbirds), Arctic hare, and Arctic fox, between October 31, 2021, and June 5, 2022. No caribou, wolves or bears were observed in any reviewed images, which supports the current observation of low caribou numbers and movement in the PDA, despite increased observation and monitoring period.
- Height of Land, snow track surveys, snowbank height surveys, remote camera monitoring and incidental observations using wildlife logs will continue in 2023 and subsequent years on an annual basis.

11 BIRDS

The following Project Condition (PC) addresses concerns regarding migratory birds and raptors at the Mary River Project (the Project) (Nunavut Impact Review Board 2020):

- **PC #74** *"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."*

To address all or a portion of this PC, bird surveys at the Project have historically included effects monitoring of songbirds and shorebirds. Based on 2012 and 2013 analyses of the Program for Regional and International Shorebird Monitoring (PRISM) plots and 2013 bird encounter transects, it was identified that the level of detection for Project-related effects on songbirds and shorebirds was low due to the low number of birds present. In consultation with the Terrestrial Environment Working Group (TEWG) and Canadian Wildlife Service (CWS), it was resolved that effects monitoring for tundra breeding birds could be discontinued; instead, Baffinland Iron Mines Corporation (Baffinland) would commit to the following:

- conducting 20 PRISM plots every five years to contribute to regional monitoring efforts (completed in 2018; next scheduled for 2023 and led by Environment Climate Change Canada);
- completing coastline nesting surveys of the identified islet near the proposed Steensby Port Site before the construction of the port;
- conducting Active Migratory Bird Nest Surveys (AMBNS) before any vegetation clearing or surface disturbance during the nesting season; and,
- continuing monitoring programs for cliff-nesting raptors (annual occupancy and productivity) and inland waterfowl (roadside waterfowl surveys) when qualified biologists are available and on site (paused indefinitely since 2021 since no Project-related trends have been observed).

In 2022, bird surveys at the Project focused on AMBNS for active migratory bird nests (if/when necessary, before vegetation clearing or surface disturbance).

11.1 ACTIVE MIGRATORY BIRD NEST SURVEYS

The following PCs address concerns regarding migratory birds (Nunavut Impact Review Board 2020):

- **PC #66** *"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."*
- **PC #70** *"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."*

Active Migratory Bird Nest Surveys were conducted before vegetation clearing or surface disturbance to verify that no active bird nests were near the Project area (Baffinland Iron Mines Corporation 2016a). To the extent possible, Baffinland has resolved to pre-emptively clear potential development areas before the breeding bird window (May 17 to August 19) to avoid or minimize potential effects on nesting birds. This section summarizes the methods and outcomes of the 2022 AMBNS.

11.1.1 METHODS

In June 2022, EDI Environmental Dynamics Inc. (EDI) facilitated on-site training to Baffinland personnel for AMBNS, applying search methods developed by the CWS (Baffinland Iron Mines Corporation 2016b). Methods included 'rope-drags' and identification indicators for common species known to occur in the Project area. Rope-drag equipment was constructed following the template provided by CWS (Rausch 2015).

In 2022, AMBNS were completed by at least two Baffinland searchers/observers in areas scheduled for approved construction activities during the nesting season (May 17 to August 19). During each survey, rope-drag equipment was systematically pulled across the search area as observers surveyed for potential breeding bird activities. Areas were surveyed for active nests up to five days before land clearing activities to inform the following mitigations:

- If active nests were found, the Project activity was postponed until the nests or nesting areas were no longer active.
- If no active nests were found, the Project activity proceeded.
- If no Project activity within the five-day survey window, surveys were repeated.

If/where applicable, observers documented behavioural signs of nesting birds, including broken wing displays, alarm calls, or carrying food items or nesting material. Species identification varied depending on the observers' experience.

11.1.2 RESULTS AND DISCUSSIONS

To the extent possible, Baffinland prioritized land clearing activities outside of the breeding bird window in previously undisturbed areas. Only one AMBNS was completed on August 14, 2022 in a previously disturbed area. No active or non-active nests were detected during the 2022 AMBNS, though disturbance did not occur until mid September, outside the breeding bird window. Approximately 512 m² (0.05 ha) were disturbed outside the disturbance window for Project infrastructure in 2022 (Table 11-1).

Table 11-1. Disturbed Project area in relation to the 2022 AMBNS breeding window.

AMBNS Disturbance Window	Disturbance Area (m²)
Within (May 17 – August 19, 2022)	0
Outside (August 20 to May 16, 2022)	**512**
Total	**512**

11.2 BIRDS SUMMARY

Baffinland is committed to a range of surveys and monitoring programs designed to enhance baseline data and evaluate effects of Project-related activities on birds. These programs include AMBNS to verify that no active nests are present before vegetation clearing or surface disturbance. The following items highlight key findings from 2022 monitoring programs at the Project on birds.

- One AMBNS survey was completed, covering roughly 512 m^2. No nests were detected.
- Raptor monitoring at the Project (conducted from 2011 to 2020, in collaboration with Arctic Raptors Inc.) has been paused based on no evidence of Project-related effects on raptors.

12 WILDLIFE INTERACTIONS

Wildlife interactions and mortalities related to the Mary River Project (the Project) are uncommon. Despite mitigation measures, wildlife interactions and mortalities may occur. Any/all incidents are recorded and carefully investigated to document leading causes and underlying circumstances.

12.1 WILDLIFE INTERACTIONS AND MORTALITIES

In 2022, 15 individual wildlife mortality incidents were reported involving five different species:

- Arctic fox (11);
- Arctic hare (1);
- Snow Bunting (1);
- Lapland Longspur (1); and,
- Ptarmigan (1).

Vehicle collisions were confirmed or suspected in the mortalities of six Arctic fox, one Arctic hare, and one Ptarmigan. One Arctic fox inadvertently trapped in the top grate of a waste bin located behind the Port Site Main Camp (PSC) kitchen. Two Arctic fox were euthanized due to suspected rabies at the KM 104 laydown and Mary River Sailiviik areas. The cause of mortality was undetermined for the four remaining reported incidents involving two Arctic fox, one Snow Bunting, and one Lapland Longspur.

12.2 WILDLIFE INTERACTIONS AND MORTALITY PREVENTION

Baffinland mitigates wildlife interactions at the Project through training, implementation, and waste management practices and guidelines monitoring. All Project personnel (including managers, supervisors, and contract staff) attend mandatory Environment Protection Plan (EPP) training. The EPP includes mitigations and protection measures for wolf, polar bear, Arctic fox, and caribou and waste management guidelines that are regularly reviewed, updated, and implemented. No major changes to policies and procedures occurred in 2022. Previous policy and procedure changes are described below.

Waste Management — 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. Waste sorting guidelines clearly defining where food and other attractants should be placed are posted around each site.

Fencing — Significant effort was made in 2018 and 2019 to improve on-site waste management infrastructure with the objective of minimizing human-wildlife interactions at the landfill. Site visits by the Nunavut Impact Review Board prior to 2018 resulted in recommendations to improve the fencing at the landfill facility to reduce occurrences of windblown-debris escape. A 275 m fence was installed on the west side (downwind) of the landfill in the fall of 2018 to address these concerns. The fence also repurposed over 800 used tires as part of Baffinland's used tire disposal and recycling initiative. The fence captures windblown debris from the landfill effectively.

Other Prevention Measures — Wire skirting is used under the main camps at both sites preventing wildlife, such as foxes or hares, from creating dens. As part of Baffinland driver training, honking the horn before starting the vehicle helps scare off wildlife hiding in or near the equipment. Wildlife have the right of way on all roadways unless they create a safety hazard. Snowbanks along the Tote Road are reduced where feasible by feathering back snow with equipment to assure personnel along the Tote Road can view wildlife crossing the road. Feeding wildlife is strictly prohibited, and workers found to be feeding wildlife would face disciplinary action.

12.3 INTER-ANNUAL TRENDS

Inter-annual trends regarding wildlife interactions and mortalities are tracked. Most mortalities on site from 2014 to 2022 have been attributed to collisions with vehicles or infrastructure (Figure 12-1). Other reported causes of mortality were associated with heavy machinery or Project infrastructure, incidental non-target capture, and euthanization of wildlife (where rabies was suspected) for health and safety reasons. No inter-annual trends were identified for wildlife mortality. No caribou mortalities have occurred thus far due to the Project (Figure 12-2).

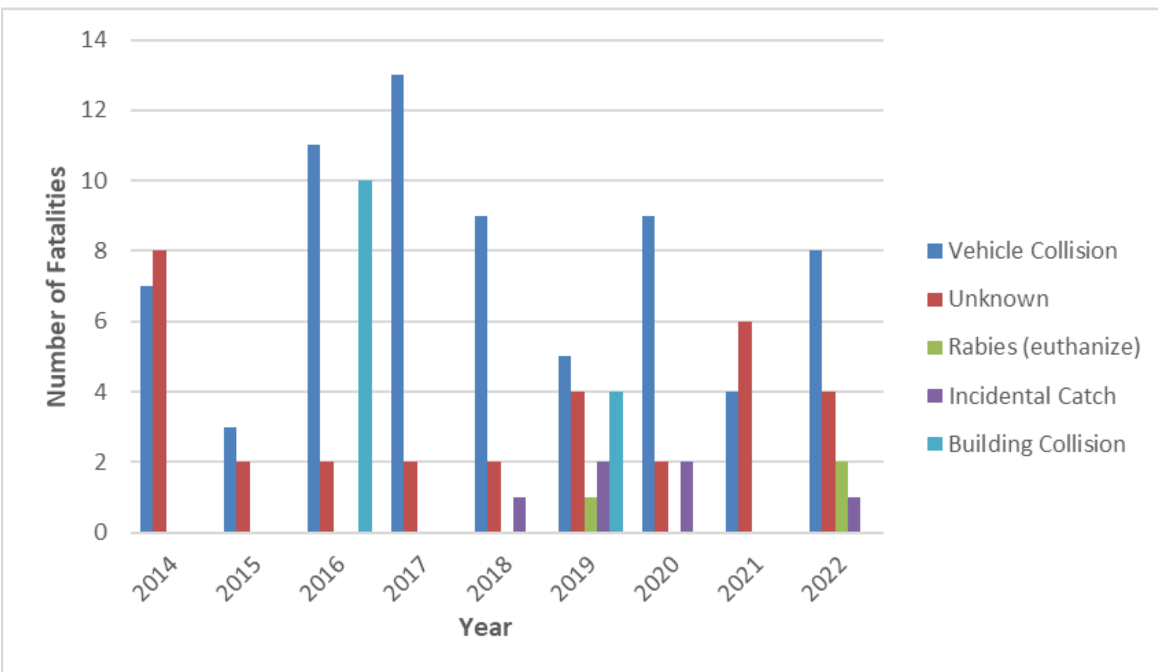


Figure 12-1. 2022 wildlife interactions – inter-annual mortality trends by cause of death (2014 to 2022).

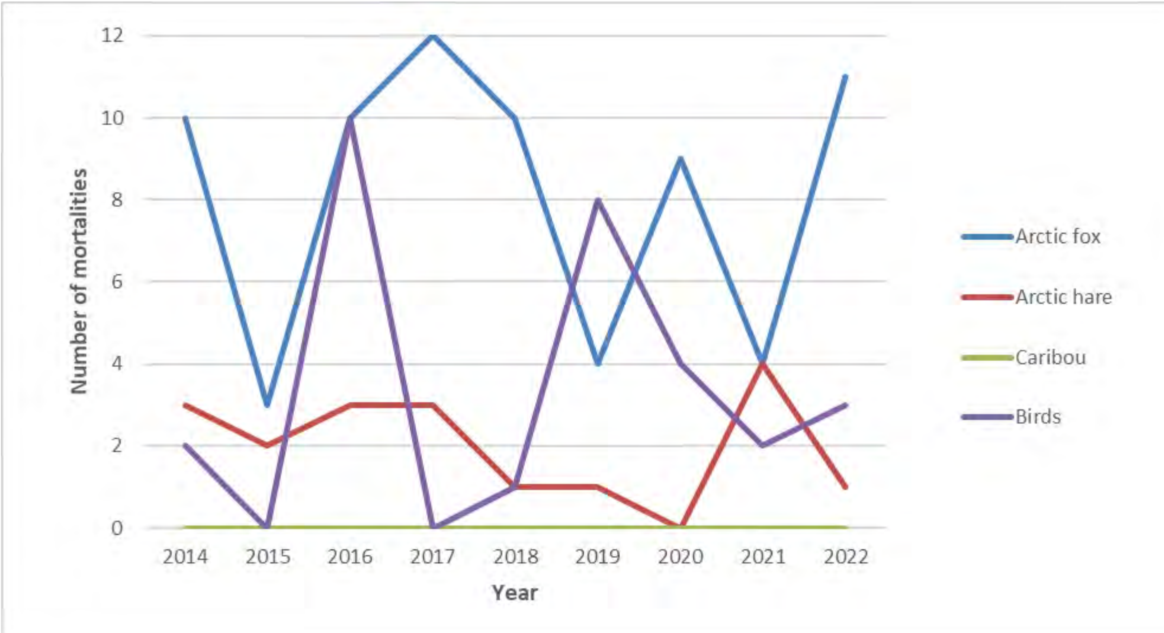


Figure 12-2. 2022 wildlife interactions – inter-annual mortality trends by species (2014 to 2022).

12.4 WILDLIFE INTERACTIONS SUMMARY

Baffinland is committed to monitoring activities and mitigation measures to minimize wildlife interactions and mortalities at the Project. Wildlife incident and mortality logs are used to note human-wildlife conflicts to identify and minimize current and potential wildlife-related issues. Since 2014, there have been no noticeable trends in wildlife interactions and mortalities, with relatively stable low numbers given the size of the Project. The following items highlight key findings and actions regarding wildlife interactions.

- In 2022, 15 individual wildlife mortality incidents were reported involving five different species: Arctic fox (11), Arctic hare (1), Snow Bunting (1), Lapland Longspur (1), and Ptarmigan (1). Vehicle collisions were confirmed or suspected in most of these incidents. One incident involved the accidental entrapment of an Arctic fox in a waste bin, and two involved the euthanization of Arctic fox suspected of rabies. The cause of mortality was undetermined for the four remaining reported incidents.
- Baffinland continues to mitigate wildlife interactions in the Project area by training, enforcing, and monitoring waste management practices and guidelines and integrating preventative measures into road maintenance, infrastructure design, and the EPP.

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APPENDICES

APPENDIX A CLIMATE DATA

Appendix Table A-1. Mary River baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2005	Jun	-	5.0	13.9
2005	Jul	8.4	4.4	112.5
2005	Aug	8.6	4.2	37.1
2005	Sep	-0.2	5.0	5.1
2005	Oct	-	2.7	-
2005	Nov	-	-	-
2005	Dec	-	-	-
2006	Jan	-	-	-
2006	Feb	-	-	-
2006	Mar	-	-	-
2006	Apr	-	-	-
2006	May	-	-	-
2006	Jun	3.5	4.8	22.1
2006	Jul	9.7	4.2	94.8
2006	Aug	9.1	4.1	74.5
2006	Sep	2.4	3.3	25.4
2006	Oct	-4.8	4.0	4.2
2006	Nov	-19.8	2.8	0.0
2006	Dec	-29.7	2.5	0.0
2007	Jan	-32.3	1.4	0.0
2007	Feb	-26.2	2.6	0.0
2007	Mar	-31.0	2.5	0.0
2007	Apr	-20.0	1.9	0.0
2007	May	-11.7	3.6	0.1
2007	Jun	3.6	4.2	0.9
2007	Jul	13.2	4.3	37.8
2007	Aug	9.6	3.3	57.4
2007	Sep	-0.9	2.9	9.3
2007	Oct	-12.4	3.3	0.1
2007	Nov	-21.5	4.3	0.0
2007	Dec	-30.6	1.6	0.1
2008	Jan	-29.6	4.1	0.0
2008	Feb	-35.3	2.1	0.0
2008	Mar	-27.8	4.5	0.0
2008	Apr	-15.2	4.7	0.0
2008	May	-0.8	3.2	23.8
2008	Jun		6.5	0.0

Appendix Table A-1. Mary River baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2008	Jul	-	5.0	11.4
2008	Aug	-	3.2	30.4
2008	Sep	-	4.9	8.8
2008	Oct	-11.8	4.5	0.1
2008	Nov	-22.4	3.4	0.0
2008	Dec	-29.9	2.5	0.0
2009	Jan	-27.8	2.6	0.0
2009	Feb	-31.3	1.4	0.0
2009	Mar	-27.8	3.1	0.0
2009	Apr	-17.8	2.7	3.1
2009	May	-6.4	2.6	3.1
2009	Jun	4.3	5.1	35.2
2009	Jul	12.5	3.2	28.4
2009	Aug	8.6	3.3	36.2
2009	Sep	-	4.7	26.6
2009	Oct	-	4.4	0.1
2009	Nov	-	2.6	0.0
2009	Dec	-	5.4	0.0
2010	Jan	-32.1	3.9	0.0
2010	Feb	-	4.5	0.0
2010	Mar	-	3.5	0.0
2010	Apr	-	3.0	1.0
2010	May	-	4.8	8.4
2010	Jun	-	4.6	8.2
2010	Jul	-	2.2	1.9

Appendix Table A-2. Mary River post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2013	Aug	2.0	2.8	0.4
2013	Sep	-1.8	4.8	4.0
2013	Oct	-8.4	4.8	1.1
2013	Nov	-27.2	2.1	0.0
2013	Dec	-31.2	2.0	0.0
2014	Jan	-28.5	2.5	0.0
2014	Feb	-31.7	1.5	0.0
2014	Mar	-29.0	1.8	0.0

Appendix Table A-2. Mary River post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2014	Apr	-18.2	4.2	0.1
2014	May	-7.8	2.9	7.5
2014	Jun	2.7	4.8	43.8
2014	Jul	11.5	2.8	36.1
2014	Aug	6.0	4.0	67.8
2014	Sep	-2.1	3.2	3.1
2014	Oct	-10.6	3.8	0.4
2014	Nov	-20.9	2.5	0.0
2014	Dec	-29.9	2.1	0.0
2015	Jan	-35.4	1.3	0.0
2015	Feb	-37.0	1.2	0.0
2015	Mar	-30.3	1.8	0.2
2015	Apr	-22.6	1.8	0.0
2015	May	-6.1	4.5	3.2
2015	Jun	4.3	4.1	18.2
2015	Jul	12.2	4.2	34.6
2015	Aug	7.1	4.2	41.8
2015	Sep	0.2	4.9	48.5
2015	Oct	-10.3	3.9	5.0
2015	Nov	-23.5	2.8	0.0
2015	Dec	-32.0	3.4	0.0
2016	Jan	-25.9	2.5	0.0
2016	Feb	-31.6	2.3	0.0
2016	Mar	-29.4	0.5	0.0
2016	Apr	-15.4	4.1	2.8
2016	May	-4.2	5.2	6.0
2016	Jun	5.8	3.3	17.4
2016	Jul	11.8	4.1	31.8
2016	Aug	10.6	3.6	59.9
2016	Sep	-1.9	4.8	51.5
2016	Oct	-11.2	5.0	0.2
2016	Nov	-16.8	3.6	0.0
2016	Dec	-29.4	2.0	0.0
2017	Jan	-26.4	3.5	0.0
2017	Feb	-31.2	1.6	0.0
2017	Mar	-30.6	2.8	0.0
2017	Apr	-15.4	4.4	1.0

Appendix Table A-2. Mary River post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2017	May	-5.6	3.9	1.4
2017	Jun	4.2	4.2	21.9
2017	Jul	7.2	5.4	67.8
2017	Aug	8.6	3.4	56.7
2017	Sep	-0.3	4.1	1.6
2017	Oct	-	-	-
2017	Nov	-	-	-
2017	Dec	-	-	-
2018	Jan	-32.2	0.6	0.0
2018	Feb	-34.6	2.0	0.0
2018	Mar	-25.3	3.4	0.0
2018	Apr	-17.6	3.2	1.7
2018	May	-8.5	3.2	0.6
2018	Jun	4.8	4.3	26.0
2018	Jul	7.5	4.4	51.3
2018	Aug	6.4	4.0	2.0
2018	Sep	-2.1	4.7	25.1
2018	Oct	-14.2	3.3	0.0
2018	Nov	-25.4	2.0	0.0
2018	Dec	-26.5	2.9	0.0
2019	Jan	-31.4	3.0	0.0
2019	Feb	-33.6	0.8	0.0
2019	Mar	-27.8	2.9	0.0
2019	Apr	-20.6	3.3	0.1
2019	May	-0.1	4.1	7.1
2019	Jun	6.4	4.4	45.2
2019	Jul	11.0	4.0	54.4
2019	Aug	11.2	4.0	22.6
2019	Sep	2.4	4.4	20.6
2019	Oct	3.0	4.8	*2.4*
2019	Nov	-8.9	3.1	*0.1*
2019	Dec	-14.9	3.7	*0.0*
2020	Jan	-33.1	1.0	*0.0*
2020	Feb	-32.4	0.6	*0.0*
2020	Mar	-25.9	2.3	*0.0*
2020	Apr	-13.9	1.5	*0.0*
2020	May	-6.1	2.9	*0.1*

Appendix Table A-2. Mary River post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2020	Jun	5.8	1.8	*0.2*
2020	Jul	14.1	2.2	*0.4*
2020	Aug	8.5	2.2	*0.9*
2020	Sep	5.3	2.5	*0.0*
2020	Oct	-	-	*-*
2020	Nov	-	-	*-*
2020	Dec	-19.6	4.8	*0.0*
2021	Jan	-21.9	3.6	*0.0*
2021	Feb	-26.2	4.0	*0.0*
2021	Mar	-29.9	3.3	*0.0*
2021	Apr	-13.9	5.6	*0.0*
2021	May	-4.9	3.9	*0.1*
2021	Jun	6.2	4.5	*1.5*
2021	Jul	7.0	4.5	*2.2*
2021	Aug	6.6	5.3	*11.8*
2021	Sep	-1.6	3.8	13.0
2021	Oct	-2.5	5.9	22.6
2021	Nov	-20.0	2.3	0.0
2021	Dec	-21.6	3.4	0.0
2022	Jan	-29.0	2.1	0
2022	Feb	-33.7	2.1	0
2022	Mar	-25.0	2.4	0
2022	Apr	-17.8	4.5	0
2022	May	-8.7	3.6	1.6
2022	Jun	3.4	4.1	33.2
2022	Jul	13.4	3.4	7.4
2022	Aug	8.0	3.8	32
2022	Sep	1.1	5.5	35.8
2022	Oct	-10.6	5.2	10.8
2022	Nov	-26.9	2.4	0
2022	Dec	-23.3	5.0	0

Italicized grey text indicates precipitation data recorded during time periods with a potentially blocked rain gauge.

Appendix Table A-3. Milne Inlet baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2006	Jun	-	5.6	1.5
2006	Jul	8.6	5.5	76.5
2006	Aug	8.1	6.4	35.8
2006	Sep	1.6	5.0	52.3
2006	Oct	-4.8	5.0	0.3
2006	Nov	-19.1	4.9	0.0
2006	Dec	-28.2	3.7	0.0
2007	Jan	-30.6	2.4	0.0
2007	Feb	-25.3	4.7	0.0
2007	Mar	-30.9	4.0	0.0
2007	Apr	-18.6	4.2	0.0
2007	May	-10.7	2.8	0.0
2007	Jun	2.8	5.0	0.0
2007	Jul	9.9	5.4	16.1
2007	Aug	7.8	5.1	24.7
2007	Sep	-1.0	5.0	7.2
2007	Oct	-10.5	5.3	0.0
2007	Nov	-22.9	5.2	0.0
2007	Dec	-29.7	3.5	0.0
2008	Jan	-28.0	4.4	0.0
2008	Feb	-34.2	3.0	0.0
2008	Mar	-29.9	4.8	0.0
2008	Apr	-17.3	5.3	0.0
2008	May	-4.6	4.9	0.0
2008	Jun	-	5.1	14.4
2008	Jul	9.9	5.5	82.2
2008	Aug	-	3.7	3.9
2008	Sep	-	5.3	0.0
2008	Oct	-11.3	5.3	0.0
2008	Nov	-21.9	3.5	0.0
2008	Dec	-28.8	5.2	0.0
2009	Jan	-27.7	4.5	0.0
2009	Feb	-31.0	2.6	0.0
2009	Mar	-27.9	4.6	0.0
2009	Apr	-17.9	3.2	0.0
2009	May	-7.5	3.8	0.0
2009	Jun	3.5	5.7	0.0

Appendix Table A-3. Milne Inlet baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2009	Jul	11.5	5.8	0.0
2009	Aug	-	6.3	0.0
2009	Sep	-	4.5	0.0
2009	Oct	-	4.5	0.0
2009	Nov	-	4.5	0.0
2009	Dec	-	4.5	0.0
2010	Jan	-	-	-
2010	Feb	-	-	-
2010	Mar	-	13.9	26.2

Appendix Table A-4. Milne Inlet post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2013	Aug	2.1	5.2	37.4
2013	Sep	-1.8	6.2	0.6
2013	Oct	-7.9	5.1	1.4
2013	Nov	-25.7	3.1	0.0
2013	Dec	-30.2	2.8	0.0
2014	Jan	-29.2	4.2	0.0
2014	Feb	-31.2	3.8	0.0
2014	Mar	-29.0	2.4	0.0
2014	Apr	-19.4	4.8	1.0
2014	May	-7.5	4.3	1.8
2014	Jun	1.8	5.0	13.9
2014	Jul	10.5	4.0	8.9
2014	Aug	5.4	5.7	10.3
2014	Sep	-2.3	4.0	3.0
2014	Oct	-10.6	3.6	0.2
2014	Nov	-21.3	2.1	0.0
2014	Dec	-29.2	4.3	0.0
2015	Jan	-33.8	2.6	0.0
2015	Feb	-35.3	2.5	0.0
2015	Mar	-29.5	3.0	0.0
2015	Apr	-23.7	3.6	0.0
2015	May	-8.3	5.2	1.1
2015	Jun	2.5	4.9	10.1
2015	Jul	10.0	4.8	8.0

Appendix Table A-4. Milne Inlet post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2015	Aug	6.0	5.5	7.7
2015	Sep	-0.1	5.9	10.1
2015	Oct	-9.5	5.8	6.5
2015	Nov	-21.6	4.5	0.0
2015	Dec	-30.5	6.8	0.0
2016	Jan	-25.3	4.9	0.0
2016	Feb	-31.6	3.3	0.2
2016	Mar	-29.3	2.5	0.0
2016	Apr	-16.8	5.7	1.2
2016	May	-5.8	5.8	5.3
2016	Jun	4.0	4.0	8.8
2016	Jul	9.9	5.4	22.7
2016	Aug	8.7	5.3	39.8
2016	Sep	-1.6	6.2	18.5
2016	Oct	-10.6	5.5	0.1
2016	Nov	-16.8	5.1	0.0
2016	Dec	-27.0	3.2	0.0
2017	Jan	-25.7	4.9	0.0
2017	Feb	-30.7	3.4	0.0
2017	Mar	-30.4	4.0	0.0
2017	Apr	-16.7	5.3	0.0
2017	May	-6.9	4.4	0.0
2017	Jun	3.1	5.0	0.0
2017	Jul	6.9	6.2	34.1
2017	Aug	7.0	4.9	10.8
2017	Sep	-0.7	6.5	8.9
2017	Oct	-	-	-
2017	Nov	-	-	-
2017	Dec	-	-	-
2018	Jan	-31.0	21.5	0.0
2018	Feb	-35.1	16.7	0.0
2018	Mar	-26.9	5.4	0.0
2018	Apr	-19.4	6.9	0.1
2018	May	-9.8	4.8	0.0
2018	Jun	3.3	5.6	19.3
2018	Jul	6.7	6.3	74.8
2018	Aug	4.9	5.9	52.5

Appendix Table A-4. Milne Inlet post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2018	Sep	-11.8	6.0	18.1
2018	Oct	-23.4	6.8	0.0
2018	Nov	-35.3	2.5	0.0
2018	Dec	-34.2	14.4	0.0
2019	Jan	-40.9	11.5	0.0
2019	Feb	-41.1	30.5	0.0
2019	Mar	-36.2	5.0	0.0
2019	Apr	-31.3	6.0	0.5
2019	May	-12.0	6.0	2.8
2019	Jun	-4.4	5.5	30.5
2019	Jul	-0.3	6.3	50.1
2019	Aug	0.3	5.7	30.4
2019	Sep	-8.1	2.9	41.3
2019	Oct	-8.2	0.0	1.0
2019	Nov	-19.1	0.0	0.0
2019	Dec	-25.1	0.0	0.0
2020	Jan	-35.3	0.0	0.0
2020	Feb	-34.7	0.0	0.0
2020	Mar	-29.3	0.0	0.0
2020	Apr	-17.9	0.0	0.0
2020	May	-7.9	0.0	0.2
2020	Jun	4.4	0.0	31.0
2020	Jul	11.5	0.0	20.9
2020	Aug	6.6	0.1	*0.0*
2020	Sep	-1.4	2.5	*0.3*
2020	Oct	-6.8	4.6	*0.0*
2020	Nov	-22.1	5.6	*0.0*
2020	Dec	-22.4	5.5	*0.0*
2021	Jan	-22.5	4.8	*0.0*
2021	Feb	-28.1	5.1	*0.0*
2021	Mar	-29.2	5.3	*0.0*
2021	Apr	-15.3	5.4	*0.0*
2021	May	-6.1	4.7	*0.0*
2021	Jun	4.3	5.5	*0.4*
2021	Jul	5.9	6.2	*0.4*
2021	Aug	5.2	6.6	*9.2*
2021	Sep	-1.3	5.2	10.6

Appendix Table A-4. Milne Inlet post-baseline climate data.

Year	Month	Average Air Temperature (°C)	Average Wind Speed (m/s)	Total Precipitation (mm)
2021	Oct	-2.4	8.6	15.2
2021	Nov	-18.9	3.3	0.0
2021	Dec	-22.2	5.3	0.0
2022	Jan	-29.4	3.4	0
2022	Feb	-33.4	3.1	0
2022	Mar	-25.8	4.1	0
2022	Apr	-18.7	6.3	0
2022	May	-9.3	5.5	0.4
2022	Jun	2.4	5.3	6.8
2022	Jul	11.3	4.7	2.4
2022	Aug	6.9	5.7	13.6
2022	Sep	0.7	6.5	39
2022	Oct	-10.3	6.0	0.2
2022	Nov	-24.8	3.7	0
2022	Dec	-23.7	6.2	0

Italicized grey text indicates precipitation data recorded during time periods with a potentially blocked rain gauge.

APPENDIX B VEGETATION AND SOIL BASE METALS MONITORING SITES 2012 - 2022

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
MP-01	Near	2014	L-56	1	1	1		0.00	DF-P-04	14.25	71.8709	-80.8824
		2020	MP-01_2020	1	1			0.00	DF-P-04	37.40	71.8710	-80.8817
		2021	MP-L-56	1	1			0.00	DF-P-04	14.27	71.8710	-80.8820
		2022	MP-01_2022	1	1			0.00	DF-P-04	22.70	71.87117	-80.8824
MP-02	Near	2016	L-101	1	1			50.93	DF-P-04	594.69	71.8761	-80.8778
		2019	L-118	1	1			50.12	DF-P-04	573.38	71.8759	-80.8778
		2020	MP-02_2020	1	1			49.39	DF-P-04	572.11	71.8759	-80.8778
		2021	MP-L-118	1	1			45.86	DF-P-04	571.27	71.8759	-80.8778
		2022	MP-02_2022	1	1			53.12	DF-P-04	580.25	71.8760	-80.8777
MP-03	Near	2016	L-100	1	1			36.01	DF-P-04	654.69	71.8767	-80.8783
		2019	L-119	1	1			39.89	DF-P-04	666.35	71.8768	-80.8782
		2020	MP-03_2020	1	1			35.72	DF-P-04	665.37	71.8768	-80.8783
		2021	MP-L-119	1	1			35.97	DF-P-04	666.25	71.8767	-80.8782
		2022	MP-03_2022	1	1			34.87	DF-P-04	659.22	71.8768	-80.8784
MP-04	Near	2016	L-97	1	1			63.31	DF-P-04	833.29	71.8783	-80.8777
		2019	L-121	1	1			57.18	DF-P-06	817.54	71.8785	-80.8779
		2020	MP-04_2020	1	1			66.90	DF-P-06	837.00	71.8783	-80.8776
		2021	MP-L-121	1	1			60.27	DF-P-06	843.31	71.8783	-80.8777
		2022	MP-04_2022	1	1			62.75	DF-P-06	833.80	71.8784	-80.8777
MP-05	Near	2016	L-96	1	1			45.74	DF-P-06	750.13	71.8791	-80.8783
		2019	L-122	1	1			46.14	DF-P-06	738.98	71.8792	-80.8783
		2020	MP-05_2020	1	1			46.84	DF-P-06	739.01	71.8792	-80.8783
		2021	MP-L-122	1	1			44.46	DF-P-06	741.51	71.8791	-80.8782
		2022	MP-05_2022	1	1			34.36	DF-P-06	747.01	71.8791	-80.8786
MP-06	Near	2016	L-94	1	1			25.28	DF-P-06	549.02	71.8809	-80.8791
		2019	L-144	1	1			35.28	DF-P-06	560.19	71.8808	-80.8788

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
		2020	MP-06_2020	1	1			33.83	DF-P-06	552.37	71.8809	-80.8789
		2021	MP-L-144	1	1			34.85	DF-P-06	561.25	71.8808	-80.8789
		2022	MP-06_2022	1	1			30.38	DF-P-06	563.32	71.8808	-80.8790
MP-07	Near	2016	L-91	1	1			66.59	DF-P-06	438.74	71.8819	-80.8780
		2019	L-145	1	1			44.35	DF-P-06	426.50	71.8820	-80.8786
		2020	MP-07_2020	1	1			43.67	DF-P-06	426.48	71.8820	-80.8786
		2021	MP-L-145	1	1			44.47	DF-P-06	426.58	71.8819	-80.8784
		2022	MP-07_2022	1	1			53.18	DF-P-06	430.09	71.8820	-80.8784
MP-08	Near	2014	L-57	1		1		0.00	DF-P-06	6.37	71.8858	-80.8790
		2020	MP-08_2020	1	1			0.00	DF-P-06	12.14	71.8859	-80.8790
		2021	MP-57-2021	1	1			0.00	DF-P-06	6.94	71.8858	-80.8790
		2022	MP-08_2022	1	1			0.00	DF-P-06	32.54	71.8859	-80.8799
MP-09	Near	2019	L-147	1	1			104.15	DF-P-06	247.90	71.8838	-80.8760
		2020	MP-09_2020	1	1			119.47	DF-P-06	250.19	71.8838	-80.8755
		2021	MP-L-147	1	1			104.37	DF-P-06	249.44	71.8834	-80.8766
		2022	MP-09_2022	1	1			90.17	DF-P-06	285.97	71.8834	-80.8766
MP-10	Near	2019	L-146	1	1			82.92	DF-P-06	322.07	71.8830	-80.8770
		2020	MP-10_2020	1	1			71.19	DF-P-06	303.79	71.8832	-80.8773
		2021	MP-L-146	1	1			82.41	DF-P-06	322.52	71.8830	-80.8771
		2022	MP-10_2022	1	1			75.57	DF-P-06	317.00	71.8830	-80.8772
MP-11	Far	2016	L-93	1	1			171.14	DF-P-06	469.25	71.8818	-80.8750
		2020	MP-11_2020	1	1			171.37	DF-P-06	472.55	71.8818	-80.8750
		2022	MP-11_2022	1	1			168.32	DF-P-06	465.27	71.8818	-80.8751
MP-12	Far	2016	L-102	1	1			424.04	DF-P-04	758.30	71.8757	-80.8670
		2020	MP-12_2020	1	1			425.51	DF-P-04	760.84	71.8757	-80.8670
		2022	MP-12_2022	1	1			420.68	DF-P-04	759.81	71.8758	-80.8671

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
MP-13	Far	2019	L-142	1	1			841.35	DF-P-04	1034.94	71.8742	-80.8548
		2020	MP-13_2020	1	1			839.30	DF-P-04	1033.37	71.8742	-80.8549
		2022	MP-13_2022	1	1			835.61	DF-P-04	1030.42	71.8742	-80.8550
MP-14	Far	2019	L-136	1	1			755.54	DF-P-04	1003.25	71.8753	-80.8574
		2020	MP-14_2020	1	1			755.34	DF-P-04	1000.59	71.8752	-80.8574
		2022	MP-14_2022	1	1			772.05	DF-P-04	1009.34	71.8751	-80.8569
MP-15	Far	2016	L-103	1	1			649.33	DF-P-04	984.57	71.8765	-80.8606
		2020	MP-15_2020	1	1			647.47	DF-P-04	981.13	71.8765	-80.8607
		2022	MP-15_2022	1	1			645.56	DF-P-04	978.94	71.8765	-80.8607
MP-16	Reference	2013	L-02	1	1	1		3269.31	DF-P-03	0.84	71.8996	-80.7884
		2019	L-135	1	1			3266.82	DF-P-03	25.58	71.8994	-80.7882
		2020	MP-16_2020	1	1			3268.13	DF-P-03	18.93	71.8995	-80.7882
		2022	MP-16_2022	1	1			3255.69	DF-P-03	13.02	71.8996	-80.7887
MP-17	Reference	2019	L-141	1	1			2168.16	DF-P-03	1744.01	71.8865	-80.8157
		2020	MP-17_2020	1	1			2164.88	DF-P-03	1742.16	71.8865	-80.8158
		2022	MP-17_2022	1	1			2176.20	DF-P-03	1738.95	71.8865	-80.8155
MP-18	Reference	2016	L-105	1	1			1824.06	DF-P-04	2055.62	71.8770	-80.8268
		2020	MP-18_2020	1	1			1822.94	DF-P-04	2053.91	71.8770	-80.8268
		2022	MP-18_2022	1	1			1821.81	DF-P-04	2053.03	71.8770	-80.8269
MP-19	Near	2016	L-92	1	1			44.65	DF-P-06	493.40	71.8814	-80.8786
		2019	L-143	1	1			34.25	DF-P-06	493.24	71.8814	-80.8789
MP-20	Near	2016	L-98	1	1			40.07	DF-P-04	763.50	71.8777	-80.8783
		2019	L-120	1	1			19.25	DF-P-04	759.54	71.8777	-80.8789
MP-21	Near	2013	L-01	1	1			0.00	DF-P-05	139.00	71.8850	-80.8912
MP-22	Reference	2019	L-140	1	1			2303.95	DF-P-03	1842.41	71.8848	-80.8118
MP-23	Near	2014	L-58	1	1			0.00	DF-P-07	324.09	71.8838	-80.9159

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
MP-24	Near	2016	L-95	1	1			28.98	DF-P-06	638.24	71.8801	-80.8789
MP-25	Near	2016	L-99	1	1			17.22	DF-P-04	704.72	71.8772	-80.8789
MP-26	Far	2019	L-137	1	1			726.06	DF-P-04	1051.98	71.8766	-80.8584
MP-27	Near	2013	L-03	1	1		1	0.00	DF-P-04	103.98	71.8702	-80.8844
MP-28	Reference	2019	L-139	1	1			3157.83	DF-P-03	127.06	71.8988	-80.7909
MP-29	Far	2016	L-104	1	1			805.58	DF-P-04	1024.99	71.8748	-80.8559
		2022	MP-29_2022	1	1			802.57	DF-P-04	1020.07	71.8748	-80.8560
MP-30	Reference	2016	L-106	1	1			3217.83	DF-P-03	70.63	71.8999	-80.7902
		2022	MP-30_2022	1	1			3218.62	DF-P-03	68.22	71.8999	-80.7902
MS-01	Near	2020	MS-01_2020	1	1			0.00	DF-M-01	42.23	71.3243	-79.3759
		2022	MS-01_2022	1	1			0.00	DF-M-01	22.74	71.3242	-79.3753
MS-02	Near	2019	L-128	1	1			30.95	DF-M-01	709.06	71.3202	-79.3595
		2020	MS-02_2020	1	1			38.52	DF-M-01	710.67	71.3201	-79.3596
		2022	MS-02_2022	1	1			34.58	DF-M-01	712.49	71.3202	-79.3595
MS-03	Near	2016	L-83	1	1			92.95	DF-M-07	1142.60	71.3101	-79.2012
		2019	L-154	1	1			87.41	DF-M-07	1144.64	71.3101	-79.2015
		2020	MS-03_2020	1	1			90.23	DF-M-07	1142.10	71.3101	-79.2014
		2022	MS-03_2022	1	1			96.00	DF-M-07	1137.31	71.3101	-79.2013
MS-04	Near	2016	L-85	1	1			63.14	DF-M-03	1189.10	71.3102	-79.2114
		2019	L-155	1	1			74.36	DF-M-03	1192.90	71.3101	-79.2112
		2020	MS-04_2020	1	1			71.50	DF-M-03	1198.63	71.3101	-79.2111
		2022	MS-04_2022	1	1			72.66	DF-M-03	1192.02	71.3101	-79.2112
MS-05	Near	2016	L-86	1	1			46.83	DF-M-03	817.49	71.3094	-79.2215
		2019	L-156	1	1			55.68	DF-M-03	803.94	71.3093	-79.2218
		2020	MS-05_2020	1	1			59.59	DF-M-03	806.40	71.3093	-79.2217
		2022	MS-05_2022	1	1			38.21	DF-M-03	814.50	71.3095	-79.2217

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
MS-06	Near	2016	L-88	1	1			53.84	DF-M-03	313.01	71.3075	-79.2346
		2019	L-157	1	1			53.23	DF-M-03	335.66	71.3076	-79.2340
		2020	MS-06_2020	1	1			53.58	DF-M-03	336.72	71.3076	-79.2340
		2022	MS-06_2022	1	1			42.21	DF-M-03	329.33	71.3077	-79.2342
MS-07	Near	2019	L-153	1	1			18.73	DF-M-02	1103.30	71.3004	-79.2729
		2020	MS-07_2020	1	1			26.40	DF-M-02	1109.90	71.3003	-79.2729
		2022	MS-07_2022	1	1			29.23	DF-M-02	1108.08	71.3003	-79.2731
MS-08	Near	2016	L-82	1	1			69.06	DF-M-03	1214.29	71.2997	-79.2679
		2019	L-131	1	1			71.21	DF-M-03	1224.70	71.2997	-79.2683
		2020	MS-08_2020	1	1			66.38	DF-M-03	1219.61	71.2997	-79.2682
		2022	MS-08_2022	1	1			68.28	DF-M-03	1218.12	71.2997	-79.2681
MS-09	Near	2019	L-130	1	1			33.83	DF-M-03	1094.74	71.2998	-79.2634
		2020	MS-09_2020	1	1			27.76	DF-M-03	1092.06	71.2999	-79.2635
		2022	MS-09_2022	1	1			29.11	DF-M-03	1089.82	71.2999	-79.2633
MS-10	Near	2019	L-132	1	1			1.56	DF-M-03	1033.91	71.3000	-79.2615
		2020	MS-10_2020	1	1			0.00	DF-M-03	1027.77	71.3000	-79.2614
		2022	MS-10_2022	1	1			0.00	DF-M-03	1029.86	71.3000	-79.2615
MS-11	Far	2019	L-134	1	1			238.26	DF-M-01	867.31	71.3181	-79.3600
		2020	MS-11_2020	1	1			242.25	DF-M-01	866.72	71.3181	-79.3601
		2022	MS-11_2022	1	1			242.85	DF-M-01	867.54	71.3181	-79.3601
MS-12	Far	2020	MS-12_2020	1	1			335.08	DF-M-01	669.35	71.3187	-79.3679
		2022	MS-12_2022	1	1			335.81	DF-M-01	673.38	71.3187	-79.3679
MS-13	Far	2019	L-159	1	1			367.31	DF-M-07	1150.49	71.3103	-79.1922
		2020	MS-13_2020	1	1			365.40	DF-M-07	1149.14	71.3103	-79.1923
		2022	MS-13_2022	1	1			373.51	DF-M-07	1132.40	71.3101	-79.1922
MS-14	Far	2016	L-115	1	1			451.95	DF-M-07	1186.34	71.3105	-79.1894

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
		2020	MS-14_2020	1	1			451.78	DF-M-07	1188.66	71.3105	-79.1894
		2022	MS-14_2022	1	1			442.11	DF-M-07	1211.25	71.3107	-79.1894
MS-15	Far	2020	MS-15_2020	1	1			162.69	DF-M-03	479.82	71.3070	-79.2299
		2022	MS-15_2022	1	1			162.20	DF-M-03	480.27	71.3070	-79.2299
MS-16	Far	2020	MS-16_2021	1	1			353.30	DF-M-02	1302.34	71.2976	-79.2774
		2022	MS-16_2022	1	1			354.46	DF-M-02	1302.19	71.2976	-79.2775
MS-17	Far	2020	MS-17_2021	1	1			655.56	DF-M-07	755.76	71.3043	-79.2116
		2022	MS-17_2022	1	1			656.58	DF-M-07	755.44	71.3043	-79.2116
MS-18	Far	2020	MS-18_2020	1	1			781.12	DF-M-02	1501.15	71.2951	-79.2891
		2022	MS-18_2022	1	1			781.68	DF-M-02	1500.66	71.2951	-79.2892
MS-19	Far	2020	MS-19_2020	1	1			537.87	DF-M-02	1302.74	71.2969	-79.2854
		2022	MS-19_2022	1	1			537.98	DF-M-02	1303.48	71.2969	-79.2854
MS-20	Far	2019	L-129	1	1			744.82	DF-M-01	1043.56	71.3150	-79.3712
		2020	MS-20_2020	1	1			740.84	DF-M-01	1040.50	71.3150	-79.3711
		2022	MS-20_2022	1	1			744.84	DF-M-01	1043.69	71.3150	-79.3713
MS-21	Far	2020	MS-21_2020	1	1			947.46	DF-M-01	1173.86	71.3138	-79.3757
		2022	MS-21_2022	1	1			945.19	DF-M-01	1174.46	71.3138	-79.3756
MS-22	Reference	2013	L-29	1	1	1		9228.31	DF-M-04	0.84	71.2197	-79.3277
		2019	L-165	1	1			9227.39	DF-M-04	3.28	71.2197	-79.3276
		2020	MS-22_2020	1	1			9233.41	DF-M-04	12.88	71.2196	-79.3274
		2022	MS-22_2022	1	1			9233.14	DF-M-04	4.08	71.2197	-79.3277
MS-23	Reference	2019	L-138	1	1			4139.17	DF-M-08	303.03	71.2968	-79.0955
		2020	MS-23_2020	1	1			4143.27	DF-M-08	299.61	71.2968	-79.0954
		2022	MS-23_2022	1	1			4144.40	DF-M-08	298.96	71.2968	-79.0954
MS-24	Reference	2019	L-166	1	1			10254.11	DF-M-05	1403.66	71.3843	-78.9051
		2020	MS-24_2020	1	1			10235.26	DF-M-05	1393.70	71.3843	-78.9057

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
		2022	MS-24_2022	1	1			10234.70	DF-M-05	1392.60	71.3843	-78.9057
MS-25	Reference	2014	L-65	1	1	1		1230.76	DF-M-07	2.38	71.3000	-79.1953
		2019	L-170	1	1			1221.17	DF-M-07	7.48	71.3001	-79.1953
		2020	MS-25_2020	1	1			1219.94	DF-M-07	22.60	71.3001	-79.1959
		2022	MS-25_2022	1	1			1218.44	DF-M-07	20.96	71.3001	-79.1959
MS-26	Reference	2014	L-64	1	1			1186.92	DF-M-06	4.26	71.3196	-79.1559
		2016	L-113	1	1			1182.06	DF-M-06	5.49	71.3196	-79.1560
		2019	L-174	1	1			1215.24	DF-M-06	36.63	71.3196	-79.1550
MS-27	Reference	2014	L-66	1	1	1		4092.75	DF-M-08	2.87	71.2945	-79.1001
MS-28	Reference	2012	L-20	1	1			32532.26	DF-RS-08	28077.06	71.6457	-79.2153
MS-29	Reference	2012	L-28	1	1			39601.07	DF-M-05	30884.62	71.5403	-78.2296
MS-30	Reference	2016	L-111	1	1			10383.88	DF-M-05	1600.41	71.3860	-78.9034
MS-31	Reference	2012	L-27	1	-			2447.89	DF-M-06	7062.32	71.3758	-79.2471
MS-32	Reference	2012	L-26	1	1			2880.93	DF-M-06	3122.46	71.3391	-79.0935
MS-33	Far	2012	L-24	1	1			128.79	DF-M-01	979.85	71.3331	-79.3766
MS-34	Near	2019	L-133	1	1			18.65	DF-M-01	357.19	71.3220	-79.3677
MS-35	Far	2016	L-90	1	1			403.25	DF-M-01	707.93	71.3182	-79.3691
MS-36	Near	2016	L-84	1	1			83.75	DF-M-07	1168.22	71.3101	-79.2043
MS-37	Near	2016	L-87	1	1			62.94	DF-M-03	636.98	71.3089	-79.2263
MS-38	Near	2013	L-25	1	1	1		0.00	DF-M-03	2.44	71.3072	-79.2433
MS-39	Near	2019	L-158	1	1			92.01	DF-M-03	252.95	71.3060	-79.2373
MS-40	Near	2016	L-89	1	1			90.01	DF-M-03	339.23	71.3047	-79.2379
MS-41	Near	2016	L-117	1	1			46.20	DF-M-03	1150.47	71.2998	-79.2657
MS-42	Reference	2016	L-110	1	1			3869.16	DF-M-08	402.83	71.2981	-79.1020
MS-43	Reference	2014	L-67	1	1	1	1	3346.77	DF-M-09	5.01	71.2936	-79.4128
MS-44	Reference	2016	L-109	1	1			9105.87	DF-M-04	124.22	71.2208	-79.3274

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
MS-45	Reference	2016	L-112	1	1			1044.33	DF-M-06	141.07	71.3202	-79.1594
MS-46	Far	2016	L-114	1	1			391.40	DF-M-07	1095.36	71.3098	-79.1921
MS-47	Far	2019	L-160	1	1			417.07	DF-M-07	1250.49	71.3111	-79.1897
MS-48	Near	2013	L-23	1	1		1	0.00	DF-M-01	4.33	71.3243	-79.3747
MS-49	Near	2016	L-81	1	1			56.11	DF-M-02	1115.09	71.3001	-79.2737
TR-01	Near	2019	L-152	1	1			17.83	DF-RS-03	1549.83	71.3913	-79.7827
		2020	TR-01_2020	1	1			20.28	DF-RS-03	1554.86	71.3913	-79.7826
		2021	TR_152_2021	1	1			19.87	DF-RS-03	1549.02	71.3912	-79.7826
		2022	TR-01_2022	1	1			21.56	DF-RS-03	1552.08	71.3913	-79.7826
TR-02	Near	2020	TR-02_2020	1	1			92.93	DF-RS-03	1015.34	71.3920	-79.7984
		2022	TR-02_2022	1	1			94.19	DF-RS-03	995.65	71.3921	-79.7989
TR-03	Near	2013	L-16	1	1	1		0.00	DF-RS-06	1.46	71.3986	-79.8234
		2019	L-151	1	1			0.00	DF-RS-06	3.56	71.3986	-79.8235
		2020	TR-03_2020	1	1			0.00	DF-RS-06	1.07	71.3986	-79.8234
		2022	TR-03_2022	1	1			0.00	DF-RS-06	3.03	71.3986	-79.8235
TR-04	Near	2016	L-79	1	1			0.00	DF-RS-03	1554.84	71.3891	-79.7862
		2020	TR-04_2020	1	1			0.00	DF-RS-03	1530.50	71.3893	-79.7867
		2021	TR-79-2021	1	1			0.00	DF-RS-03	0.00	71.3891	-79.7864
TR-05	Near	2013	L-15	1	1		1	67.05	DF-RS-03	0.53	71.3967	-79.8228
		2019	L-124	1	1			66.03	DF-RS-03	7.12	71.3967	-79.8230
		2020	TR-05_2020	1	1			83.57	DF-RS-03	31.38	71.3965	-79.8234
		2022	TR-05_2022	1	1			75.39	DF-RS-03	14.95	71.3966	-79.8231
TR-06	Near	2019	L-125	1	1			75.11	DF-RS-03	207.05	71.3962	-79.8284
		2020	TR-06_2020	1	1			79.38	DF-RS-03	216.10	71.3961	-79.8286
TR-07	Near	2019	L-149	1	1			36.10	DF-RS-03	786.23	71.3958	-79.8447
		2020	TR-07_2020	1	1			38.12	DF-RS-03	789.90	71.3958	-79.8448

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
		2022	TR-07_2022	1	1			42.39	DF-RS-03	762.40	71.3961	-79.8441
TR-08	Near	2019	L-172	1	1			19.48	DF-RN-05	11.16	71.7186	-80.4414
		2020	TR-08_2020	1	1			25.63	DF-RN-05	34.50	71.7188	-80.4416
		2022	TR-08_2022	1	1			14.70	DF-RN-05	20.29	71.7187	-80.4417
TR-09	Near	2013	L-07	1	1			86.51	DF-RN-06	1.15	71.7189	-80.4397
		2020	TR-09_2020	1	1			90.05	DF-RN-06	3.50	71.7189	-80.4397
		2022	TR-09_2022	1	1			93.13	DF-RN-06	10.22	71.7190	-80.4397
TR-10	Near	2013	L-06	1	1	1		73.72	DF-RN-03	3.79	71.7186	-80.4473
		2020	TR-10_2020	1	1			70.77	DF-RN-03	1.79	71.7186	-80.4473
TR-11	Far	2019	L-123	1	1			246.74	DF-RS-03	205.76	71.3954	-79.8187
		2020	TR-11_2020	1	1			245.67	DF-RS-03	204.98	71.3954	-79.8187
		2022	TR-11_2022	1	1			256.42	DF-RS-03	199.98	71.3952	-79.8197
TR-12	Far	2016	L-116	1	1			449.12	DF-RS-02	2032.15	71.3833	-79.8862
		2020	TR-12_2020	1	1			446.80	DF-RS-02	2032.08	71.3833	-79.8862
		2022	TR-12_2022	1	1			450.62	DF-RS-02	2031.80	71.3833	-79.8862
TR-13	Far	2013	L-17	1	1	1		954.74	DF-RS-07	1.28	71.4077	-79.8182
		2016	L-77	1	1			976.34	DF-RS-07	28.53	71.4079	-79.8187
		2019	L-162	1	1			943.12	DF-RS-07	11.15	71.4076	-79.8182
		2020	TR-13_2020	1	1			945.14	DF-RS-07	16.80	71.4076	-79.8186
		2022	TR-13_2022	1	1			954.80	DF-RS-07	5.45	71.4077	-79.8184
TR-14	Far	2013	L-14	1	1			627.65	DF-RS-02	4.26	71.3893	-79.8324
		2016	L-76	1	1			599.30	DF-RS-02	27.96	71.3896	-79.8326
		2019	L-161	1	1			611.19	DF-RS-02	14.93	71.3894	-79.8328
		2020	TR-14_2020	1	1			600.00	DF-RS-02	25.11	71.3896	-79.8327
		2022	TR-14_2022	1	1			606.22	DF-RS-02	17.95	71.3895	-79.8327
TR-15	Reference	2013	L-12	1	1	1	1	13986.35	DF-RR-01	2.77	71.2805	-80.2450

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
		2019	L-169	1	1			13978.40	DF-RR-01	14.09	71.2806	-80.2451
		2020	TR-15_2020	1	1			13975.85	DF-RR-01	17.45	71.2806	-80.2451
		2022	TR-15_2022	1	1			13984.48	DF-RR-01	6.47	71.2805	-80.2449
TR-16	Reference	2013	L-22	1	-	1		6022.58	DF-RS-01	1.78	71.3275	-79.8001
		2019	L-168	1	1			6032.35	DF-RS-01	20.36	71.3275	-79.8007
		2020	TR-16_2020	1	1			6002.17	DF-RS-01	35.52	71.3278	-79.8006
		2022	TR-16_2022	1	1			6012.06	DF-RS-01	26.08	71.3277	-79.8006
TR-17	Reference	2013	L-19	1	-	1		6672.12	DF-RS-08	1.33	71.4489	-79.7106
		2019	L-167	1	1			6663.09	DF-RS-08	19.48	71.4489	-79.7112
		2020	TR-17_2020	1	1			6648.29	DF-RS-08	38.95	71.4486	-79.7103
		2022	TR-17_2022	1	1			6675.56	DF-RS-08	4.26	71.4489	-79.7105
TR-18	Reference	2014	L-63	1	1	1		10692.18	DF-P-03	11616.77	71.8805	-80.4592
TR-19	Reference	2014	L-59	1	1	1		13242.00	DF-RN-08	7368.60	71.7752	-80.1047
TR-20	Reference	2013	L-09	1	1	1		5925.58	DF-RN-08	1.78	71.7435	-80.2898
		2022	TR-20_2022	1	1			5919.91	DF-RN-08	4.62	71.7435	-80.2899
TR-21	Far	2013	L-08	1	1	1		979.87	DF-RN-07	0.84	71.7226	-80.4165
		2022	TR217_2022	1	1			980.53	DF-RN-07	5.79	71.7226	-80.4164
TR-22	Near	2019	L-173	1	1			13.98	DF-RN-04	48.43	71.7192	-80.4466
TR-23	Far	2016	L-75	1	1			282.93	DF-RS-03	215.51	71.3948	-79.8217
TR-24	Near	2016	L-72	1	1			63.07	DF-RS-03	712.12	71.3967	-79.8428
TR-25	Far	2013	L-05	1	1	1		998.63	DF-RN-02	0.84	71.7145	-80.4704
TR-26	Reference	2013	L-04	1	1	1		4544.76	DF-RN-01	1.48	71.6882	-80.5363
TR-27	Reference	2012	L-11	1	1			3019.46	DF-TR-56E	5924.75	71.5628	-80.2148
TR-28	Reference	2013	L-10	1	-	1		14000.46	DF-RR-02	2.30	71.5189	-80.6923
TR-29	Reference	2016	L-108	1	1			6899.43	DF-RS-08	293.17	71.4515	-79.7117
TR-30	Reference	2012	L-18	1	1			1494.38	DF-RS-07	820.09	71.4113	-79.7981

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
TR-31	Reference	2019	L-164	1	1			6723.69	DF-RS-08	50.97	71.4493	-79.7100
TR-32	Far	2019	L-163	1	1			587.64	DF-RS-06	1034.30	71.4004	-79.8519
TR-33	Near	2016	L-73	1	1			79.93	DF-RS-06	324.75	71.3984	-79.8325
TR-34	Near	2019	L-171	1	1			0.00	DF-RS-05	13.24	71.3981	-79.8230
TR-35	Near	2019	L-150	1	1			2.79	DF-RS-06	240.90	71.3980	-79.8299
TR-36	Near	2019	L-126	1	1			10.97	DF-RS-04	163.68	71.3978	-79.8177
TR-37	Near	2019	L-127	1	1			0.00	DF-RS-04	15.44	71.3974	-79.8225
TR-38	Near	2016	L-74	1	1			122.81	DF-RS-03	55.88	71.3962	-79.8227
TR-39	Near	2016	L-71	1	1			115.29	DF-RS-02	1011.26	71.3944	-79.8560
TR-40	Near	2019	L-148	1	1			53.92	DF-RS-02	910.20	71.3941	-79.8532
TR-41	Near	2016	L-70	1	1			151.45	DF-RS-02	1311.70	71.3933	-79.8671
TR-42	Near	2016	L-69	1	1			82.69	DF-RS-02	1191.70	71.3904	-79.8657
TR-43	Near	2016	L-80	1	1			135.29	DF-RS-03	1812.00	71.3904	-79.7759
TR-44	Near	2016	L-68	1	1			113.77	DF-RS-02	1577.96	71.3884	-79.8766
TR-45	Near	2014	L-60	1	1	1	1	22.33	DF-M-01	6617.87	71.3423	-79.5512
TR-46	Reference	2012	L-13	1	1			8657.51	DF-RR-01	6532.74	71.3387	-80.2239
TR-47	Reference	2012	L-21	1	1			15563.78	DF-RS-01	11813.00	71.2216	-79.7948
TR-48	Far	2014	L-61	1	1	1	1	474.82	DF-M-01	5580.24	71.3383	-79.5246
TR-49	Reference	2016	L-107	1	1			6196.55	DF-RS-01	179.61	71.3259	-79.8008
TR-50	Near	2016	L-78	1	1			96.48	DF-RS-03	969.72	71.3922	-79.7995
SP[3]-01	Near	2012	L-52	1	1			114648.66	DF-M-04	106703.48	70.3044	-78.4834
SP-02	Reference	2012	L-53	1	1			116160.98	DF-M-04	108425.81	70.3025	-78.3506
SP-03	Reference	2012	L-54	1	1			122627.02	DF-M-04	114788.92	70.2413	-78.3607
SP-04	Reference	2012	L-51	1	1			108650.57	DF-M-04	100549.82	70.3491	-78.6165
SR[4]-01	Reference	2012	L-30	1	1			13826.31	DF-M-08	10252.60	71.2144	-78.9602
SR-02	Near	2012	L-31	1	1			17505.65	DF-M-08	13534.96	71.2128	-78.8212

Appendix Table B-1. Vegetation and soil base metals monitoring sites, 2012 to 2022.

Site ID	Distance Category	Year	Visit ID[1]	Soil	Lichen	Willow	Blue-berry	Distance to PDA (m)	Associated Dustfall Site[2]	Distance to Dustfall Site (m)	Latitude	Longitude
SR-03	Reference	2012	L-32	1	1			32466.09	DF-M-05	24196.07	71.3204	-78.2655
SR-04	Reference	2012	L-33	1	1			23731.69	DF-M-04	14793.63	71.0875	-79.2946
SR-05	Reference	2012	L-34	1	1			36223.15	DF-M-08	32282.17	71.0966	-78.4455
SR-06	Near	2012	L-35	1	1			40222.23	DF-M-08	36202.87	71.0947	-78.3074
SR-07	Reference	2012	L-36	1	1			44424.52	DF-M-08	40362.82	71.0926	-78.1693
SR-08	Reference	2012	L-37	1	1			49880.53	DF-M-05	43090.31	71.1990	-77.8489
SR-09	Reference	2012	L-38	1	1			61126.19	DF-M-05	54910.40	71.1263	-77.5989
SR-10	Reference	2012	L-39	1	1			46027.24	DF-M-04	37303.99	70.8878	-79.2013
SR-11	Reference	2012	L-40	1	1			56697.25	DF-M-04	51289.90	70.8778	-78.3816
SR-12	Near	2012	L-41	1	1			59477.26	DF-M-04	54729.82	70.8763	-78.2491
SR-13	Reference	2012	L-42	1	1			62698.21	DF-M-04	58552.22	70.8734	-78.1139
SR-14	Reference	2012	L-43	1	1			85517.56	DF-M-08	81479.30	70.8591	-77.2928
SR-15	Reference	2012	L-44	1	1			66939.34	DF-M-04	58475.05	70.7046	-79.0278
SR-16	Reference	2012	L-45	1	1			75851.59	DF-M-04	69487.49	70.7024	-78.2643
SR-17	Far	2012	L-46	1	1			79833.16	DF-M-04	73738.24	70.6845	-78.1393
SR-18	Reference	2012	L-47	1	1			90414.17	DF-M-04	81810.38	70.4932	-79.0190
SR-19	Far	2012	L-48	1	1			97006.40	DF-M-04	89650.45	70.4844	-78.3384
SR-20	Reference	2012	L-49	1	1			98863.91	DF-M-04	91743.17	70.4813	-78.2233
SR-21	Reference	2012	L-50	1	1			114424.91	DF-M-04	109190.26	70.4673	-77.4203
SR-22	Reference	2012	L-55	1	1			128982.36	DF-M-04	122594.05	70.2890	-77.5545
SR-23	Near	2014	L-62	1	1	1	1	36343.66	DF-M-08	32283.33	71.1324	-78.3563

[1] Visit ID represents the specific position that the sample was taken for a particular sampling year. All Visit IDs have an associated Site ID.

[2] Dustfall collectors and metal sampling sites were considered 'associated' if Near sites (0 to 100 m of the Mine Site, Tote Road, or Milne Port PDA) were within 0 to 12 m of a dustfall collector, if Far sites (100 to 1,000 m from the PDA) were within 13 to 60 m of a dustfall collector, and if Reference sites (≥1,000 m from the PDA) were within 60 to 150 m of a dustfall collector.

[3,4] SB = Steensby Inlet Port; SR = South Rail.

APPENDIX C VEGETATION AND SOIL BASE METALS MONITORING, 2022 LABORATORY RETURNS

Baffinland Iron Mine's Corporation
(Oakville)
ATTN: Connor Devereaux/Kendra Button
2275 Upper Middle Rd. E.
Suite #300
Oakville ON L6H 0C3

Date Received: 30-JUL-22
Report Date: 12-AUG-22 10:04 (MT)
Version: FINAL

Client Phone: 647-253-0596

Certificate of Analysis

Lab Work Order #: L2725848

Project P.O. #: 4500114277

Job Reference: 22Y0273_2022_SOIL-VEG MONITORING

C of C Numbers:

Legal Site Desc:

Rick Hawthorne
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit

Federal CCME Canadian Environmental Quality Guidelines (JUN, 2018) - CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

(No parameter exceedances)

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-1	L2725848-2	L2725848-3	L2725848-4	L2725848-5	L2725848-6	L2725848-7	L2725848-8	L2725848-9
Sample Date				17-JUL-22	24-JUL-22	24-JUL-22	17-JUL-22	24-JUL-22	24-JUL-22	16-JUL-22	16-JUL-22	17-JUL-22
Sample ID				TR-S-01_2022	TR-S-02_2022	TR-S-03_2022	TR-S-05_2022	TR-S-07_2022	TR-S-07_2022R	TR-S-08_2022	TR-S-09_2022	TR-S-11_2022
% Moisture	%	-	-	4.62	17.3	1.93	10.7	14.9	16.9	4.51	3.84	12.7
pH	pH units	-	-	4.72	4.40	4.86	4.68	4.30	4.24	7.65	7.47	4.20

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-10	L2725848-11	L2725848-12	L2725848-13	L2725848-14	L2725848-15	L2725848-16	L2725848-17	L2725848-18
Sample Date				17-JUL-22	17-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	18-JUL-22
Sample ID				TR-S-12_2022	TR-S-12_2022R	TR-S-13_2022	TR-S-14_2022	TR-S-15_2022	TR-S-16_2022	TR-S-17_2022	TR-S-20_2022	TR-S-21_2022
% Moisture	%	-	-	9.26	4.49	7.98	2.66	2.59	7.49	2.55	11.0	12.5
pH	pH units	-	-	4.76	4.88	5.23	4.44	6.08	6.53	6.30	5.24	7.12

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-1	L2725848-2	L2725848-3	L2725848-4	L2725848-5	L2725848-6	L2725848-7	L2725848-8	L2725848-9
Sample Date				17-JUL-22	24-JUL-22	24-JUL-22	17-JUL-22	24-JUL-22	24-JUL-22	16-JUL-22	16-JUL-22	17-JUL-22
Sample ID				TR-S-01_2022	TR-S-02_2022	TR-S-03_2022	TR-S-05_2022	TR-S-07_2022	TR-S-07_2022R	TR-S-08_2022	TR-S-09_2022	TR-S-11_2022
% Gravel (>2mm)	%	-	-	<1.0	<1.0	2.0	<1.0	2.8	1.7	23.2	32.8	<1.0
% Sand (2.00mm - 1.00mm)	%	-	-	1.6	2.2	3.9	3.4	7.2	2.1	3.4	19.5	1.7
% Sand (1.00mm - 0.50mm)	%	-	-	20.2	22.9	18.7	33.6	25.0	14.2	23.6	16.4	9.6
% Sand (0.50mm - 0.25mm)	%	-	-	54.7	47.4	53.5	46.1	43.9	49.9	31.6	10.4	36.3
% Sand (0.25mm - 0.125mm)	%	-	-	19.3	17.5	18.5	13.1	14.6	26.0	4.9	6.0	36.8
% Sand (0.125mm - 0.063mm)	%	-	-	1.8	1.9	1.8	1.3	1.1	2.9	2.9	3.3	9.9
% Silt (0.063mm - 0.0312mm)	%	-	-	1.1	3.1	<1.0	1.2	1.7	1.4	3.5	3.9	3.3
% Silt (0.0312mm - 0.004mm)	%	-	-	1.0	4.0	<1.0	1.2	3.2	1.6	5.4	6.2	1.7
% Clay (<4um)	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	1.4	<1.0
Texture		-	-	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Loamy sand	Sand

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

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ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-10	L2725848-11	L2725848-12	L2725848-13	L2725848-14	L2725848-15	L2725848-16	L2725848-17	L2725848-18
Sample Date				17-JUL-22	17-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	18-JUL-22
Sample ID				TR-S-12_2022	TR-S-12_2022R	TR-S-13_2022	TR-S-14_2022	TR-S-15_2022	TR-S-16_2022	TR-S-17_2022	TR-S-20_2022	TR-S-21_2022
% Gravel (>2mm)	%	-	-	<1.0	<1.0	2.9	<1.0	<1.0	8.0	20.5	<1.0	6.8
% Sand (2.00mm - 1.00mm)	%	-	-	<1.0	<1.0	4.5	<1.0	<1.0	5.4	4.4	1.9	<1.0
% Sand (1.00mm - 0.50mm)	%	-	-	17.4	17.2	13.7	12.3	5.0	10.3	9.1	11.4	3.0
% Sand (0.50mm - 0.25mm)	%	-	-	56.2	54.1	41.4	46.3	29.2	20.7	23.1	37.2	40.9
% Sand (0.25mm - 0.125mm)	%	-	-	21.1	22.4	32.0	29.4	21.6	17.9	26.2	33.1	32.8
% Sand (0.125mm - 0.063mm)	%	-	-	1.7	1.8	3.7	5.5	8.7	7.0	8.6	7.2	6.2
% Silt (0.063mm - 0.0312mm)	%	-	-	1.1	1.7	1.2	2.9	12.5	6.7	4.1	3.7	4.2
% Silt (0.0312mm - 0.004mm)	%	-	-	1.2	1.6	<1.0	2.7	17.1	15.0	3.3	4.0	4.6
% Clay (<4um)	%	-	-	<1.0	<1.0	<1.0	<1.0	5.6	9.1	<1.0	1.4	1.2
Texture		-	-	Sand	Sand	Sand	Sand	Sandy loam	Sandy loam	Sand	Sand	Sand

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.

Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-1	L2725848-2	L2725848-3	L2725848-4	L2725848-5	L2725848-6	L2725848-7	L2725848-8	L2725848-9
Sample Date				17-JUL-22	24-JUL-22	24-JUL-22	17-JUL-22	24-JUL-22	24-JUL-22	16-JUL-22	16-JUL-22	17-JUL-22
Sample ID				TR-S-01_2022	TR-S-02_2022	TR-S-03_2022	TR-S-05_2022	TR-S-07_2022	TR-S-07_2022R	TR-S-08_2022	TR-S-09_2022	TR-S-11_2022
Aluminum (Al)	ug/g	-	-	1070	1440	1350	1560	2600	2120	4120	3700	2920
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	0.21	2.36	0.32	0.31	0.59	0.29	2.05	1.79	0.33
Barium (Ba)	ug/g	2000	-	5.28	11.2	5.72	16.0	11.3	9.49	13.0	11.8	7.60
Beryllium (Be)	ug/g	8	-	<0.10	0.12	<0.10	<0.10	0.20	0.15	0.30	0.28	0.12
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	ug/g	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	21.4	23.4	<5.0
Cadmium (Cd)	ug/g	22	-	<0.020	<0.020	<0.020	<0.020	0.042	0.021	0.026	0.029	<0.020
Calcium (Ca)	ug/g	-	-	329	429	384	364	510	375	49500	68900	708
Chromium (Cr)	ug/g	87	-	6.21	23.4	7.50	7.01	18.8	13.3	12.8	11.7	15.4
Cobalt (Co)	ug/g	300	-	0.84	0.83	1.24	17.3	0.94	0.99	2.99	3.16	2.43
Copper (Cu)	ug/g	91	-	1.14	3.57	1.80	1.81	5.59	4.08	6.11	6.72	2.70
Iron (Fe)	ug/g	-	-	3570	6600	5060	4970	7270	3550	10800	9160	6390
Lead (Pb)	ug/g	260	-	1.38	1.74	1.31	1.46	1.67	1.43	5.35	5.07	2.27
Lithium (Li)	ug/g	-	-	<2.0	<2.0	2.4	2.5	3.0	3.3	17.4	15.9	5.3
Magnesium (Mg)	ug/g	-	-	643	460	1120	1100	1060	1120	22000	29700	2680
Manganese (Mn)	ug/g	-	-	21.9	11.9	33.0	849	16.1	17.3	158	168	47.3
Mercury (Hg)	ug/g	24	-	<0.0050	0.0098	<0.0050	0.0081	0.0122	0.0055	0.0159	0.0181	<0.0050
Molybdenum (Mo)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.47	0.39	<0.10
Nickel (Ni)	ug/g	89	-	2.89	8.16	4.16	5.59	7.86	5.84	7.77	8.17	11.1
Phosphorus (P)	ug/g	-	-	112	250	141	131	163	115	285	321	223
Potassium (K)	ug/g	-	-	200	110	240	190	130	130	1090	920	400
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/g	-	-	<50	<50	<50	<50	<50	<50	68	54	<50
Strontium (Sr)	ug/g	-	-	1.83	2.75	1.79	1.74	2.20	1.78	26.2	34.3	2.30
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.100	0.102	<0.050
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	88.8	102	115	107	127	133	116	90.9	272

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-10	L2725848-11	L2725848-12	L2725848-13	L2725848-14	L2725848-15	L2725848-16	L2725848-17	L2725848-18
Sample Date				17-JUL-22	17-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	18-JUL-22
Sample ID				TR-S-12_2022	TR-S-12_2022R	TR-S-13_2022	TR-S-14_2022	TR-S-15_2022	TR-S-16_2022	TR-S-17_2022	TR-S-20_2022	TR-S-21_2022
Aluminum (Al)	ug/g	-	-	952	972	1210	1200	4680	9380	5050	3150	1860
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	0.17	0.19	0.37	0.14	0.89	1.72	0.62	0.79	0.91
Barium (Ba)	ug/g	2000	-	3.58	3.93	5.14	4.71	15.1	31.4	21.3	14.0	8.94
Beryllium (Be)	ug/g	8	-	<0.10	<0.10	<0.10	<0.10	0.24	0.42	0.23	0.22	0.14
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	ug/g	-	-	<5.0	<5.0	<5.0	<5.0	10.0	8.1	6.5	<5.0	<5.0
Cadmium (Cd)	ug/g	22	-	<0.020	<0.020	<0.020	<0.020	0.039	0.023	<0.020	<0.020	<0.020
Calcium (Ca)	ug/g	-	-	378	403	530	391	14100	2930	1090	1850	6290
Chromium (Cr)	ug/g	87	-	5.04	5.20	21.3	7.74	22.4	38.3	21.9	11.3	4.99
Cobalt (Co)	ug/g	300	-	0.67	0.76	1.94	0.57	3.97	7.51	4.46	2.52	2.28
Copper (Cu)	ug/g	91	-	0.98	1.09	2.02	0.83	6.99	11.0	9.68	3.84	4.15
Iron (Fe)	ug/g	-	-	2820	2890	16100	1290	10500	19100	11300	8090	3720
Lead (Pb)	ug/g	260	-	1.32	1.14	1.92	1.52	4.34	7.93	3.06	3.29	2.92
Lithium (Li)	ug/g	-	-	<2.0	<2.0	2.8	<2.0	10.7	18.4	9.2	5.7	3.4
Magnesium (Mg)	ug/g	-	-	575	605	859	739	10700	5500	4590	1620	3370
Manganese (Mn)	ug/g	-	-	15.7	19.8	47.0	13.1	110	266	120	106	73.1
Mercury (Hg)	ug/g	24	-	<0.0050	<0.0050	<0.0050	<0.0050	0.0055	0.0050	<0.0050	0.0103	0.0058
Molybdenum (Mo)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	0.16	0.20	<0.10	0.12	<0.10
Nickel (Ni)	ug/g	89	-	1.98	2.06	4.01	2.81	15.9	21.3	14.9	5.17	3.37
Phosphorus (P)	ug/g	-	-	83	85	179	153	319	563	210	356	154
Potassium (K)	ug/g	-	-	150	150	160	120	790	1950	870	340	330
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/g	-	-	<50	<50	<50	<50	54	80	<50	<50	<50
Strontium (Sr)	ug/g	-	-	1.29	1.37	2.15	1.68	7.87	5.25	3.66	3.60	4.09
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	<0.050	<0.050	<0.050	<0.050	0.085	0.251	0.079	<0.050	<0.050
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	71.7	73.9	124	122	362	925	346	191	55.8

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-1	L2725848-2	L2725848-3	L2725848-4	L2725848-5	L2725848-6	L2725848-7	L2725848-8	L2725848-9
Sample Date				17-JUL-22	24-JUL-22	24-JUL-22	17-JUL-22	24-JUL-22	24-JUL-22	16-JUL-22	16-JUL-22	17-JUL-22
Sample ID				TR-S-01_2022	TR-S-02_2022	TR-S-03_2022	TR-S-05_2022	TR-S-07_2022	TR-S-07_2022R	TR-S-08_2022	TR-S-09_2022	TR-S-11_2022
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	0.243	0.937	0.237	0.261	0.753	0.527	0.520	0.386	0.324
Vanadium (V)	ug/g	130	-	5.55	25.6	6.67	5.68	13.6	9.99	13.7	11.3	9.98
Zinc (Zn)	ug/g	410	-	3.6	<2.0	3.8	4.5	6.8	4.8	11.2	12.3	9.1
Zirconium (Zr)	ug/g	-	-	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	1.5	1.7	<1.0

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725848-10	L2725848-11	L2725848-12	L2725848-13	L2725848-14	L2725848-15	L2725848-16	L2725848-17	L2725848-18
Sample Date				17-JUL-22	17-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22	18-JUL-22
Sample ID				TR-S-12_2022	TR-S-12_2022R	TR-S-13_2022	TR-S-14_2022	TR-S-15_2022	TR-S-16_2022	TR-S-17_2022	TR-S-20_2022	TR-S-21_2022
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	0.173	0.145	0.903	0.225	1.40	0.922	0.377	0.901	0.286
Vanadium (V)	ug/g	130	-	4.18	4.56	17.4	3.36	15.4	30.1	17.4	12.8	5.84
Zinc (Zn)	ug/g	410	-	3.0	3.0	3.9	3.4	16.7	27.1	13.9	7.0	5.7
Zirconium (Zr)	ug/g	-	-	<1.0	<1.0	<1.0	<1.0	6.3	16.4	2.4	1.2	1.0

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
HG-200.2-CVAA-WT	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020B (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H_2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Baffinland Iron Mine's Corporation
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Date Received: 30-JUL-22
Report Date: 15-AUG-22 07:11 (MT)
Version: FINAL

Client Phone: 647-253-0596

Certificate of Analysis

Lab Work Order #: L2725849
Project P.O. #: 4500114277
Job Reference: 22Y0273_2022_SOIL-VEG MONITORING
C of C Numbers:
Legal Site Desc:

Rick Hawthorne
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit

Federal CCME Canadian Environmental Quality Guidelines (JUN, 2018) - CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

(No parameter exceedances)

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725849-1	L2725849-2	L2725849-3	L2725849-4	L2725849-5	L2725849-6	L2725849-7	L2725849-8	L2725849-9
Sample Date				16-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	14-JUL-22	14-JUL-22
Sample ID				MP-S-01_2022	MP-S-02_2022	MP-S-03_2022	MP-S-04_2022	MP-S-05_2022	MP-S-05_2022R	MP-S-06_2022	MP-S-07_2022	MP-S-08_2022
% Moisture	%	-	-	30.3	8.94	8.40	7.00	7.78	8.76	20.0	11.5	4.33
pH	pH units	-	-	6.65	7.50	7.29	6.79	7.62	7.57	5.80	7.26	7.35

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725849-10	L2725849-11	L2725849-12	L2725849-13	L2725849-14	L2725849-15	L2725849-16
Sample Date				14-JUL-22	14-JUL-22	14-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22
Sample ID				MP-S-09_2022	MP-S-10_2022	MP-S-11_2022	MP-S-12_2022	MP-S-12_2022R	MP-S-13_2022	MP-S-14_2022
% Moisture	%	-	-	8.12	18.5	33.9	6.18	13.5	19.4	16.8
pH	pH units	-	-	7.44	7.01	5.74	7.63	7.25	6.80	7.01

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Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725849-1	L2725849-2	L2725849-3	L2725849-4	L2725849-5	L2725849-6	L2725849-7	L2725849-8	L2725849-9
Sample Date				16-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	14-JUL-22	14-JUL-22
Sample ID				MP-S-01_2022	MP-S-02_2022	MP-S-03_2022	MP-S-04_2022	MP-S-05_2022	MP-S-05_2022R	MP-S-06_2022	MP-S-07_2022	MP-S-08_2022
% Gravel (>2mm)	%	-	-	4.5	14.0	32.9	28.3	18.6	23.9	28.5	7.3	5.4
% Sand (2.00mm - 1.00mm)	%	-	-	1.3	5.8	7.2	7.0	4.2	3.8	7.5	2.5	7.6
% Sand (1.00mm - 0.50mm)	%	-	-	2.5	9.0	9.9	9.9	8.2	7.0	7.5	3.8	18.8
% Sand (0.50mm - 0.25mm)	%	-	-	17.4	18.7	15.1	15.7	17.4	15.4	9.4	4.9	33.0
% Sand (0.25mm - 0.125mm)	%	-	-	29.7	19.7	14.5	16.6	17.6	16.4	16.6	4.8	23.4
% Sand (0.125mm - 0.063mm)	%	-	-	10.6	11.7	6.0	8.4	9.1	9.1	11.5	4.6	5.4
% Silt (0.063mm - 0.0312mm)	%	-	-	13.4	9.1	6.5	6.0	7.9	7.3	7.9	12.9	3.1
% Silt (0.0312mm - 0.004mm)	%	-	-	17.6	9.9	7.0	6.7	11.6	11.5	9.4	33.3	2.7
% Clay (<4um)	%	-	-	2.9	2.1	<1.0	1.4	5.4	5.6	1.7	25.9	<1.0
Texture		-	-	Sandy loam	Loamy sand	Loamy sand	Loamy sand	Sandy loam	Sandy loam	Loamy sand	Silt loam	Sand

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725849-10	L2725849-11	L2725849-12	L2725849-13	L2725849-14	L2725849-15	L2725849-16
Sample Date				14-JUL-22	14-JUL-22	14-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22
Sample ID				MP-S-09_2022	MP-S-10_2022	MP-S-11_2022	MP-S-12_2022	MP-S-12_2022R	MP-S-13_2022	MP-S-14_2022
% Gravel (>2mm)	%	-	-	48.0	40.0	10.4	24.1	25.5	7.9	18.2
% Sand (2.00mm - 1.00mm)	%	-	-	14.0	2.9	4.8	6.5	6.5	2.7	6.2
% Sand (1.00mm - 0.50mm)	%	-	-	11.9	5.1	6.3	10.2	10.1	5.5	9.2
% Sand (0.50mm - 0.25mm)	%	-	-	10.7	10.7	11.4	14.7	15.8	17.0	14.2
% Sand (0.25mm - 0.125mm)	%	-	-	5.0	10.9	11.4	13.9	14.9	23.8	15.2
% Sand (0.125mm - 0.063mm)	%	-	-	4.2	6.3	7.8	7.8	6.9	13.4	10.1
% Silt (0.063mm - 0.0312mm)	%	-	-	2.8	10.1	20.0	7.3	7.5	13.5	9.7
% Silt (0.0312mm - 0.004mm)	%	-	-	2.8	11.8	24.7	11.1	10.5	14.3	14.0
% Clay (<4um)	%	-	-	<1.0	2.1	3.2	4.4	2.4	1.8	3.2
Texture		-	-	Sand	Sandy loam	Silt loam	Sandy loam	Loamy sand	Sandy loam / Loamy sand	Sandy loam

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
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ANALYTICAL REPORT

Metals - SOIL

			Lab ID	L2725849-1	L2725849-2	L2725849-3	L2725849-4	L2725849-5	L2725849-6	L2725849-7	L2725849-8	L2725849-9
			Sample Date	16-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	14-JUL-22	14-JUL-22
			Sample ID	MP-S-01_2022	MP-S-02_2022	MP-S-03_2022	MP-S-04_2022	MP-S-05_2022	MP-S-05_2022R	MP-S-06_2022	MP-S-07_2022	MP-S-08_2022
		Guide Limits										
Analyte	**Unit**	**#1**	**#2**									
Aluminum (Al)	ug/g	-	-	3980	4460	4840	3830	4070	4390	6740	10500	1240
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	0.82	1.18	1.18	1.16	0.95	1.13	1.37	3.06	0.53
Barium (Ba)	ug/g	2000	-	12.5	11.1	13.7	9.62	13.0	15.1	21.0	21.8	3.22
Beryllium (Be)	ug/g	8	-	0.26	0.30	0.32	0.25	0.24	0.27	0.37	0.63	<0.10
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	ug/g	-	-	10.1	8.3	8.4	<5.0	7.6	9.5	11.4	53.9	7.6
Cadmium (Cd)	ug/g	22	-	0.027	0.021	0.041	<0.020	0.023	<0.020	0.037	0.065	<0.020
Calcium (Ca)	ug/g	-	-	7270	20900	7800	4010	21300	33000	3730	80500	14000
Chromium (Cr)	ug/g	87	-	12.7	10.3	10.0	7.10	8.71	9.28	20.8	26.2	4.73
Cobalt (Co)	ug/g	300	-	2.89	2.85	2.90	2.51	2.65	2.92	4.83	6.74	0.81
Copper (Cu)	ug/g	91	-	4.90	6.08	5.47	4.09	5.12	5.93	8.48	13.2	1.29
Iron (Fe)	ug/g	-	-	8470	9240	9590	8640	7310	8240	14100	15600	2890
Lead (Pb)	ug/g	260	-	4.44	4.69	6.00	5.43	4.17	4.82	11.2	9.55	1.59
Lithium (Li)	ug/g	-	-	9.5	13.1	13.9	11.7	11.3	12.6	17.7	42.3	5.2
Magnesium (Mg)	ug/g	-	-	2850	13500	6340	4440	13500	20200	4670	36700	8800
Manganese (Mn)	ug/g	-	-	122	137	169	137	120	133	227	281	33.6
Mercury (Hg)	ug/g	24	-	0.0204	0.0060	0.0128	0.0051	<0.0050	<0.0050	0.0121	0.0247	<0.0050
Molybdenum (Mo)	ug/g	40	-	0.21	0.18	0.22	0.17	0.19	0.19	0.36	0.42	<0.10
Nickel (Ni)	ug/g	89	-	6.43	5.79	5.72	4.15	5.46	5.67	11.2	17.7	2.20
Phosphorus (P)	ug/g	-	-	345	215	240	146	228	207	298	627	179
Potassium (K)	ug/g	-	-	800	630	560	440	780	910	1150	3560	440
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/g	-	-	<50	54	60	55	90	101	50	128	67
Strontium (Sr)	ug/g	-	-	8.31	9.79	5.38	3.17	9.84	13.1	7.68	48.2	8.61
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	0.087	0.101	0.104	0.093	0.089	0.107	0.134	0.163	<0.050
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	189	241	227	254	236	265	393	307	77.2

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725849-10	L2725849-11	L2725849-12	L2725849-13	L2725849-14	L2725849-15	L2725849-16
Sample Date				14-JUL-22	14-JUL-22	14-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22
Sample ID				MP-S-09_2022	MP-S-10_2022	MP-S-11_2022	MP-S-12_2022	MP-S-12_2022R	MP-S-13_2022	MP-S-14_2022
Aluminum (Al)	ug/g	-	-	5460	6880	9400	5930	5910	6820	7920
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	1.41	1.77	1.82	1.42	1.42	1.65	1.42
Barium (Ba)	ug/g	2000	-	11.0	16.6	20.8	13.5	13.1	11.9	15.5
Beryllium (Be)	ug/g	8	-	0.33	0.46	0.54	0.40	0.37	0.41	0.50
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	ug/g	-	-	13.4	23.8	20.8	19.0	16.3	9.7	12.3
Cadmium (Cd)	ug/g	22	-	0.030	0.046	0.044	0.027	0.042	0.027	0.032
Calcium (Ca)	ug/g	-	-	28400	24200	5070	63800	37900	3290	8870
Chromium (Cr)	ug/g	87	-	13.2	18.0	25.3	13.1	13.3	16.3	18.1
Cobalt (Co)	ug/g	300	-	3.48	4.44	6.16	3.33	3.59	4.06	4.03
Copper (Cu)	ug/g	91	-	5.62	7.76	8.36	6.62	8.34	6.41	8.91
Iron (Fe)	ug/g	-	-	10900	12700	17000	10200	11200	12600	12900
Lead (Pb)	ug/g	260	-	6.10	7.04	11.4	6.12	8.80	6.51	8.32
Lithium (Li)	ug/g	-	-	17.3	23.6	24.0	19.6	19.0	19.6	21.2
Magnesium (Mg)	ug/g	-	-	17100	15600	5220	26100	19500	5140	7800
Manganese (Mn)	ug/g	-	-	181	220	284	174	200	221	130
Mercury (Hg)	ug/g	24	-	0.0066	0.0224	0.0206	0.0061	0.0102	0.0086	0.0130
Molybdenum (Mo)	ug/g	40	-	0.17	0.35	0.46	0.19	0.25	0.22	0.24
Nickel (Ni)	ug/g	89	-	7.45	10.1	11.7	8.02	8.39	9.78	9.93
Phosphorus (P)	ug/g	-	-	380	470	540	216	289	272	353
Potassium (K)	ug/g	-	-	950	1640	2060	980	810	890	1070
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/g	-	-	68	81	116	84	60	53	78
Strontium (Sr)	ug/g	-	-	13.8	17.9	14.5	33.0	17.2	4.33	7.12
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	0.108	0.133	0.137	0.128	0.114	0.103	0.131
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	323	221	404	335	295	422	434

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ANALYTICAL REPORT

Metals - SOIL

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Sample Date				16-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	14-JUL-22	14-JUL-22
Sample ID				MP-S-01_2022	MP-S-02_2022	MP-S-03_2022	MP-S-04_2022	MP-S-05_2022	MP-S-05_2022R	MP-S-06_2022	MP-S-07_2022	MP-S-08_2022
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	4.58	1.10	1.40	1.32	1.45	0.994	4.65	0.918	0.270
Vanadium (V)	ug/g	130	-	12.7	13.7	13.9	12.5	11.9	13.4	21.2	25.7	5.05
Zinc (Zn)	ug/g	410	-	14.1	15.4	18.6	13.8	13.5	13.5	25.5	24.4	3.1
Zirconium (Zr)	ug/g	-	-	1.2	1.9	1.6	1.6	1.7	3.3	1.2	6.2	<1.0

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ALS Environmental

ANALYTICAL REPORT

Metals - SOIL

		Guide Limits								
			Lab ID	L2725849-10	L2725849-11	L2725849-12	L2725849-13	L2725849-14	L2725849-15	L2725849-16
			Sample Date	14-JUL-22	14-JUL-22	14-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22
			Sample ID	MP-S-09_2022	MP-S-10_2022	MP-S-11_2022	MP-S-12_2022	MP-S-12_2022R	MP-S-13_2022	MP-S-14_2022
Analyte	**Unit**	**#1**	**#2**							
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	0.871	0.918	4.13	1.15	1.90	3.29	2.13
Vanadium (V)	ug/g	130	-	16.9	19.5	28.2	16.7	16.4	18.9	22.3
Zinc (Zn)	ug/g	410	-	20.1	23.0	35.7	17.4	21.5	20.2	24.3
Zirconium (Zr)	ug/g	-	-	<1.0	1.8	<1.0	1.7	1.5	1.4	1.2

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
HG-200.2-CVAA-WT	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020B (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H_2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Baffinland Iron Mine's Corporation
(Oakville)
ATTN: Connor Devereaux/Kendra Button
2275 Upper Middle Rd. E.
Suite #300
Oakville ON L6H 0C3

Date Received: 30-JUL-22
Report Date: 15-AUG-22 07:13 (MT)
Version: FINAL

Client Phone: 647-253-0596

Certificate of Analysis

Lab Work Order #: L2725850
Project P.O. #: 4500114277
Job Reference: 22Y0273_2022_SOIL-VEG MONITORING
C of C Numbers:
Legal Site Desc:

Rick Hawthorne
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit

Federal CCME Canadian Environmental Quality Guidelines (JUN, 2018) - CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

(No parameter exceedances)

ALS Environmental

ANALYTICAL REPORT

Physical Tests - SOIL

			Lab ID	L2725850-1	L2725850-2	L2725850-3	L2725850-4	L2725850-5	L2725850-6	L2725850-7	L2725850-8	L2725850-9
			Sample Date	20-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22
			Sample ID	MS-S-16_2022	MS-S-17_2022	MS-S-18_2022	MS-S-19_2022	MS-S-20_2022	MS-S-21_2022	MS-S-22_2022	MS-S-23_2022	MS-S-24_2022
Analyte	**Unit**	**Guide Limits #1**	**#2**									
% Moisture	%	-	-	14.4	5.62	15.0	11.8	19.9	32.7	9.56	2.60	6.13
pH	pH units	-	-	5.86	5.51	5.60	5.00	4.22	7.02	5.51	5.33	4.36

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725850-10	L2725850-11	L2725850-12	L2725850-13	L2725850-14	L2725850-15	L2725850-16
Sample Date				19-JUL-22	16-JUL-22	18-JUL-22	18-JUL-22	18-JUL-22	15-JUL-22	18-JUL-22
Sample ID				MS-S-25_2022	MP-S-15_2022	MP-S-16_2022	MP-S-17_2022	MP-S-18_2022	MP-S-29_2022	MP-S-30_2022
% Moisture	%	-	-	7.66	5.70	8.18	7.10	15.3	17.5	7.22
pH	pH units	-	-	6.12	7.28	7.17	6.65	6.53	6.54	6.51

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Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725850-1	L2725850-2	L2725850-3	L2725850-4	L2725850-5	L2725850-6	L2725850-7	L2725850-8	L2725850-9
Sample Date				20-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22
Sample ID				MS-S-16_2022	MS-S-17_2022	MS-S-18_2022	MS-S-19_2022	MS-S-20_2022	MS-S-21_2022	MS-S-22_2022	MS-S-23_2022	MS-S-24_2022
% Gravel (>2mm)	%	-	-	1.1	<1.0	<1.0	8.8	<1.0	9.0	15.5	15.1	20.2
% Sand (2.00mm - 1.00mm)	%	-	-	1.5	3.6	2.8	6.3	<1.0	5.3	8.6	7.6	13.1
% Sand (1.00mm - 0.50mm)	%	-	-	7.6	14.7	12.1	11.5	6.1	6.1	15.7	15.2	16.4
% Sand (0.50mm - 0.25mm)	%	-	-	36.8	36.1	38.3	44.7	20.1	10.0	25.1	24.8	24.5
% Sand (0.25mm - 0.125mm)	%	-	-	35.6	29.4	27.5	18.5	29.8	9.1	21.8	23.7	16.8
% Sand (0.125mm - 0.063mm)	%	-	-	6.3	4.9	6.7	3.1	8.7	3.3	5.7	5.6	4.7
% Silt (0.063mm - 0.0312mm)	%	-	-	5.2	5.1	5.5	2.9	12.0	15.4	2.9	2.6	1.9
% Silt (0.0312mm - 0.004mm)	%	-	-	5.2	5.1	5.6	3.3	17.9	22.9	3.0	3.3	1.5
% Clay (<4um)	%	-	-	<1.0	<1.0	1.0	<1.0	4.9	18.8	1.7	2.1	<1.0
Texture		-	-	Sand	Sand	Sand	Sand	Sandy loam	Loam	Sand	Sand	Sand

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ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725850-10	L2725850-11	L2725850-12	L2725850-13	L2725850-14	L2725850-15	L2725850-16
Sample Date				19-JUL-22	16-JUL-22	18-JUL-22	18-JUL-22	18-JUL-22	15-JUL-22	18-JUL-22
Sample ID				MS-S-25_2022	MP-S-15_2022	MP-S-16_2022	MP-S-17_2022	MP-S-18_2022	MP-S-29_2022	MP-S-30_2022
% Gravel (>2mm)	%	-	-	6.3	11.9	16.7	24.3	9.5	3.4	15.0
% Sand (2.00mm - 1.00mm)	%	-	-	3.7	6.0	5.0	8.0	2.6	4.1	5.7
% Sand (1.00mm - 0.50mm)	%	-	-	9.9	14.0	9.4	12.5	7.4	7.9	11.2
% Sand (0.50mm - 0.25mm)	%	-	-	31.1	27.3	22.9	22.4	27.8	30.7	29.6
% Sand (0.25mm - 0.125mm)	%	-	-	28.2	18.2	19.7	15.9	28.0	31.1	21.5
% Sand (0.125mm - 0.063mm)	%	-	-	5.3	5.3	5.7	4.5	7.2	8.2	4.8
% Silt (0.063mm - 0.0312mm)	%	-	-	6.4	7.4	7.1	4.3	6.4	5.7	4.1
% Silt (0.0312mm - 0.004mm)	%	-	-	7.2	8.2	9.2	6.5	8.7	7.1	5.8
% Clay (<4um)	%	-	-	1.9	1.7	4.4	1.8	2.4	1.8	2.2
Texture		-	-	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Sand	Sand

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725850-1	L2725850-2	L2725850-3	L2725850-4	L2725850-5	L2725850-6	L2725850-7	L2725850-8	L2725850-9
Sample Date				20-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22
Sample ID				MS-S-16_2022	MS-S-17_2022	MS-S-18_2022	MS-S-19_2022	MS-S-20_2022	MS-S-21_2022	MS-S-22_2022	MS-S-23_2022	MS-S-24_2022
Aluminum (Al)	ug/g	-	-	1680	2010	1400	1090	5990	17100	3890	2340	2650
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	0.24	0.63	0.26	0.14	10.0	3.64	0.50	0.40	0.39
Barium (Ba)	ug/g	2000	-	6.76	9.85	5.08	3.82	25.9	83.6	16.4	7.19	9.90
Beryllium (Be)	ug/g	8	-	<0.10	0.10	<0.10	<0.10	0.66	0.83	0.17	0.11	0.13
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	ug/g	-	-	<5.0	<5.0	<5.0	<5.0	8.8	28.6	6.6	<5.0	<5.0
Cadmium (Cd)	ug/g	22	-	<0.020	0.021	<0.020	<0.020	0.066	0.045	<0.020	<0.020	<0.020
Calcium (Ca)	ug/g	-	-	1280	1380	1080	498	2030	8310	1190	614	1050
Chromium (Cr)	ug/g	87	-	10.8	10.9	10.3	7.74	17.6	56.9	13.8	6.87	9.80
Cobalt (Co)	ug/g	300	-	1.69	1.81	1.50	0.67	18.7	11.4	2.74	1.57	1.83
Copper (Cu)	ug/g	91	-	1.37	2.04	1.50	0.77	40.2	47.8	4.08	2.31	2.97
Iron (Fe)	ug/g	-	-	6530	5190	6430	2380	76700	27100	9330	5070	7220
Lead (Pb)	ug/g	260	-	1.85	2.57	1.67	1.54	18.3	13.9	2.94	2.90	2.37
Lithium (Li)	ug/g	-	-	3.1	3.3	2.6	2.0	9.8	37.5	8.1	4.1	6.4
Magnesium (Mg)	ug/g	-	-	1350	1250	1110	709	2570	12800	3090	1040	1680
Manganese (Mn)	ug/g	-	-	49.3	64.9	35.2	18.0	177	314	75.1	66.4	55.5
Mercury (Hg)	ug/g	24	-	<0.0050	<0.0050	<0.0050	<0.0050	0.0125	0.0258	<0.0050	<0.0050	<0.0050
Molybdenum (Mo)	ug/g	40	-	<0.10	<0.10	0.16	<0.10	0.26	0.27	<0.10	<0.10	<0.10
Nickel (Ni)	ug/g	89	-	5.81	5.82	5.25	2.93	24.6	37.5	7.21	3.55	4.85
Phosphorus (P)	ug/g	-	-	256	252	235	131	613	633	269	210	393
Potassium (K)	ug/g	-	-	320	360	220	150	1130	4850	780	320	530
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	<0.20	<0.20	0.22	<0.20	<0.20	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/g	-	-	<50	<50	<50	<50	<50	180	<50	<50	<50
Strontium (Sr)	ug/g	-	-	2.59	2.22	2.19	1.87	3.44	11.0	3.12	2.16	2.90
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	<0.050	<0.050	<0.050	<0.050	0.273	0.453	0.069	<0.050	0.052
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	200	178	190	141	210	1070	385	177	331

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725850-10	L2725850-11	L2725850-12	L2725850-13	L2725850-14	L2725850-15	L2725850-16
Sample Date				19-JUL-22	16-JUL-22	18-JUL-22	18-JUL-22	18-JUL-22	15-JUL-22	18-JUL-22
Sample ID				MS-S-25_2022	MP-S-15_2022	MP-S-16_2022	MP-S-17_2022	MP-S-18_2022	MP-S-29_2022	MP-S-30_2022
Aluminum (Al)	ug/g	-	-	4170	3970	4590	3120	3140	2690	4360
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	0.73	0.93	1.01	1.12	1.35	0.75	0.92
Barium (Ba)	ug/g	2000	-	13.9	10.9	13.3	8.62	9.38	8.56	11.9
Beryllium (Be)	ug/g	8	-	0.21	0.24	0.26	0.22	0.20	0.17	0.27
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	ug/g	-	-	6.5	7.8	14.9	7.5	6.2	5.1	11.3
Cadmium (Cd)	ug/g	22	-	<0.020	<0.020	<0.020	0.021	<0.020	0.024	<0.020
Calcium (Ca)	ug/g	-	-	2080	19500	22200	3060	2070	2930	2450
Chromium (Cr)	ug/g	87	-	17.8	10.4	25.4	10.2	6.60	8.18	22.3
Cobalt (Co)	ug/g	300	-	3.56	2.58	3.97	2.42	2.12	1.78	3.37
Copper (Cu)	ug/g	91	-	5.35	4.03	5.03	4.31	5.11	3.05	3.78
Iron (Fe)	ug/g	-	-	7980	7950	9500	7860	5530	5560	9070
Lead (Pb)	ug/g	260	-	4.23	4.68	3.90	4.62	4.75	3.13	3.62
Lithium (Li)	ug/g	-	-	7.8	10.8	15.2	10.0	8.7	6.5	14.8
Magnesium (Mg)	ug/g	-	-	3390	8440	12400	2640	2240	1940	4350
Manganese (Mn)	ug/g	-	-	114	133	136	131	109	87.8	132
Mercury (Hg)	ug/g	24	-	0.0063	0.0078	0.0116	0.0092	0.0070	0.0094	0.0063
Molybdenum (Mo)	ug/g	40	-	<0.10	0.14	0.14	0.18	0.15	0.12	0.13
Nickel (Ni)	ug/g	89	-	14.8	6.13	18.2	5.20	3.87	4.51	15.6
Phosphorus (P)	ug/g	-	-	288	208	254	239	206	208	197
Potassium (K)	ug/g	-	-	910	550	1000	630	710	410	890
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/g	-	-	<50	<50	<50	<50	<50	<50	<50
Strontium (Sr)	ug/g	-	-	3.12	13.0	14.6	3.81	3.09	3.67	4.23
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	0.088	0.076	0.104	0.051	0.071	<0.050	0.076
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	309	178	222	131	133	128	221

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - SOIL

			Lab ID	L2725850-1	L2725850-2	L2725850-3	L2725850-4	L2725850-5	L2725850-6	L2725850-7	L2725850-8	L2725850-9
			Sample Date	20-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22
			Sample ID	MS-S-16_2022	MS-S-17_2022	MS-S-18_2022	MS-S-19_2022	MS-S-20_2022	MS-S-21_2022	MS-S-22_2022	MS-S-23_2022	MS-S-24_2022
		Guide Limits										
Analyte	Unit	#1	#2									
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	0.266	0.310	0.343	0.219	0.731	2.75	0.569	0.258	0.535
Vanadium (V)	ug/g	130	-	10.2	8.39	10.1	4.31	22.7	47.3	15.5	8.25	12.5
Zinc (Zn)	ug/g	410	-	6.6	7.1	4.6	3.0	30.3	47.7	11.6	8.0	9.1
Zirconium (Zr)	ug/g	-	-	<1.0	<1.0	<1.0	<1.0	5.4	10.0	<1.0	<1.0	<1.0

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ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725850-10	L2725850-11	L2725850-12	L2725850-13	L2725850-14	L2725850-15	L2725850-16
Sample Date				19-JUL-22	16-JUL-22	18-JUL-22	18-JUL-22	18-JUL-22	15-JUL-22	18-JUL-22
Sample ID				MS-S-25_2022	MP-S-15_2022	MP-S-16_2022	MP-S-17_2022	MP-S-18_2022	MP-S-29_2022	MP-S-30_2022
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	0.414	0.629	0.538	0.758	4.10	2.52	1.42
Vanadium (V)	ug/g	130	-	13.3	12.2	14.6	12.2	9.11	8.85	13.4
Zinc (Zn)	ug/g	410	-	13.4	14.3	14.4	12.9	8.6	8.5	12.4
Zirconium (Zr)	ug/g	-	-	1.6	<1.0	1.1	<1.0	1.1	<1.0	<1.0

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
HG-200.2-CVAA-WT	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020B (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Baffinland Iron Mine's Corporation
(Oakville)
ATTN: Connor Devereaux/Kendra Button
2275 Upper Middle Rd. E.
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Date Received: 30-JUL-22
Report Date: 15-AUG-22 07:21 (MT)
Version: FINAL

Client Phone: 647-253-0596

Certificate of Analysis

Lab Work Order #: L2725852

Project P.O. #: 4500114277
Job Reference: 22Y0273_2022_SOIL-VEG MONITORING
C of C Numbers:
Legal Site Desc:

Rick Hawthorne
Account Manager

ALS Environmental

ANALYTICAL REPORT

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Federal CCME Canadian Environmental Quality Guidelines (JUN, 2018) - CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected						
L2725852-8	MS-S-06_2022	Metals	Copper (Cu)	119	91	ug/g

ALS Environmental

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725852-1	L2725852-2	L2725852-3	L2725852-4	L2725852-5	L2725852-6	L2725852-7	L2725852-8	L2725852-9
Sample Date				17-JUL-22	17-JUL-22	17-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	24-JUL-22
Sample ID				MS-S-01_2022	MS-S-02_2022	MS-S-02_2022R	MS-S-03_2022	MS-S-04_2022	MS-S-05_2022	MS-S-05_2022R	MS-S-06_2022	MS-S-07_2022
% Moisture	%	-	-	2.68	8.47	9.46	33.0	3.58	17.7	21.9	23.4	1.54
pH	pH units	-	-	5.86	7.52	7.80	5.92	6.68	7.09	6.98	6.40	4.99

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725852-10	L2725852-11	L2725852-12	L2725852-13	L2725852-14	L2725852-15	L2725852-16	L2725852-17
Sample Date				20-JUL-22	20-JUL-22	24-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22
Sample ID				MS-S-08_2022	MS-S-09_2022	MS-S-10_2022	MS-S-11_2022	MS-S-12_2022	MS-S-13_2022	MS-S-14_2022	MS-S-15_2022
% Moisture	%	-	-	9.67	37.6	13.4	12.3	6.60	5.18	21.2	14.4
pH	pH units	-	-	5.53	6.12	5.71	6.60	6.28	6.14	6.37	6.60

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725852-1	L2725852-2	L2725852-3	L2725852-4	L2725852-5	L2725852-6	L2725852-7	L2725852-8	L2725852-9
Sample Date				17-JUL-22	17-JUL-22	17-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	24-JUL-22
Sample ID				MS-S-01_2022	MS-S-02_2022	MS-S-02_2022R	MS-S-03_2022	MS-S-04_2022	MS-S-05_2022	MS-S-05_2022R	MS-S-06_2022	MS-S-07_2022
% Gravel (>2mm)	%	-	-	12.0	3.8	4.5	14.0	24.3	3.2	1.9	10.7	24.3
% Sand (2.00mm - 1.00mm)	%	-	-	17.6	3.7	2.5	7.7	8.3	1.8	3.5	4.2	7.6
% Sand (1.00mm - 0.50mm)	%	-	-	26.7	7.0	5.7	7.8	15.9	6.4	6.6	8.9	20.1
% Sand (0.50mm - 0.25mm)	%	-	-	29.2	14.3	15.6	9.2	21.4	20.4	17.0	21.6	29.9
% Sand (0.25mm - 0.125mm)	%	-	-	6.4	46.2	46.0	11.0	14.8	29.5	26.5	23.2	13.9
% Sand (0.125mm - 0.063mm)	%	-	-	1.6	5.6	6.4	6.7	4.3	9.9	9.7	5.8	1.9
% Silt (0.063mm - 0.0312mm)	%	-	-	2.4	9.3	9.6	18.1	4.0	11.0	12.6	8.6	1.0
% Silt (0.0312mm - 0.004mm)	%	-	-	3.3	9.6	9.2	22.8	5.4	14.6	18.3	12.1	<1.0
% Clay (<4um)	%	-	-	<1.0	<1.0	<1.0	2.7	1.6	3.2	4.0	4.9	<1.0
Texture		-	-	Sand	Loamy sand	Loamy sand	Sandy loam	Sand	Loamy sand	Sandy loam	Sandy loam	Sand

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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ANALYTICAL REPORT

Particle Size - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725852-10 20-JUL-22 MS-S-08_2022	L2725852-11 20-JUL-22 MS-S-09_2022	L2725852-12 24-JUL-22 MS-S-10_2022	L2725852-13 21-JUL-22 MS-S-11_2022	L2725852-14 21-JUL-22 MS-S-12_2022	L2725852-15 19-JUL-22 MS-S-13_2022	L2725852-16 19-JUL-22 MS-S-14_2022	L2725852-17 20-JUL-22 MS-S-15_2022
% Gravel (>2mm)	%	-	-	3.8	3.4	<1.0	13.1	39.3	8.4	2.7	10.5
% Sand (2.00mm - 1.00mm)	%	-	-	2.7	4.7	<1.0	6.0	7.0	5.0	1.5	4.6
% Sand (1.00mm - 0.50mm)	%	-	-	7.8	8.6	6.8	14.6	10.7	13.2	6.0	11.6
% Sand (0.50mm - 0.25mm)	%	-	-	30.4	33.7	32.8	26.1	20.4	29.4	17.1	25.5
% Sand (0.25mm - 0.125mm)	%	-	-	31.7	31.5	32.9	22.8	14.7	28.4	28.4	24.3
% Sand (0.125mm - 0.063mm)	%	-	-	9.6	4.5	12.2	6.4	3.1	6.3	18.5	6.0
% Silt (0.063mm - 0.0312mm)	%	-	-	7.0	5.2	7.6	4.5	2.0	3.7	12.7	7.6
% Silt (0.0312mm - 0.004mm)	%	-	-	6.0	7.2	6.1	5.3	2.2	3.8	11.3	8.5
% Clay (<4um)	%	-	-	<1.0	1.2	<1.0	1.1	<1.0	1.8	1.8	1.3
Texture		-	-	Sand	Sand	Sand	Sand	Sand	Sand	Loamy sand	Loamy sand

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
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ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725852-1	L2725852-2	L2725852-3	L2725852-4	L2725852-5	L2725852-6	L2725852-7	L2725852-8	L2725852-9
Sample Date				17-JUL-22	17-JUL-22	17-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	24-JUL-22
Sample ID				MS-S-01_2022	MS-S-02_2022	MS-S-02_2022R	MS-S-03_2022	MS-S-04_2022	MS-S-05_2022	MS-S-05_2022R	MS-S-06_2022	MS-S-07_2022
Aluminum (Al)	ug/g	-	-	6160	221	384	11400	5960	8710	10200	14300	2940
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	1.61	1.02	0.83	2.77	1.07	2.15	2.48	4.55	0.62
Barium (Ba)	ug/g	2000	-	25.3	2.49	2.88	63.7	19.2	33.4	39.9	58.1	11.4
Beryllium (Be)	ug/g	8	-	0.27	<0.10	<0.10	0.54	0.23	0.42	0.52	0.73	0.15
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	1.39	1.18	3.15	<0.20
Boron (B)	ug/g	-	-	5.1	<5.0	<5.0	17.1	6.0	11.7	14.8	14.8	<5.0
Cadmium (Cd)	ug/g	22	-	0.040	0.021	<0.020	0.058	0.026	0.062	0.066	0.758	<0.020
Calcium (Ca)	ug/g	-	-	1550	83600	61000	9900	2080	4990	5670	3850	1050
Chromium (Cr)	ug/g	87	-	73.3	1.23	2.30	56.3	27.4	33.8	40.2	43.9	21.8
Cobalt (Co)	ug/g	300	-	9.15	1.71	1.42	13.0	5.19	7.15	8.02	10.8	3.62
Copper (Cu)	ug/g	91	-	6.27	7.01	6.58	33.4	7.58	17.8	20.9	119	6.78
Iron (Fe)	ug/g	-	-	18600	3030	3150	18400	11600	15600	18100	29000	15900
Lead (Pb)	ug/g	260	-	8.76	1.96	1.88	15.5	4.96	10.3	12.8	42.9	4.34
Lithium (Li)	ug/g	-	-	10.1	<2.0	<2.0	18.2	8.5	15.4	19.3	21.0	5.3
Magnesium (Mg)	ug/g	-	-	8560	47200	35700	8490	5210	7280	7730	10500	2620
Manganese (Mn)	ug/g	-	-	233	182	163	404	194	443	428	574	109
Mercury (Hg)	ug/g	24	-	0.0103	<0.0050	<0.0050	0.0553	0.0071	0.0106	0.0126	0.0294	0.0051
Molybdenum (Mo)	ug/g	40	-	0.16	<0.10	<0.10	0.37	<0.10	0.78	0.89	12.4	0.16
Nickel (Ni)	ug/g	89	-	80.6	4.27	5.01	87.4	29.4	23.8	27.5	54.2	15.1
Phosphorus (P)	ug/g	-	-	364	54	55	827	246	441	506	471	268
Potassium (K)	ug/g	-	-	660	<100	130	1790	890	1510	1660	2580	380
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	0.39	<0.20	<0.20	<0.20	0.29	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.81	<0.10
Sodium (Na)	ug/g	-	-	<50	<50	<50	87	<50	69	87	84	<50
Strontium (Sr)	ug/g	-	-	3.87	18.7	15.1	9.34	3.18	6.08	7.33	6.42	2.97
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	0.083	<0.050	<0.050	0.299	0.083	0.230	0.256	0.318	<0.050
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	449	15.0	32.6	496	497	565	613	631	307

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725852-10	L2725852-11	L2725852-12	L2725852-13	L2725852-14	L2725852-15	L2725852-16	L2725852-17
Sample Date				20-JUL-22	20-JUL-22	24-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22
Sample ID				MS-S-08_2022	MS-S-09_2022	MS-S-10_2022	MS-S-11_2022	MS-S-12_2022	MS-S-13_2022	MS-S-14_2022	MS-S-15_2022
Aluminum (Al)	ug/g	-	-	2700	2260	2730	5060	4240	2900	4000	3890
Antimony (Sb)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	ug/g	12	-	0.44	0.44	0.43	0.81	1.01	0.60	0.71	1.00
Barium (Ba)	ug/g	2000	-	15.0	16.2	9.59	21.6	14.0	10.6	16.6	14.0
Beryllium (Be)	ug/g	8	-	0.13	0.12	0.11	0.18	0.20	0.14	0.20	0.20
Bismuth (Bi)	ug/g	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	ug/g	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.0
Cadmium (Cd)	ug/g	22	-	0.024	0.035	<0.020	0.022	0.042	<0.020	<0.020	0.025
Calcium (Ca)	ug/g	-	-	1780	7110	2360	3250	1750	1560	2070	4140
Chromium (Cr)	ug/g	87	-	17.5	11.5	15.8	21.0	34.5	11.4	14.2	16.9
Cobalt (Co)	ug/g	300	-	3.04	1.64	2.56	4.61	5.33	2.40	3.08	3.16
Copper (Cu)	ug/g	91	-	2.21	5.55	2.50	6.77	7.84	3.83	3.48	5.55
Iron (Fe)	ug/g	-	-	9230	6370	8750	11000	12900	7540	10200	8530
Lead (Pb)	ug/g	260	-	4.54	2.52	2.99	3.00	4.40	3.46	3.60	4.43
Lithium (Li)	ug/g	-	-	4.6	2.8	3.8	9.8	7.3	5.0	7.0	6.5
Magnesium (Mg)	ug/g	-	-	1820	2640	2180	4150	4890	1970	2500	3350
Manganese (Mn)	ug/g	-	-	119	48.5	72.3	202	156	82.8	84.0	121
Mercury (Hg)	ug/g	24	-	0.0110	0.0182	0.0075	0.0097	0.0103	<0.0050	0.0064	0.0082
Molybdenum (Mo)	ug/g	40	-	0.12	0.13	<0.10	0.12	0.11	<0.10	0.28	0.16
Nickel (Ni)	ug/g	89	-	10.2	7.00	8.43	12.1	44.6	7.21	7.90	11.3
Phosphorus (P)	ug/g	-	-	292	356	476	329	342	317	480	392
Potassium (K)	ug/g	-	-	450	280	370	870	730	510	610	560
Selenium (Se)	ug/g	2.9	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	ug/g	40	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/g	-	-	<50	<50	90	<50	<50	<50	<50	<50
Strontium (Sr)	ug/g	-	-	3.52	5.21	3.46	3.12	2.76	3.30	4.01	4.02
Sulfur (S)	ug/g	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium (Tl)	ug/g	1	-	0.068	<0.050	<0.050	0.083	0.088	<0.050	0.067	0.065
Tin (Sn)	ug/g	300	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/g	-	-	285	244	307	460	401	243	402	313

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Metals - SOIL

			Lab ID	L2725852-1	L2725852-2	L2725852-3	L2725852-4	L2725852-5	L2725852-6	L2725852-7	L2725852-8	L2725852-9
			Sample Date	17-JUL-22	17-JUL-22	17-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	24-JUL-22
			Sample ID	MS-S-01_2022	MS-S-02_2022	MS-S-02_2022R	MS-S-03_2022	MS-S-04_2022	MS-S-05_2022	MS-S-05_2022R	MS-S-06_2022	MS-S-07_2022
		Guide Limits										
Analyte	Unit	#1	#2									
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	1.64	0.083	0.105	5.99	0.539	2.02	3.93	3.12	0.595
Vanadium (V)	ug/g	130	-	24.7	3.93	4.03	33.0	19.0	24.9	28.7	34.2	22.6
Zinc (Zn)	ug/g	410	-	19.7	2.1	2.1	30.1	17.3	26.7	31.9	74.6	10.1
Zirconium (Zr)	ug/g	-	-	<1.0	<1.0	<1.0	4.1	2.0	3.0	3.9	4.7	<1.0

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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ANALYTICAL REPORT

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2725852-10	L2725852-11	L2725852-12	L2725852-13	L2725852-14	L2725852-15	L2725852-16	L2725852-17
Sample Date				20-JUL-22	20-JUL-22	24-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22
Sample ID				MS-S-08_2022	MS-S-09_2022	MS-S-10_2022	MS-S-11_2022	MS-S-12_2022	MS-S-13_2022	MS-S-14_2022	MS-S-15_2022
Tungsten (W)	ug/g	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	-	0.618	2.00	0.839	0.911	1.11	0.430	1.64	1.36
Vanadium (V)	ug/g	130	-	14.8	10.1	14.5	19.3	19.2	12.6	17.0	14.4
Zinc (Zn)	ug/g	410	-	9.2	7.0	10.0	15.5	17.8	8.9	12.0	13.7
Zirconium (Zr)	ug/g	-	-	<1.0	2.3	<1.0	<1.0	<1.0	1.3	<1.0	1.6

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
HG-200.2-CVAA-WT	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020B (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Baffinland Iron Mine's Corporation
(Oakville)
ATTN: Connor Devereaux/Kendra Button
2275 Upper Middle Rd. E.
Suite #300
Oakville ON L6H 0C3

Date Received: 01-SEP-22
Report Date: 29-DEC-22 07:19 (MT)
Version: FINAL

Client Phone: 647-253-0596

Certificate of Analysis

Lab Work Order #: L2731267

Project P.O. #: 4500106851
Job Reference: 22Y0273_2022_SOIL-VEG MONITORING
C of C Numbers:
Legal Site Desc:

Rick Hawthorne

Rick Hawthorne
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit

Federal CCME Canadian Environmental Quality Guidelines (JUN, 2018) - CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

(No parameter exceedances)

ANALYTICAL REPORT

Physical Tests - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-1	L2731267-2	L2731267-3	L2731267-4	L2731267-5	L2731267-6	L2731267-7	L2731267-8	L2731267-9
Sample Date				16-JUL-22	16-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22
Sample ID				MP-L-01_2022	MP-L-01_2022 WASHED	MP-L-02_2022	MP-L-02_2022 WASHED	MP-L-03_2022	MP-L-03_2022 WASHED	MP-L-04_2022	MP-L-04_2022 WASHED	MP-L-05_2022
% Moisture	%	-	-	8.56	70.7	7.65	66.9	10.1	71.0	7.82	82.5	9.69

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Physical Tests - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-10	L2731267-11	L2731267-12	L2731267-13	L2731267-14	L2731267-15	L2731267-16	L2731267-17	L2731267-18
Sample Date				16-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22
Sample ID				MP-L-05_2022 WASHED	MP-L-05_2022R	MP-L-05_2022R WASHED	MP-L-06_2022	MP-L-06_2022 WASHED	MP-L-07_2022	MP-L-07_2022 WASHED	MP-L-08_2022	MP-L-08_2022 WASHED
% Moisture	%	-	-	71.7	9.79	72.6	10.2	76.9	7.41	62.7	9.47	75.4

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731267-19	L2731267-20	L2731267-21	L2731267-22	L2731267-23	L2731267-24	L2731267-25	L2731267-26	L2731267-27
			Sample Date	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22
			Sample ID	MP-L-09_2022	MP-L-09_2022 WASHED	MP-L-10_2022	MP-L-10_2022 WASHED	MP-L-11_2022	MP-L-11_2022 WASHED	MP-L-12_2022	MP-L-12_2022 WASHED	MP-L-12_2022R
Analyte	Unit	Guide Limits #1	Guide Limits #2									
% Moisture	%	-	-	8.47	75.1	8.79	69.0	7.65	75.9	8.78	74.5	9.03

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

- (yellow) Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
- (pink) Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731267-28	L2731267-29	L2731267-30	L2731267-31	L2731267-32	L2731267-33	L2731267-34	L2731267-35	L2731267-36
			Sample Date	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22	16-JUL-22	18-JUL-22	18-JUL-22
			Sample ID	MP-L-12_2022R WASHED	MP-L-13_2022	MP-L-13_2022 WASHED	MP-L-14_2022	MP-L-14_2022 WASHED	MP-L-15_2022	MP-L-15_2022 WASHED	MP-L-16_2022	MP-L-16_2022 WASHED
Analyte	Unit	Guide Limits #1	Guide Limits #2									
% Moisture	%	-	-	77.8	10.3	81.8	9.59	74.6	10.5	65.7	11.5	71.6

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731267-37	L2731267-38	L2731267-39	L2731267-40	L2731267-41	L2731267-42	L2731267-43	L2731267-44
			Sample Date	18-JUL-22	18-JUL-22	18-JUL-22	18-JUL-22	15-JUL-22	15-JUL-22	18-JUL-22	18-JUL-22
			Sample ID	MP-L-17_2022	MP-L-17_2022 WASHED	MP-L-18_2022	MP-L-18_2022 WASHED	MP-L-29_2022	MP-L-29_2022 WASHED	MP-L-30_2022	MP-L-30_2022 WASHED
Analyte	**Unit**	**Guide Limits #1**	**#2**								
% Moisture	%	-	-	11.2	74.2	11.1	77.7	10.0	70.8	8.93	76.3

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-1	L2731267-2	L2731267-3	L2731267-4	L2731267-5	L2731267-6	L2731267-7	L2731267-8	L2731267-9
Sample Date				16-JUL-22	16-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22
Sample ID				MP-L-01_2022	MP-L-01_2022 WASHED	MP-L-02_2022	MP-L-02_2022 WASHED	MP-L-03_2022	MP-L-03_2022 WASHED	MP-L-04_2022	MP-L-04_2022 WASHED	MP-L-05_2022
Aluminum (Al)-Total	mg/kg	-	-	748	783	873	832	761	630	715	555	1530
Antimony (Sb)-Total	mg/kg	40	-	0.010	<0.010	0.010	0.010	0.011	<0.010	<0.010	0.011	0.017
Arsenic (As)-Total	mg/kg	12	-	0.143	0.146	0.197	0.187	0.174	0.138	0.177	0.142	0.333
Barium (Ba)-Total	mg/kg	2000	-	11.9	12.9	8.26	9.28	8.92	8.47	8.38	7.93	11.0
Beryllium (Be)-Total	mg/kg	8	-	0.041	0.044	0.050	0.048	0.050	0.041	0.048	0.034	0.096
Bismuth (Bi)-Total	mg/kg	-	-	0.018	0.019	0.019	0.019	0.021	0.017	0.018	0.014	0.032
Boron (B)-Total	mg/kg	-	-	2.2	2.6	3.2	3.2	2.5	2.3	2.7	2.5	3.5
Cadmium (Cd)-Total	mg/kg	22	-	0.0331	0.0335	0.0342	0.0361	0.0396	0.0444	0.0316	0.0345	0.0459
Calcium (Ca)-Total	mg/kg	-	-	17900	16900	39800	37900	34900	33500	26800	25600	29000
Cesium (Cs)-Total	mg/kg	-	-	0.221	0.210	0.226	0.219	0.281	0.247	0.219	0.175	0.440
Chromium (Cr)-Total	mg/kg	87	-	1.27	1.35	1.61	1.60	1.41	1.19	1.36	1.07	2.81
Cobalt (Co)-Total	mg/kg	300	-	0.388	0.424	0.436	0.446	0.399	0.377	0.413	0.337	0.933
Copper (Cu)-Total	mg/kg	91	-	1.72	2.00	1.74	1.94	1.68	1.66	1.65	1.79	2.58
Iron (Fe)-Total	mg/kg	-	-	1890	2000	2200	1960	1990	1630	1900	1430	4570
Lead (Pb)-Total	mg/kg	260	-	1.69	1.65	2.00	2.01	2.48	2.10	2.00	1.74	3.50
Lithium (Li)-Total	mg/kg	-	-	1.61	1.56	2.06	1.88	1.95	1.50	1.83	1.31	4.18
Magnesium (Mg)-Total	mg/kg	-	-	1920	1810	2000	2070	2200	2110	2200	2020	2500
Manganese (Mn)-Total	mg/kg	-	-	37.8	41.3	34.0	36.1	35.7	34.3	36.3	31.7	64.6
Mercury (Hg)-Total	mg/kg	24	-	0.079	0.082	0.050	0.054	0.052	0.050	0.055	0.054	0.049
Molybdenum (Mo)-Total	mg/kg	40	-	0.347	0.395	0.329	0.320	0.320	0.234	0.345	0.307	0.452
Nickel (Ni)-Total	mg/kg	89	-	0.91	0.96	1.08	1.06	0.95	0.82	0.99	0.84	1.88
Phosphorus (P)-Total	mg/kg	-	-	489	484	360	370	382	345	392	408	411
Potassium (K)-Total	mg/kg	-	-	1620	1500	1260	1270	1360	1180	1350	1310	1330
Rubidium (Rb)-Total	mg/kg	-	-	6.44	6.09	5.02	5.11	7.20	6.13	5.70	4.87	7.41
Selenium (Se)-Total	mg/kg	2.9	-	0.070	0.072	0.076	0.086	0.083	0.078	0.064	0.074	0.083
Silver (Ag)-Total	mg/kg	40	-	0.0165	0.0168	0.0187	0.0192	0.0240	0.0224	0.0185	0.0167	0.0302
Sodium (Na)-Total	mg/kg	-	-	355	278	286	282	318	273	314	275	362
Strontium (Sr)-Total	mg/kg	-	-	17.1	16.3	20.1	20.2	20.0	20.3	17.0	15.8	23.2
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0183	0.0186	0.0180	0.0164	0.0177	0.0140	0.0166	0.0125	0.0300

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-10	L2731267-11	L2731267-12	L2731267-13	L2731267-14	L2731267-15	L2731267-16	L2731267-17	L2731267-18
Sample Date				16-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22
Sample ID				MP-L-05_2022 WASHED	MP-L-05_2022R	MP-L-05_2022R WASHED	MP-L-06_2022	MP-L-06_2022 WASHED	MP-L-07_2022	MP-L-07_2022 WASHED	MP-L-08_2022	MP-L-08_2022 WASHED
Aluminum (Al)-Total	mg/kg	-	-	1200	1250	1210	1000	557	947	1380	589	540
Antimony (Sb)-Total	mg/kg	40	-	0.015	0.016	0.014	0.018	0.013	0.012	0.013	0.014	0.013
Arsenic (As)-Total	mg/kg	12	-	0.293	0.301	0.282	0.284	0.183	0.284	0.365	0.204	0.184
Barium (Ba)-Total	mg/kg	2000	-	10.6	9.39	9.13	11.3	9.99	7.38	7.72	4.53	4.97
Beryllium (Be)-Total	mg/kg	8	-	0.092	0.082	0.078	0.071	0.042	0.064	0.087	0.039	0.034
Bismuth (Bi)-Total	mg/kg	-	-	0.033	0.032	0.028	0.031	0.023	0.020	0.023	0.015	0.013
Boron (B)-Total	mg/kg	-	-	3.2	3.9	3.2	2.4	1.7	4.6	7.0	6.1	5.6
Cadmium (Cd)-Total	mg/kg	22	-	0.0520	0.0462	0.0446	0.0386	0.0393	0.0411	0.0401	0.0454	0.0482
Calcium (Ca)-Total	mg/kg	-	-	31300	31500	29000	22300	22800	29000	27800	32500	28600
Cesium (Cs)-Total	mg/kg	-	-	0.376	0.355	0.353	0.329	0.224	0.235	0.288	0.146	0.123
Chromium (Cr)-Total	mg/kg	87	-	2.36	2.49	2.50	2.20	1.32	2.05	3.11	1.58	1.39
Cobalt (Co)-Total	mg/kg	300	-	0.691	0.720	0.733	0.694	0.445	0.683	0.898	0.407	0.393
Copper (Cu)-Total	mg/kg	91	-	2.30	2.42	2.12	2.35	1.75	2.13	2.63	1.75	2.06
Iron (Fe)-Total	mg/kg	-	-	3760	4210	3380	4610	3190	2620	3510	2100	1880
Lead (Pb)-Total	mg/kg	260	-	3.56	3.18	3.18	3.96	3.36	2.52	2.76	1.46	1.33
Lithium (Li)-Total	mg/kg	-	-	3.15	3.20	3.15	2.76	1.25	2.99	4.30	1.94	1.57
Magnesium (Mg)-Total	mg/kg	-	-	2570	2370	2480	2130	2140	2750	3670	2990	2940
Manganese (Mn)-Total	mg/kg	-	-	53.8	50.8	50.0	54.8	39.4	45.0	51.5	24.9	26.3
Mercury (Hg)-Total	mg/kg	24	-	0.055	0.046	0.045	0.051	0.051	0.044	0.048	0.049	0.049
Molybdenum (Mo)-Total	mg/kg	40	-	0.393	0.457	0.382	0.642	0.365	0.312	0.317	0.278	0.218
Nickel (Ni)-Total	mg/kg	89	-	1.63	1.75	1.73	1.64	1.04	1.60	2.24	1.13	1.06
Phosphorus (P)-Total	mg/kg	-	-	391	415	386	443	373	499	535	441	437
Potassium (K)-Total	mg/kg	-	-	1230	1370	1120	1490	1310	1530	1640	1420	1230
Rubidium (Rb)-Total	mg/kg	-	-	6.33	6.46	6.21	7.56	5.62	5.57	6.45	3.18	2.75
Selenium (Se)-Total	mg/kg	2.9	-	0.092	0.076	0.075	0.085	0.073	0.068	0.077	0.068	0.064
Silver (Ag)-Total	mg/kg	40	-	0.0315	0.0276	0.0264	0.0272	0.0265	0.0226	0.0257	0.0134	0.0128
Sodium (Na)-Total	mg/kg	-	-	336	399	338	488	394	407	348	587	447
Strontium (Sr)-Total	mg/kg	-	-	25.2	25.3	24.6	18.3	19.6	23.9	23.6	52.1	45.1
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0237	0.0228	0.0229	0.0218	0.0135	0.0177	0.0237	0.0107	0.0094

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

			Lab ID	L2731267-19	L2731267-20	L2731267-21	L2731267-22	L2731267-23	L2731267-24	L2731267-25	L2731267-26	L2731267-27
			Sample Date	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22
			Sample ID	MP-L-09_2022	MP-L-09_2022 WASHED	MP-L-10_2022	MP-L-10_2022 WASHED	MP-L-11_2022	MP-L-11_2022 WASHED	MP-L-12_2022	MP-L-12_2022 WASHED	MP-L-12_2022R
Analyte	**Unit**	**Guide Limits #1**	**#2**									
Aluminum (Al)-Total	mg/kg	-	-	659	568	912	649	678	711	903	859	1070
Antimony (Sb)-Total	mg/kg	40	-	0.014	0.013	0.015	0.024	0.015	0.016	0.011	<0.010	0.012
Arsenic (As)-Total	mg/kg	12	-	0.207	0.194	0.256	0.198	0.233	0.230	0.195	0.134	0.219
Barium (Ba)-Total	mg/kg	2000	-	6.02	5.88	6.69	6.21	7.45	7.80	8.30	7.38	8.41
Beryllium (Be)-Total	mg/kg	8	-	0.041	0.036	0.061	0.040	0.046	0.048	0.058	0.034	0.072
Bismuth (Bi)-Total	mg/kg	-	-	0.016	0.020	0.019	0.016	0.022	0.022	0.018	0.023	0.023
Boron (B)-Total	mg/kg	-	-	2.8	2.7	4.7	3.8	2.8	3.1	4.4	2.2	3.4
Cadmium (Cd)-Total	mg/kg	22	-	0.0448	0.0565	0.0384	0.0396	0.0389	0.0449	0.0473	0.0377	0.0486
Calcium (Ca)-Total	mg/kg	-	-	26000	26000	25800	23000	21100	20500	32600	26500	40800
Cesium (Cs)-Total	mg/kg	-	-	0.174	0.163	0.220	0.169	0.207	0.195	0.239	0.176	0.241
Chromium (Cr)-Total	mg/kg	87	-	1.42	1.27	2.00	1.51	1.48	1.53	1.96	1.13	2.16
Cobalt (Co)-Total	mg/kg	300	-	0.407	0.413	0.573	0.431	0.499	0.551	0.516	0.333	0.650
Copper (Cu)-Total	mg/kg	91	-	1.60	1.60	2.08	1.86	1.91	2.27	1.87	1.32	1.76
Iron (Fe)-Total	mg/kg	-	-	2580	2040	2870	2140	3020	3190	2060	1590	2470
Lead (Pb)-Total	mg/kg	260	-	1.62	1.62	1.91	1.62	2.19	2.50	1.96	2.02	2.19
Lithium (Li)-Total	mg/kg	-	-	1.60	1.43	2.57	1.61	1.68	1.65	2.52	1.41	3.43
Magnesium (Mg)-Total	mg/kg	-	-	1850	1930	2790	2670	1960	2050	1730	1570	2230
Manganese (Mn)-Total	mg/kg	-	-	28.1	25.7	36.6	30.6	36.5	38.6	37.9	25.5	44.5
Mercury (Hg)-Total	mg/kg	24	-	0.060	0.057	0.070	0.067	0.069	0.074	0.062	0.056	0.053
Molybdenum (Mo)-Total	mg/kg	40	-	0.316	0.247	0.312	0.243	0.399	0.355	0.288	0.209	0.334
Nickel (Ni)-Total	mg/kg	89	-	1.09	1.08	1.43	1.11	1.23	1.34	1.33	0.87	1.64
Phosphorus (P)-Total	mg/kg	-	-	453	364	469	432	486	478	373	326	351
Potassium (K)-Total	mg/kg	-	-	1450	1210	1520	1350	1480	1470	1290	1180	1180
Rubidium (Rb)-Total	mg/kg	-	-	4.95	4.24	4.03	3.52	5.29	5.10	4.89	3.72	5.34
Selenium (Se)-Total	mg/kg	2.9	-	0.077	0.074	0.087	0.080	0.087	0.094	0.092	0.074	0.096
Silver (Ag)-Total	mg/kg	40	-	0.0168	0.0157	0.0183	0.0171	0.0182	0.0172	0.0175	0.0167	0.0198
Sodium (Na)-Total	mg/kg	-	-	387	318	456	388	451	383	284	249	322
Strontium (Sr)-Total	mg/kg	-	-	20.8	22.4	44.3	39.5	30.0	28.3	21.3	18.0	25.6
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0133	0.0122	0.0183	0.0136	0.0162	0.0161	0.0200	0.0154	0.0196

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-28	L2731267-29	L2731267-30	L2731267-31	L2731267-32	L2731267-33	L2731267-34	L2731267-35	L2731267-36
Sample Date				15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22	16-JUL-22	18-JUL-22	18-JUL-22
Sample ID				MP-L-12_2022R WASHED	MP-L-13_2022	MP-L-13_2022 WASHED	MP-L-14_2022	MP-L-14_2022 WASHED	MP-L-15_2022	MP-L-15_2022 WASHED	MP-L-16_2022	MP-L-16_2022 WASHED
Aluminum (Al)-Total	mg/kg	-	-	835	215	190	331	439	465	319	191	155
Antimony (Sb)-Total	mg/kg	40	-	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (As)-Total	mg/kg	12	-	0.193	0.065	0.056	0.084	0.099	0.110	0.080	0.047	0.040
Barium (Ba)-Total	mg/kg	2000	-	8.81	4.79	4.36	6.32	6.92	5.62	4.86	4.53	4.13
Beryllium (Be)-Total	mg/kg	8	-	0.048	0.013	0.011	0.019	0.026	0.027	0.019	0.011	<0.010
Bismuth (Bi)-Total	mg/kg	-	-	0.018	<0.010	<0.010	<0.010	0.013	0.011	<0.010	<0.010	<0.010
Boron (B)-Total	mg/kg	-	-	3.3	1.7	1.1	1.8	1.8	2.3	1.5	1.2	<1.0
Cadmium (Cd)-Total	mg/kg	22	-	0.0539	0.0482	0.0409	0.0282	0.0333	0.0233	0.0232	0.0296	0.0274
Calcium (Ca)-Total	mg/kg	-	-	32400	25800	24100	18900	17800	33900	30400	16400	13600
Cesium (Cs)-Total	mg/kg	-	-	0.216	0.0842	0.0613	0.103	0.127	0.143	0.102	0.0482	0.0362
Chromium (Cr)-Total	mg/kg	87	-	1.83	0.483	0.434	0.715	0.893	1.03	0.709	0.630	0.509
Cobalt (Co)-Total	mg/kg	300	-	0.532	0.157	0.140	0.206	0.277	0.272	0.205	0.138	0.114
Copper (Cu)-Total	mg/kg	91	-	2.06	0.99	0.98	1.19	1.30	1.21	1.01	0.86	0.86
Iron (Fe)-Total	mg/kg	-	-	2150	858	808	1090	1200	1140	833	314	272
Lead (Pb)-Total	mg/kg	260	-	2.05	0.602	0.547	0.815	1.03	0.985	0.792	0.386	0.316
Lithium (Li)-Total	mg/kg	-	-	1.96	0.52	<0.50	0.72	0.95	1.28	0.82	<0.50	<0.50
Magnesium (Mg)-Total	mg/kg	-	-	2010	1600	1720	1590	1770	1640	1570	1400	1420
Manganese (Mn)-Total	mg/kg	-	-	40.7	19.0	17.8	20.5	25.0	22.9	18.3	14.2	12.4
Mercury (Hg)-Total	mg/kg	24	-	0.054	0.042	0.045	0.059	0.062	0.061	0.053	0.067	0.068
Molybdenum (Mo)-Total	mg/kg	40	-	0.222	0.244	0.198	0.191	0.228	0.184	0.136	0.222	0.069
Nickel (Ni)-Total	mg/kg	89	-	1.32	0.41	0.37	0.54	0.68	0.71	0.54	0.55	0.42
Phosphorus (P)-Total	mg/kg	-	-	343	326	319	374	339	368	298	425	386
Potassium (K)-Total	mg/kg	-	-	1090	1320	920	1400	1210	1350	978	1440	1180
Rubidium (Rb)-Total	mg/kg	-	-	4.85	3.77	2.66	3.93	3.96	4.20	3.12	2.52	2.13
Selenium (Se)-Total	mg/kg	2.9	-	0.099	<0.050	<0.050	0.067	0.074	0.064	0.054	0.057	<0.050
Silver (Ag)-Total	mg/kg	40	-	0.0194	0.0089	0.0083	0.0113	0.0121	0.0113	0.0100	<0.0050	<0.0050
Sodium (Na)-Total	mg/kg	-	-	270	374	247	338	266	264	197	383	260
Strontium (Sr)-Total	mg/kg	-	-	21.8	16.4	15.0	13.2	13.3	21.0	19.8	10.9	9.27
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0175	0.0056	0.0043	0.0081	0.0103	0.0116	0.0080	0.0050	0.0037

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-37	L2731267-38	L2731267-39	L2731267-40	L2731267-41	L2731267-42	L2731267-43	L2731267-44
Sample Date				18-JUL-22	18-JUL-22	18-JUL-22	18-JUL-22	15-JUL-22	15-JUL-22	18-JUL-22	18-JUL-22
Sample ID				MP-L-17_2022	MP-L-17_2022 WASHED	MP-L-18_2022	MP-L-18_2022 WASHED	MP-L-29_2022	MP-L-29_2022 WASHED	MP-L-30_2022	MP-L-30_2022 WASHED
Aluminum (Al)-Total	mg/kg	-	-	126	99.7	136	116	200	210	284	151
Antimony (Sb)-Total	mg/kg	40	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (As)-Total	mg/kg	12	-	0.046	0.036	0.042	0.039	0.060	0.069	0.070	0.042
Barium (Ba)-Total	mg/kg	2000	-	3.32	3.00	2.87	2.76	4.30	6.11	4.66	3.79
Beryllium (Be)-Total	mg/kg	8	-	<0.010	<0.010	<0.010	<0.010	0.010	0.015	0.017	<0.010
Bismuth (Bi)-Total	mg/kg	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Boron (B)-Total	mg/kg	-	-	1.4	1.1	1.4	<1.0	1.1	1.8	2.0	1.1
Cadmium (Cd)-Total	mg/kg	22	-	0.0200	0.0187	0.0253	0.0258	0.0319	0.0414	0.0319	0.0300
Calcium (Ca)-Total	mg/kg	-	-	20000	15700	10500	9240	16300	18500	26000	21100
Cesium (Cs)-Total	mg/kg	-	-	0.0379	0.0271	0.0491	0.0346	0.0708	0.0676	0.0617	0.0331
Chromium (Cr)-Total	mg/kg	87	-	0.303	0.226	0.297	0.280	0.435	0.435	0.874	0.451
Cobalt (Co)-Total	mg/kg	300	-	0.080	0.068	0.099	0.097	0.154	0.180	0.193	0.118
Copper (Cu)-Total	mg/kg	91	-	0.80	0.73	1.03	0.96	1.12	1.25	1.15	0.88
Iron (Fe)-Total	mg/kg	-	-	339	303	351	302	744	761	470	282
Lead (Pb)-Total	mg/kg	260	-	0.314	0.291	0.345	0.324	0.532	0.600	0.530	0.381
Lithium (Li)-Total	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.76	<0.50
Magnesium (Mg)-Total	mg/kg	-	-	1720	1830	1670	1640	1450	1720	1750	1710
Manganese (Mn)-Total	mg/kg	-	-	10.4	9.50	13.1	12.4	18.2	31.5	15.5	12.4
Mercury (Hg)-Total	mg/kg	24	-	0.062	0.059	0.060	0.051	0.049	0.052	0.068	0.060
Molybdenum (Mo)-Total	mg/kg	40	-	0.141	0.116	0.181	0.139	0.155	0.160	0.089	0.078
Nickel (Ni)-Total	mg/kg	89	-	0.24	<0.20	0.26	0.26	0.40	0.45	0.70	0.36
Phosphorus (P)-Total	mg/kg	-	-	366	294	435	396	380	425	439	353
Potassium (K)-Total	mg/kg	-	-	1260	826	1480	1020	1600	1400	1490	873
Rubidium (Rb)-Total	mg/kg	-	-	1.76	1.12	2.20	1.65	4.83	4.57	2.87	1.69
Selenium (Se)-Total	mg/kg	2.9	-	0.054	0.058	0.053	<0.050	<0.050	0.055	0.079	0.051
Silver (Ag)-Total	mg/kg	40	-	0.0051	<0.0050	0.0066	0.0060	0.0070	0.0076	0.0072	0.0051
Sodium (Na)-Total	mg/kg	-	-	321	219	358	253	476	353	376	245
Strontium (Sr)-Total	mg/kg	-	-	12.1	10.1	7.40	6.60	11.1	13.0	15.3	13.7
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0032	0.0025	0.0040	0.0032	0.0047	0.0051	0.0059	0.0037

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-1 16-JUL-22 MP-L-01_2022	L2731267-2 16-JUL-22 MP-L-01_2022 WASHED	L2731267-3 15-JUL-22 MP-L-02_2022	L2731267-4 15-JUL-22 MP-L-02_2022 WASHED	L2731267-5 15-JUL-22 MP-L-03_2022	L2731267-6 15-JUL-22 MP-L-03_2022 WASHED	L2731267-7 15-JUL-22 MP-L-04_2022	L2731267-8 15-JUL-22 MP-L-04_2022 WASHED	L2731267-9 16-JUL-22 MP-L-05_2022
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13
Titanium (Ti)-Total	mg/kg	-	-	39.2	41.6	42.4	38.5	36.3	31.8	33.0	24.2	90.1
Uranium (U)-Total	mg/kg	33	-	0.552	0.577	1.01	0.963	1.01	1.06	1.12	0.908	2.77
Vanadium (V)-Total	mg/kg	130	-	1.08	1.19	1.65	1.59	1.32	1.16	1.26	0.97	2.78
Zinc (Zn)-Total	mg/kg	410	-	14.4	16.5	10.9	11.7	11.3	10.7	11.4	12.5	14.7
Zirconium (Zr)-Total	mg/kg	-	-	1.36	1.44	1.84	1.57	1.79	1.37	1.52	1.07	3.01

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-10	L2731267-11	L2731267-12	L2731267-13	L2731267-14	L2731267-15	L2731267-16	L2731267-17	L2731267-18
Sample Date				16-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	16-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22
Sample ID				MP-L-05_2022 WASHED	MP-L-05_2022R	MP-L-05_2022R WASHED	MP-L-06_2022	MP-L-06_2022 WASHED	MP-L-07_2022	MP-L-07_2022 WASHED	MP-L-08_2022	MP-L-08_2022 WASHED
Tin (Sn)-Total	mg/kg	300	-	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	51.8	54.0	57.4	39.8	24.0	30.2	40.9	24.5	23.3
Uranium (U)-Total	mg/kg	33	-	2.49	2.75	2.43	1.31	0.884	0.671	0.682	0.447	0.455
Vanadium (V)-Total	mg/kg	130	-	2.37	2.39	2.49	1.69	0.98	1.87	2.80	1.42	1.30
Zinc (Zn)-Total	mg/kg	410	-	14.3	13.4	14.0	14.7	13.8	12.7	14.3	14.3	15.5
Zirconium (Zr)-Total	mg/kg	-	-	2.74	2.94	2.59	2.59	1.74	2.16	3.10	1.21	1.06

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-19	L2731267-20	L2731267-21	L2731267-22	L2731267-23	L2731267-24	L2731267-25	L2731267-26	L2731267-27
Sample Date				14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	14-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22
Sample ID				MP-L-09_2022	MP-L-09_2022 WASHED	MP-L-10_2022	MP-L-10_2022 WASHED	MP-L-11_2022	MP-L-11_2022 WASHED	MP-L-12_2022	MP-L-12_2022 WASHED	MP-L-12_2022R
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10
Titanium (Ti)-Total	mg/kg	-	-	25.7	21.6	36.2	26.5	29.4	30.1	46.3	30.7	48.1
Uranium (U)-Total	mg/kg	33	-	0.449	0.352	0.493	0.354	0.767	2.48	1.58	1.11	1.16
Vanadium (V)-Total	mg/kg	130	-	1.23	1.09	1.90	1.35	1.26	1.30	1.98	1.42	2.71
Zinc (Zn)-Total	mg/kg	410	-	12.1	13.9	13.8	14.3	12.9	14.5	12.5	13.6	11.5
Zirconium (Zr)-Total	mg/kg	-	-	1.21	1.03	1.75	1.29	1.40	1.38	1.56	1.09	1.58

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.

Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-28	L2731267-29	L2731267-30	L2731267-31	L2731267-32	L2731267-33	L2731267-34	L2731267-35	L2731267-36
Sample Date				15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	15-JUL-22	16-JUL-22	16-JUL-22	18-JUL-22	18-JUL-22
Sample ID				MP-L-12_2022R WASHED	MP-L-13_2022	MP-L-13_2022 WASHED	MP-L-14_2022	MP-L-14_2022 WASHED	MP-L-15_2022	MP-L-15_2022 WASHED	MP-L-16_2022	MP-L-16_2022 WASHED
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	39.5	10.9	9.92	17.9	21.3	24.7	18.0	10.9	9.65
Uranium (U)-Total	mg/kg	33	-	1.15	0.275	0.231	0.316	0.464	0.374	0.250	0.117	0.0709
Vanadium (V)-Total	mg/kg	130	-	1.88	0.40	0.36	0.67	0.90	1.00	0.66	0.42	0.36
Zinc (Zn)-Total	mg/kg	410	-	13.2	11.2	10.6	10.5	11.6	9.09	8.61	8.85	8.35
Zirconium (Zr)-Total	mg/kg	-	-	1.38	0.46	0.36	0.56	0.72	0.80	0.58	0.29	0.22

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731267-37	L2731267-38	L2731267-39	L2731267-40	L2731267-41	L2731267-42	L2731267-43	L2731267-44
Sample Date				18-JUL-22	18-JUL-22	18-JUL-22	18-JUL-22	15-JUL-22	15-JUL-22	18-JUL-22	18-JUL-22
Sample ID				MP-L-17_2022	MP-L-17_2022 WASHED	MP-L-18_2022	MP-L-18_2022 WASHED	MP-L-29_2022	MP-L-29_2022 WASHED	MP-L-30_2022	MP-L-30_2022 WASHED
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	7.05	5.83	7.92	6.65	10.6	10.2	14.3	9.24
Uranium (U)-Total	mg/kg	33	-	0.0893	0.0627	0.0965	0.0849	0.176	0.237	0.219	0.156
Vanadium (V)-Total	mg/kg	130	-	0.27	0.20	0.29	0.24	0.33	0.40	0.65	0.35
Zinc (Zn)-Total	mg/kg	410	-	9.54	8.79	12.5	12.3	10.1	18.1	9.24	7.69
Zirconium (Zr)-Total	mg/kg	-	-	0.25	<0.20	0.26	0.21	0.34	0.35	0.48	0.26

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
AG-DRY-CCMS-N-VA	Tissue	Silver in Tissue by CRC ICPMS (DRY)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

ALS Test Code	Matrix	Test Description	Method Reference**
HG-DRY-CVAFS-N-VA	Tissue	Mercury in Tissue by CVAAS (DRY)	EPA 200.3, EPA 245.7

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-DRY-CCMS-N-VA	Tissue	Metals in Tissue by CRC ICPMS (DRY)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-TISS-VA	Tissue	% Moisture in Tissues	Puget Sound WQ Authority, Apr 1997

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

ALS Test Code	Matrix	Test Description	Method Reference**
TI-DRY-CCMS-N-VA	Tissue	Ti in Tissue by CRC ICPMS (DRY)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Baffinland Iron Mine's Corporation
(Oakville)
ATTN: Connor Devereaux/Kendra Button
2275 Upper Middle Rd. E.
Suite #300
Oakville ON L6H 0C3

Date Received: 01-SEP-22
Report Date: 22-DEC-22 13:13 (MT)
Version: FINAL

Client Phone: 647-253-0596

Certificate of Analysis

Lab Work Order #: L2731272
Project P.O. #: 4500114277
Job Reference: 22Y0273_2022_SOIL-VEG MONITORING
C of C Numbers: 1, 2, 3, 4
Legal Site Desc:

Rick Hawthorne
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Federal CCME Canadian Environmental Quality Guidelines (JUN, 2018) - CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected						
(No parameter exceedances)						

ALS Environmental

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731272-1	L2731272-2	L2731272-3	L2731272-4	L2731272-5	L2731272-6	L2731272-7	L2731272-8	L2731272-9
			Sample Date	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	24-JUL-22	24-JUL-22	24-JUL-22	24-JUL-22	16-JUL-22
			Sample ID	TR-L-01_2022	TR-L-01_2022 WASHED	TR-L-05_2022	TR-L-05_2022 WASHED	TR-L-07_2022	TR-L-07_2022 WASHED	TR-L-07_2022R	TR-L-07_2022R WASHED	TR-L-09_2022
Analyte	**Unit**	**Guide Limits #1**	**Guide Limits #2**									
% Moisture	%	-	-	8.05	71.6	8.62	81.3	8.81	80.7	9.21	78.6	7.19

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-10	L2731272-11	L2731272-12	L2731272-13	L2731272-14	L2731272-15	L2731272-16	L2731272-17	L2731272-18
Sample Date				16-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	21-JUL-22	21-JUL-22
Sample ID				TR-L-09_2022 WASHED	TR-L-11_2022	TR-L-11_2022 WASHED	TR-L-12_2022	TR-L-12_2022 WASHED	TR-L-12_2022R	TR-L-12_2022R WASHED	TR-L-13_2022	TR-L-13_2022 WASHED
% Moisture	%	-	-	77.3	8.73	77.4	8.27	68.2	8.91	76.1	12.3	79.8

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731272-19	L2731272-20	L2731272-21	L2731272-22	L2731272-23	L2731272-24	L2731272-25	L2731272-26	L2731272-27
			Sample Date	21-JUL-22	21-JUL-22	18-JUL-22	18-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22
			Sample ID	TR-L-14_2022	TR-L-14_2022 WASHED	TR-L-15_2022	TR-L-15_2022 WASHED	TR-L-16_2022	TR-L-16_2022 WASHED	TR-L-17_2022	TR-L-17_2022 WASHED	TR-L-20_2022
Analyte	**Unit**	**Guide Limits #1**	**#2**									
% Moisture	%	-	-	9.59	82.7	9.12	71.4	11.1	79.8	38.9	80.9	10.2

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-28	L2731272-29	L2731272-30	L2731272-31	L2731272-32	L2731272-33	L2731272-34	L2731272-35	L2731272-36
Sample Date				18-JUL-22	18-JUL-22	18-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22
Sample ID				TR-L-20_2022 WASHED	TR-L-21_2022	TR-L-21_2022 WASHED	MS-L-01_2022	MS-L-01_2022 WASHED	MS-L-02_2022	MS-L-02_2022 WASHED	MS-L-02_2022R	MS-L-02_2022R WASHED
% Moisture	%	-	-	75.7	8.54	75.1	8.34	74.5	9.02	74.9	9.36	76.3

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731272-37	L2731272-38	L2731272-39	L2731272-40	L2731272-41	L2731272-42	L2731272-43	L2731272-44	L2731272-45
			Sample Date	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22
			Sample ID	MS-L-03_2022	MS-L-03_2022 WASHED	MS-L-04_2022	MS-L-04_2022 WASHED	MS-L-05_2022	MS-L-05_2022 WASHED	MS-L-05_2022R	MS-L-05_2022R WASHED	MS-L-06_2022
		Guide Limits										
Analyte	**Unit**	**#1**	**#2**									
% Moisture	%	-	-	10.2	78.6	9.52	83.1	10.5	82.9	10.1	80.0	11.1

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-46 20-JUL-22 MS-L-06_2022 WASHED	L2731272-47 24-JUL-22 MS-L-07_2022	L2731272-48 24-JUL-22 MS-L-07_2022 WASHED	L2731272-49 20-JUL-22 MS-L-08_2022	L2731272-50 20-JUL-22 MS-L-08_2022 WASHED	L2731272-51 20-JUL-22 MS-L-09_2022	L2731272-52 20-JUL-22 MS-L-09_2022 WASHED	L2731272-53 24-JUL-22 MS-L-10_2022	L2731272-54 24-JUL-22 MS-L-10_2022 WASHED
% Moisture	%	-	-	78.4	9.63	85.0	7.50	71.7	7.76	88.0	10.3	69.7

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731272-55	L2731272-56	L2731272-57	L2731272-58	L2731272-59	L2731272-60	L2731272-61	L2731272-62	L2731272-63
			Sample Date	21-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22
			Sample ID	MS-L-11_2022	MS-L-11_2022 WASHED	MS-L-12_2022	MS-L-12_2022 WASHED	MS-L-13_2022	MS-L-13_2022 WASHED	MS-L-14_2022	MS-L-14_2022 WASHED	MS-L-15_2022
		Guide Limits										
Analyte	Unit	#1	#2									
% Moisture	%	-	-	7.54	81.2	8.48	74.2	11.3	75.1	10.9	86.4	11.6

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Physical Tests - TISSUE

			Lab ID	L2731272-64	L2731272-65	L2731272-66	L2731272-67	L2731272-68	L2731272-69	L2731272-70	L2731272-71	L2731272-72
			Sample Date	20-JUL-22	20-JUL-22	20-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22
			Sample ID	MS-L-15_2022 WASHED	MS-L-16_2022	MS-L-16_2022 WASHED	MS-L-17_2022	MS-L-17_2022 WASHED	MS-L-18_2022	MS-L-18_2022 WASHED	MS-L-19_2022	MS-L-19_2022 WASHED
		Guide Limits										
Analyte	Unit	#1	#2									
% Moisture	%	-	-	80.1	11.9	70.0	10.6	76.3	9.35	73.4	10.0	69.5

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.

Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-73	L2731272-74	L2731272-75	L2731272-76	L2731272-77	L2731272-78	L2731272-79	L2731272-80	L2731272-81
Sample Date				21-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22
Sample ID				MS-L-20_2022	MS-L-20_2022 WASHED	MS-L-21_2022	MS-L-21_2022 WASHED	MS-L-22_2022	MS-L-22_2022 WASHED	MS-L-23_2022	MS-L-23_2022 WASHED	MS-L-24_2022
% Moisture	%	-	-	10.0	79.1	11.3	66.0	10.4	70.3	10.7	74.4	12.5

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Physical Tests - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-82	L2731272-83	L2731272-84
Sample Date				19-JUL-22	19-JUL-22	19-JUL-22
Sample ID				MS-L-24_2022 WASHED	MS-L-25_2022	MS-L-25_2022 WASHED
% Moisture	%	-	-	70.8	10.9	71.6

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-1	L2731272-2	L2731272-3	L2731272-4	L2731272-5	L2731272-6	L2731272-7	L2731272-8	L2731272-9
Sample Date				17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	24-JUL-22	24-JUL-22	24-JUL-22	24-JUL-22	16-JUL-22
Sample ID				TR-L-01_2022	TR-L-01_2022 WASHED	TR-L-05_2022	TR-L-05_2022 WASHED	TR-L-07_2022	TR-L-07_2022 WASHED	TR-L-07_2022R	TR-L-07_2022R WASHED	TR-L-09_2022
Aluminum (Al)-Total	mg/kg	-	-	1510	1170	1040	1110	1380	1270	1590	1080	1170
Antimony (Sb)-Total	mg/kg	40	-	0.011	0.017	0.012	0.012	0.011	0.012	0.012	0.012	0.013
Arsenic (As)-Total	mg/kg	12	-	0.165	0.148	0.143	0.157	0.203	0.184	0.210	0.169	0.253
Barium (Ba)-Total	mg/kg	2000	-	20.1	19.0	16.5	16.8	28.1	26.0	30.1	28.1	20.7
Beryllium (Be)-Total	mg/kg	8	-	0.082	0.071	0.068	0.068	0.084	0.077	0.096	0.066	0.075
Bismuth (Bi)-Total	mg/kg	-	-	0.135	0.118	0.126	0.129	0.085	0.088	0.089	0.087	0.058
Boron (B)-Total	mg/kg	-	-	2.2	2.0	2.0	2.0	2.4	2.1	2.5	1.9	5.1
Cadmium (Cd)-Total	mg/kg	22	-	0.128	0.131	0.115	0.113	0.113	0.120	0.136	0.148	0.0376
Calcium (Ca)-Total	mg/kg	-	-	21900	21800	28300	27800	19800	20400	17800	19500	50300
Cesium (Cs)-Total	mg/kg	-	-	0.464	0.398	0.399	0.408	0.431	0.414	0.442	0.374	0.388
Chromium (Cr)-Total	mg/kg	87	-	3.23	2.63	1.92	2.01	2.40	2.27	2.95	2.05	2.51
Cobalt (Co)-Total	mg/kg	300	-	0.883	0.773	0.559	0.599	0.756	0.706	0.890	0.680	0.681
Copper (Cu)-Total	mg/kg	91	-	3.40	3.11	2.55	2.50	2.78	2.57	3.24	2.52	2.51
Iron (Fe)-Total	mg/kg	-	-	3530	2660	2250	2400	2820	2630	3440	2290	2310
Lead (Pb)-Total	mg/kg	260	-	7.03	6.73	9.77	9.68	5.92	5.95	5.60	5.52	3.59
Lithium (Li)-Total	mg/kg	-	-	3.05	2.47	2.49	2.38	2.78	2.42	3.14	2.14	4.18
Magnesium (Mg)-Total	mg/kg	-	-	1920	1880	1310	1320	2690	2460	2650	2580	4570
Manganese (Mn)-Total	mg/kg	-	-	77.2	75.3	72.1	72.4	91.4	83.4	104	99.1	66.1
Mercury (Hg)-Total	mg/kg	24	-	0.0444	0.0423	0.0477	0.0513	0.0507	0.0490	0.0558	0.0509	0.0491
Molybdenum (Mo)-Total	mg/kg	40	-	0.721	0.608	0.488	0.536	0.675	0.616	0.768	0.551	0.493
Nickel (Ni)-Total	mg/kg	89	-	2.54	2.27	1.67	1.76	1.89	1.78	2.35	1.71	1.63
Phosphorus (P)-Total	mg/kg	-	-	697	740	596	602	670	603	621	628	476
Potassium (K)-Total	mg/kg	-	-	2740	2520	2470	2220	2310	2020	2270	2110	2140
Rubidium (Rb)-Total	mg/kg	-	-	13.5	12.1	12.1	12.0	11.4	10.3	11.9	10.8	9.61
Selenium (Se)-Total	mg/kg	2.9	-	0.076	0.066	0.060	0.063	0.082	0.079	0.078	0.080	0.073
Silver (Ag)-Total	mg/kg	40	-	0.0622	0.0611	0.0657	0.0673	0.0758	0.0745	0.0635	0.0626	0.0439
Sodium (Na)-Total	mg/kg	-	-	407	328	446	358	294	235	251	266	204
Strontium (Sr)-Total	mg/kg	-	-	30.8	32.3	45.8	47.2	43.8	44.4	34.6	37.7	59.6
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0534	0.0425	0.0404	0.0412	0.0441	0.0425	0.0494	0.0379	0.0346

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ALS Environmental

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-10	L2731272-11	L2731272-12	L2731272-13	L2731272-14	L2731272-15	L2731272-16	L2731272-17	L2731272-18
Sample Date				16-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	21-JUL-22	21-JUL-22
Sample ID				TR-L-09_2022 WASHED	TR-L-11_2022	TR-L-11_2022 WASHED	TR-L-12_2022	TR-L-12_2022 WASHED	TR-L-12_2022R	TR-L-12_2022R WASHED	TR-L-13_2022	TR-L-13_2022 WASHED
Aluminum (Al)-Total	mg/kg	-	-	1380	1080	1130	1010	927	1140	1090	382	355
Antimony (Sb)-Total	mg/kg	40	-	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (As)-Total	mg/kg	12	-	0.322	0.168	0.165	0.112	0.111	0.122	0.134	0.066	0.061
Barium (Ba)-Total	mg/kg	2000	-	21.4	23.1	21.6	21.2	22.6	24.4	25.6	11.0	11.5
Beryllium (Be)-Total	mg/kg	8	-	0.089	0.066	0.062	0.055	0.052	0.060	0.058	0.020	0.019
Bismuth (Bi)-Total	mg/kg	-	-	0.054	0.099	0.078	0.072	0.089	0.074	0.089	0.015	0.017
Boron (B)-Total	mg/kg	-	-	5.3	2.0	1.9	2.0	1.8	2.0	2.1	1.0	<1.0
Cadmium (Cd)-Total	mg/kg	22	-	0.0408	0.101	0.0867	0.0612	0.0595	0.0695	0.0706	0.0445	0.0486
Calcium (Ca)-Total	mg/kg	-	-	50500	17300	14200	13900	14500	15300	15400	11400	12000
Cesium (Cs)-Total	mg/kg	-	-	0.398	0.370	0.364	0.318	0.318	0.345	0.335	0.0999	0.0835
Chromium (Cr)-Total	mg/kg	87	-	2.97	2.21	2.28	1.83	1.77	2.12	2.14	0.955	0.922
Cobalt (Co)-Total	mg/kg	300	-	0.786	0.674	0.665	0.596	0.570	0.686	0.705	0.292	0.284
Copper (Cu)-Total	mg/kg	91	-	2.84	2.39	2.51	2.45	2.41	2.89	2.96	1.25	1.22
Iron (Fe)-Total	mg/kg	-	-	2680	2460	2550	2120	1920	2300	2260	818	829
Lead (Pb)-Total	mg/kg	260	-	3.79	5.10	4.63	3.52	3.53	3.64	3.75	0.805	0.861
Lithium (Li)-Total	mg/kg	-	-	4.66	2.21	2.11	1.92	1.66	2.14	1.99	0.58	<0.50
Magnesium (Mg)-Total	mg/kg	-	-	4450	2440	2390	2500	2560	2680	2710	2210	2000
Manganese (Mn)-Total	mg/kg	-	-	76.8	126	117	65.5	67.3	72.2	72.3	36.2	35.8
Mercury (Hg)-Total	mg/kg	24	-	0.0504	0.0475	0.0497	0.0447	0.0469	0.0459	0.0477	0.0499	0.0496
Molybdenum (Mo)-Total	mg/kg	40	-	0.492	0.477	0.524	0.514	0.435	0.511	0.520	0.133	0.117
Nickel (Ni)-Total	mg/kg	89	-	1.89	1.85	1.82	1.34	1.27	1.60	1.57	0.79	0.76
Phosphorus (P)-Total	mg/kg	-	-	491	617	632	458	496	505	534	443	316
Potassium (K)-Total	mg/kg	-	-	1970	2340	2150	1900	1920	2070	1930	1670	1020
Rubidium (Rb)-Total	mg/kg	-	-	9.79	12.3	12.1	9.77	10.1	10.9	10.8	3.92	2.76
Selenium (Se)-Total	mg/kg	2.9	-	0.073	0.072	0.083	0.083	0.071	0.071	0.086	0.061	0.058
Silver (Ag)-Total	mg/kg	40	-	0.0472	0.0613	0.0643	0.0394	0.0395	0.0478	0.0427	0.0104	0.0118
Sodium (Na)-Total	mg/kg	-	-	180	318	260	227	233	243	234	255	189
Strontium (Sr)-Total	mg/kg	-	-	56.7	27.9	25.3	14.5	15.4	15.3	15.6	8.88	9.30
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0366	0.0371	0.0374	0.0346	0.0323	0.0353	0.0350	0.0098	0.0098

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-19 21-JUL-22 TR-L-14_2022	L2731272-20 21-JUL-22 TR-L-14_2022 WASHED	L2731272-21 18-JUL-22 TR-L-15_2022	L2731272-22 18-JUL-22 TR-L-15_2022 WASHED	L2731272-23 21-JUL-22 TR-L-16_2022	L2731272-24 21-JUL-22 TR-L-16_2022 WASHED	L2731272-25 21-JUL-22 TR-L-17_2022	L2731272-26 21-JUL-22 TR-L-17_2022 WASHED	L2731272-27 18-JUL-22 TR-L-20_2022
Aluminum (Al)-Total	mg/kg	-	-	646	532	133	118	211	201	681	525	143
Antimony (Sb)-Total	mg/kg	40	-	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (As)-Total	mg/kg	12	-	0.108	0.085	0.043	0.034	0.061	0.053	0.118	0.088	0.034
Barium (Ba)-Total	mg/kg	2000	-	22.9	22.6	6.71	8.72	10.4	10.6	13.6	10.5	9.22
Beryllium (Be)-Total	mg/kg	8	-	0.038	0.034	<0.010	<0.010	<0.010	0.011	0.040	0.032	<0.010
Bismuth (Bi)-Total	mg/kg	-	-	0.038	0.034	<0.010	0.013	<0.010	<0.010	0.024	0.022	<0.010
Boron (B)-Total	mg/kg	-	-	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	2.5	1.0
Cadmium (Cd)-Total	mg/kg	22	-	0.0900	0.0889	0.0593	0.0680	0.165	0.142	0.0678	0.0535	0.143
Calcium (Ca)-Total	mg/kg	-	-	10100	9630	8560	8610	16700	16500	19600	15800	9990
Cesium (Cs)-Total	mg/kg	-	-	0.269	0.254	0.0522	0.0509	0.0691	0.0672	0.177	0.145	0.0501
Chromium (Cr)-Total	mg/kg	87	-	1.40	1.22	0.357	0.325	0.580	0.571	1.95	1.57	0.340
Cobalt (Co)-Total	mg/kg	300	-	0.617	0.568	0.126	0.114	0.280	0.269	0.419	0.329	0.131
Copper (Cu)-Total	mg/kg	91	-	1.57	1.47	0.97	0.97	1.45	1.23	1.91	1.83	1.20
Iron (Fe)-Total	mg/kg	-	-	1530	1330	348	311	600	568	1360	1010	285
Lead (Pb)-Total	mg/kg	260	-	2.51	2.37	0.430	0.396	0.703	0.744	1.02	0.819	0.423
Lithium (Li)-Total	mg/kg	-	-	1.32	1.01	<0.50	<0.50	<0.50	<0.50	1.15	0.90	<0.50
Magnesium (Mg)-Total	mg/kg	-	-	2310	2200	1640	1720	1430	1420	3070	2320	1670
Manganese (Mn)-Total	mg/kg	-	-	142	137	102	130	29.2	29.1	27.8	21.2	20.9
Mercury (Hg)-Total	mg/kg	24	-	0.0440	0.0435	0.046	0.041	0.046	0.046	0.082	0.072	0.052
Molybdenum (Mo)-Total	mg/kg	40	-	0.303	0.298	0.082	0.095	0.103	0.095	0.121	0.069	0.053
Nickel (Ni)-Total	mg/kg	89	-	1.23	1.13	0.33	0.31	0.57	0.53	1.26	1.04	0.31
Phosphorus (P)-Total	mg/kg	-	-	485	477	336	338	456	427	548	453	488
Potassium (K)-Total	mg/kg	-	-	2030	1800	1530	1530	1840	1540	1850	1270	1960
Rubidium (Rb)-Total	mg/kg	-	-	10.3	9.51	4.96	5.59	5.53	4.95	3.44	2.38	7.76
Selenium (Se)-Total	mg/kg	2.9	-	0.074	0.065	0.072	0.078	0.092	0.095	0.110	0.088	0.077
Silver (Ag)-Total	mg/kg	40	-	0.0330	0.0334	0.0078	0.0086	0.0094	0.0087	0.0107	0.0108	0.0074
Sodium (Na)-Total	mg/kg	-	-	329	277	239	245	378	296	406	221	256
Strontium (Sr)-Total	mg/kg	-	-	17.9	17.6	5.55	5.81	12.9	12.9	8.95	7.16	8.11
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0228	0.0201	0.0035	0.0027	0.0057	0.0062	0.0140	0.0100	0.0042

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-28	L2731272-29	L2731272-30	L2731272-31	L2731272-32	L2731272-33	L2731272-34	L2731272-35	L2731272-36
Sample Date				18-JUL-22	18-JUL-22	18-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22
Sample ID				TR-L-20_2022 WASHED	TR-L-21_2022	TR-L-21_2022 WASHED	MS-L-01_2022	MS-L-01_2022 WASHED	MS-L-02_2022	MS-L-02_2022 WASHED	MS-L-02_2022R	MS-L-02_2022R WASHED
Aluminum (Al)-Total	mg/kg	-	-	120	274	306	2580	1940	2770	2030	2360	1820
Antimony (Sb)-Total	mg/kg	40	-	<0.010	<0.010	<0.010	0.064	0.054	0.040	0.031	0.035	0.027
Arsenic (As)-Total	mg/kg	12	-	0.041	0.081	0.080	0.316	0.266	0.616	0.479	0.503	0.373
Barium (Ba)-Total	mg/kg	2000	-	9.15	6.39	7.01	28.3	27.3	22.0	19.7	21.3	18.0
Beryllium (Be)-Total	mg/kg	8	-	<0.010	0.015	0.016	0.154	0.129	0.155	0.127	0.131	0.104
Bismuth (Bi)-Total	mg/kg	-	-	<0.010	<0.010	<0.010	0.134	0.165	0.141	0.131	0.127	0.145
Boron (B)-Total	mg/kg	-	-	<1.0	1.6	1.8	3.4	2.7	3.3	2.6	2.9	2.8
Cadmium (Cd)-Total	mg/kg	22	-	0.162	0.0449	0.0391	0.124	0.157	0.0858	0.0870	0.0847	0.0751
Calcium (Ca)-Total	mg/kg	-	-	10800	25200	25100	11800	11900	17300	17400	20700	18900
Cesium (Cs)-Total	mg/kg	-	-	0.0477	0.127	0.129	0.385	0.323	0.376	0.303	0.365	0.264
Chromium (Cr)-Total	mg/kg	87	-	0.275	0.627	0.861	7.48	6.46	5.95	4.53	4.95	4.30
Cobalt (Co)-Total	mg/kg	300	-	0.134	0.195	0.209	2.32	1.89	2.75	2.38	2.22	1.77
Copper (Cu)-Total	mg/kg	91	-	1.13	1.14	1.20	6.48	5.59	5.85	4.91	5.18	4.35
Iron (Fe)-Total	mg/kg	-	-	244	581	657	6590	5430	12000	9790	9330	6930
Lead (Pb)-Total	mg/kg	260	-	0.433	0.791	0.854	7.29	7.54	7.47	6.95	7.39	6.07
Lithium (Li)-Total	mg/kg	-	-	<0.50	0.75	0.75	3.40	2.46	3.76	2.60	3.21	3.29
Magnesium (Mg)-Total	mg/kg	-	-	1720	2580	2610	3620	3200	3800	3130	3790	3260
Manganese (Mn)-Total	mg/kg	-	-	21.8	21.4	21.5	98.2	86.0	115	97.7	99.3	82.0
Mercury (Hg)-Total	mg/kg	24	-	0.049	0.039	0.043	0.071	0.066	0.053	0.054	0.057	0.052
Molybdenum (Mo)-Total	mg/kg	40	-	0.047	0.153	0.145	0.834	0.694	0.905	0.785	0.760	0.623
Nickel (Ni)-Total	mg/kg	89	-	0.25	0.41	0.45	12.2	9.22	5.68	4.54	4.69	4.07
Phosphorus (P)-Total	mg/kg	-	-	499	333	349	715	778	609	600	595	558
Potassium (K)-Total	mg/kg	-	-	1910	1610	1480	2380	2260	2770	2300	2680	2100
Rubidium (Rb)-Total	mg/kg	-	-	7.95	3.73	3.66	14.1	12.8	15.9	13.2	14.9	11.1
Selenium (Se)-Total	mg/kg	2.9	-	0.075	0.055	0.071	0.104	0.118	0.131	0.122	0.118	0.106
Silver (Ag)-Total	mg/kg	40	-	0.0071	0.0118	0.0124	0.0685	0.0582	0.0563	0.0566	0.0567	0.0474
Sodium (Na)-Total	mg/kg	-	-	247	328	289	221	243	246	205	207	177
Strontium (Sr)-Total	mg/kg	-	-	8.58	12.8	12.7	13.5	14.5	11.8	11.4	12.2	11.8
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0040	0.0083	0.0088	0.0695	0.0591	0.0723	0.0567	0.0614	0.0470

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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			Lab ID	L2731272-37	L2731272-38	L2731272-39	L2731272-40	L2731272-41	L2731272-42	L2731272-43	L2731272-44	L2731272-45
			Sample Date	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22
			Sample ID	MS-L-03_2022	MS-L-03_2022 WASHED	MS-L-04_2022	MS-L-04_2022 WASHED	MS-L-05_2022	MS-L-05_2022 WASHED	MS-L-05_2022R	MS-L-05_2022R WASHED	MS-L-06_2022
		Guide Limits										
Analyte	Unit	#1	#2									
Aluminum (Al)-Total	mg/kg	-	-	882	805	2100	1600	1800	1430	2680	1580	2350
Antimony (Sb)-Total	mg/kg	40	-	0.010	<0.010	0.012	0.012	0.012	0.010	0.015	0.012	0.019
Arsenic (As)-Total	mg/kg	12	-	0.141	0.152	0.270	0.246	0.237	0.216	0.369	0.305	0.374
Barium (Ba)-Total	mg/kg	2000	-	15.7	16.6	26.0	24.7	21.8	20.8	28.3	22.8	34.3
Beryllium (Be)-Total	mg/kg	8	-	0.042	0.039	0.093	0.085	0.091	0.079	0.129	0.088	0.134
Bismuth (Bi)-Total	mg/kg	-	-	0.033	0.031	0.077	0.057	0.067	0.068	0.090	0.072	0.134
Boron (B)-Total	mg/kg	-	-	1.3	1.4	2.2	2.1	2.6	2.3	2.8	2.8	2.2
Cadmium (Cd)-Total	mg/kg	22	-	0.0587	0.0692	0.0817	0.0814	0.0867	0.0775	0.102	0.0935	0.465
Calcium (Ca)-Total	mg/kg	-	-	12200	13100	12300	12000	14800	15900	15000	15900	10600
Cesium (Cs)-Total	mg/kg	-	-	0.150	0.152	0.270	0.260	0.262	0.219	0.332	0.227	0.333
Chromium (Cr)-Total	mg/kg	87	-	2.64	2.46	16.5	5.31	5.22	4.16	7.47	4.51	6.82
Cobalt (Co)-Total	mg/kg	300	-	0.714	0.703	1.83	1.34	1.30	1.08	1.90	1.30	2.01
Copper (Cu)-Total	mg/kg	91	-	2.16	2.19	4.37	3.81	4.28	3.84	5.75	4.36	6.90
Iron (Fe)-Total	mg/kg	-	-	2500	2520	5400	4590	5280	4450	7690	4720	7270
Lead (Pb)-Total	mg/kg	260	-	1.46	1.60	3.16	3.24	2.93	3.01	3.72	3.94	5.72
Lithium (Li)-Total	mg/kg	-	-	0.86	0.81	1.99	1.65	1.86	1.47	2.72	1.81	2.52
Magnesium (Mg)-Total	mg/kg	-	-	2730	2820	3860	3190	3430	3420	3890	4180	3590
Manganese (Mn)-Total	mg/kg	-	-	37.1	38.1	72.6	69.9	60.0	53.1	82.8	62.1	86.5
Mercury (Hg)-Total	mg/kg	24	-	0.053	0.058	0.080	0.082	0.069	0.065	0.073	0.068	0.071
Molybdenum (Mo)-Total	mg/kg	40	-	0.354	0.320	0.756	0.575	1.16	0.925	1.27	0.862	1.79
Nickel (Ni)-Total	mg/kg	89	-	2.89	3.05	12.8	5.46	3.90	3.22	5.69	3.74	6.14
Phosphorus (P)-Total	mg/kg	-	-	413	466	565	543	669	531	598	520	628
Potassium (K)-Total	mg/kg	-	-	2050	2010	2210	1960	2340	1710	2270	1620	2450
Rubidium (Rb)-Total	mg/kg	-	-	7.30	7.75	10.9	9.49	9.94	8.01	11.6	7.83	12.5
Selenium (Se)-Total	mg/kg	2.9	-	0.092	0.099	0.121	0.108	0.108	0.107	0.117	0.105	0.134
Silver (Ag)-Total	mg/kg	40	-	0.0219	0.0238	0.0370	0.0338	0.0381	0.0389	0.0499	0.0514	0.0829
Sodium (Na)-Total	mg/kg	-	-	207	234	245	231	233	158	194	141	233
Strontium (Sr)-Total	mg/kg	-	-	6.10	6.75	6.42	6.46	6.89	7.03	7.58	7.56	7.93
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0193	0.0197	0.0414	0.0394	0.0409	0.0354	0.0549	0.0409	0.0545

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-46 20-JUL-22 MS-L-06_2022 WASHED	L2731272-47 24-JUL-22 MS-L-07_2022	L2731272-48 24-JUL-22 MS-L-07_2022 WASHED	L2731272-49 20-JUL-22 MS-L-08_2022	L2731272-50 20-JUL-22 MS-L-08_2022 WASHED	L2731272-51 20-JUL-22 MS-L-09_2022	L2731272-52 20-JUL-22 MS-L-09_2022 WASHED	L2731272-53 24-JUL-22 MS-L-10_2022	L2731272-54 24-JUL-22 MS-L-10_2022 WASHED
Aluminum (Al)-Total	mg/kg	-	-	1420	1160	925	1430	914	1050	860	996	822
Antimony (Sb)-Total	mg/kg	40	-	0.014	0.012	0.013	0.010	0.011	0.011	0.011	0.013	0.019
Arsenic (As)-Total	mg/kg	12	-	0.304	0.263	0.234	0.215	0.164	0.190	0.181	0.237	0.230
Barium (Ba)-Total	mg/kg	2000	-	34.7	24.4	22.9	18.2	16.5	13.4	14.8	15.3	15.6
Beryllium (Be)-Total	mg/kg	8	-	0.094	0.067	0.057	0.072	0.051	0.055	0.052	0.056	0.051
Bismuth (Bi)-Total	mg/kg	-	-	0.116	0.048	0.043	0.048	0.035	0.038	0.039	0.044	0.039
Boron (B)-Total	mg/kg	-	-	1.7	1.4	1.4	1.9	1.6	1.8	2.1	2.5	2.6
Cadmium (Cd)-Total	mg/kg	22	-	0.432	0.0929	0.0948	0.0604	0.0601	0.0381	0.0403	0.0448	0.0479
Calcium (Ca)-Total	mg/kg	-	-	12300	9280	9260	8310	8900	6540	7150	9770	10600
Cesium (Cs)-Total	mg/kg	-	-	0.222	0.171	0.155	0.176	0.139	0.137	0.128	0.130	0.117
Chromium (Cr)-Total	mg/kg	87	-	4.33	3.42	2.73	3.85	2.71	2.97	2.70	2.85	2.36
Cobalt (Co)-Total	mg/kg	300	-	1.67	1.17	1.07	1.11	0.845	0.899	0.820	0.925	0.849
Copper (Cu)-Total	mg/kg	91	-	6.06	3.05	3.11	3.29	2.68	2.65	2.67	2.61	2.53
Iron (Fe)-Total	mg/kg	-	-	5710	5000	4700	4730	3320	3660	3210	4170	3860
Lead (Pb)-Total	mg/kg	260	-	4.92	2.28	2.13	2.09	1.75	1.47	1.65	1.64	1.63
Lithium (Li)-Total	mg/kg	-	-	1.47	1.17	0.97	1.43	0.89	1.07	0.90	1.02	0.84
Magnesium (Mg)-Total	mg/kg	-	-	3250	2460	2450	2220	2070	1910	1980	2040	2180
Manganese (Mn)-Total	mg/kg	-	-	79.7	79.0	73.7	57.8	51.1	46.2	46.8	47.4	45.8
Mercury (Hg)-Total	mg/kg	24	-	0.065	0.055	0.056	0.073	0.073	0.073	0.072	0.062	0.063
Molybdenum (Mo)-Total	mg/kg	40	-	1.08	0.591	0.509	0.613	0.456	0.513	0.461	0.505	0.483
Nickel (Ni)-Total	mg/kg	89	-	4.03	3.24	2.79	3.62	2.76	2.58	2.24	2.44	2.16
Phosphorus (P)-Total	mg/kg	-	-	552	613	593	641	645	698	743	659	664
Potassium (K)-Total	mg/kg	-	-	1710	2240	2110	2110	1990	2190	2090	1960	1660
Rubidium (Rb)-Total	mg/kg	-	-	8.44	9.50	8.76	8.86	7.94	7.36	6.77	7.24	6.59
Selenium (Se)-Total	mg/kg	2.9	-	0.130	0.109	0.112	0.082	0.083	0.064	0.085	0.081	0.077
Silver (Ag)-Total	mg/kg	40	-	0.0905	0.0325	0.0347	0.0232	0.0205	0.0200	0.0263	0.0257	0.0262
Sodium (Na)-Total	mg/kg	-	-	152	321	293	398	400	555	461	486	426
Strontium (Sr)-Total	mg/kg	-	-	8.30	7.14	6.99	5.54	5.74	4.33	4.88	6.46	7.05
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0406	0.0248	0.0212	0.0287	0.0211	0.0224	0.0192	0.0217	0.0202

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-55	L2731272-56	L2731272-57	L2731272-58	L2731272-59	L2731272-60	L2731272-61	L2731272-62	L2731272-63
Sample Date				21-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22
Sample ID				MS-L-11_2022	MS-L-11_2022 WASHED	MS-L-12_2022	MS-L-12_2022 WASHED	MS-L-13_2022	MS-L-13_2022 WASHED	MS-L-14_2022	MS-L-14_2022 WASHED	MS-L-15_2022
Aluminum (Al)-Total	mg/kg	-	-	1270	1050	1310	1110	745	641	1020	729	1670
Antimony (Sb)-Total	mg/kg	40	-	0.018	0.017	0.016	0.016	<0.010	<0.010	<0.010	<0.010	0.012
Arsenic (As)-Total	mg/kg	12	-	0.302	0.273	0.265	0.223	0.117	0.099	0.170	0.125	0.220
Barium (Ba)-Total	mg/kg	2000	-	16.2	14.9	17.4	16.9	11.2	11.5	15.5	14.8	20.9
Beryllium (Be)-Total	mg/kg	8	-	0.080	0.069	0.083	0.077	0.036	0.031	0.052	0.041	0.085
Bismuth (Bi)-Total	mg/kg	-	-	0.068	0.065	0.085	0.080	0.025	0.016	0.027	0.021	0.060
Boron (B)-Total	mg/kg	-	-	2.1	2.0	1.9	1.7	1.1	1.1	1.2	<1.0	2.1
Cadmium (Cd)-Total	mg/kg	22	-	0.0518	0.0492	0.0903	0.0948	0.0524	0.0494	0.0603	0.0581	0.0827
Calcium (Ca)-Total	mg/kg	-	-	11200	10900	10600	10200	10300	9430	9650	9360	16100
Cesium (Cs)-Total	mg/kg	-	-	0.210	0.187	0.208	0.195	0.122	0.107	0.145	0.115	0.222
Chromium (Cr)-Total	mg/kg	87	-	3.07	2.62	3.16	2.76	2.21	1.91	2.93	2.10	4.51
Cobalt (Co)-Total	mg/kg	300	-	1.21	1.07	1.26	1.18	0.615	0.545	0.886	0.728	1.18
Copper (Cu)-Total	mg/kg	91	-	3.14	2.99	3.43	3.35	1.89	1.81	2.26	1.84	3.70
Iron (Fe)-Total	mg/kg	-	-	5350	5020	5220	4530	1890	1780	3090	2420	5270
Lead (Pb)-Total	mg/kg	260	-	3.54	3.09	3.89	3.84	0.981	0.912	1.26	1.13	2.64
Lithium (Li)-Total	mg/kg	-	-	1.55	1.27	1.55	1.32	0.78	0.63	1.07	0.72	1.74
Magnesium (Mg)-Total	mg/kg	-	-	2600	2460	2540	2380	2330	2390	2590	2400	3340
Manganese (Mn)-Total	mg/kg	-	-	60.5	57.1	78.5	70.2	38.5	39.1	60.4	55.6	58.4
Mercury (Hg)-Total	mg/kg	24	-	0.068	0.066	0.061	0.064	0.052	0.057	0.056	0.054	0.053
Molybdenum (Mo)-Total	mg/kg	40	-	0.555	0.440	0.559	0.495	0.284	0.255	0.345	0.248	0.739
Nickel (Ni)-Total	mg/kg	89	-	2.76	2.40	3.34	3.22	1.71	1.52	2.21	1.65	3.53
Phosphorus (P)-Total	mg/kg	-	-	587	564	648	647	591	646	646	606	573
Potassium (K)-Total	mg/kg	-	-	2170	2010	2090	1900	2100	2060	2340	2050	2410
Rubidium (Rb)-Total	mg/kg	-	-	9.84	9.23	9.65	9.26	6.22	6.37	8.56	7.67	10.2
Selenium (Se)-Total	mg/kg	2.9	-	0.101	0.112	0.096	0.113	0.075	0.075	0.085	0.084	0.098
Silver (Ag)-Total	mg/kg	40	-	0.0346	0.0360	0.0358	0.0342	0.0139	0.0205	0.0187	0.0179	0.0321
Sodium (Na)-Total	mg/kg	-	-	234	202	217	188	252	255	298	279	233
Strontium (Sr)-Total	mg/kg	-	-	8.62	7.87	9.55	9.51	5.16	4.98	6.64	6.35	7.13
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.027
Thallium (Tl)-Total	mg/kg	1	-	0.0337	0.0310	0.0352	0.0311	0.0149	0.0136	0.0199	0.0149	0.0342

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-64 20-JUL-22 MS-L-15_2022 WASHED	L2731272-65 20-JUL-22 MS-L-16_2022	L2731272-66 20-JUL-22 MS-L-16_2022 WASHED	L2731272-67 19-JUL-22 MS-L-17_2022	L2731272-68 19-JUL-22 MS-L-17_2022 WASHED	L2731272-69 20-JUL-22 MS-L-18_2022	L2731272-70 20-JUL-22 MS-L-18_2022 WASHED	L2731272-71 20-JUL-22 MS-L-19_2022	L2731272-72 20-JUL-22 MS-L-19_2022 WASHED
Aluminum (Al)-Total	mg/kg	-	-	1150	1240	887	1590	695	1080	763	887	937
Antimony (Sb)-Total	mg/kg	40	-	0.010	0.012	<0.010	0.012	<0.010	0.011	<0.010	<0.010	<0.010
Arsenic (As)-Total	mg/kg	12	-	0.190	0.241	0.201	0.390	0.157	0.265	0.182	0.201	0.219
Barium (Ba)-Total	mg/kg	2000	-	19.1	21.8	18.7	18.4	13.6	18.8	15.7	19.6	19.6
Beryllium (Be)-Total	mg/kg	8	-	0.068	0.060	0.054	0.076	0.038	0.060	0.049	0.047	0.051
Bismuth (Bi)-Total	mg/kg	-	-	0.054	0.044	0.035	0.036	0.024	0.035	0.026	0.033	0.039
Boron (B)-Total	mg/kg	-	-	1.5	1.4	1.4	2.0	1.3	1.5	1.4	1.6	1.7
Cadmium (Cd)-Total	mg/kg	22	-	0.0712	0.0675	0.0576	0.110	0.107	0.0514	0.0504	0.0787	0.0877
Calcium (Ca)-Total	mg/kg	-	-	15100	7490	7670	12200	10600	5900	5230	8630	8850
Cesium (Cs)-Total	mg/kg	-	-	0.195	0.151	0.126	0.180	0.116	0.141	0.104	0.116	0.118
Chromium (Cr)-Total	mg/kg	87	-	3.34	3.35	2.39	5.64	2.20	2.97	2.08	2.43	2.55
Cobalt (Co)-Total	mg/kg	300	-	0.929	1.18	0.968	1.27	0.725	1.20	0.907	0.932	1.01
Copper (Cu)-Total	mg/kg	91	-	2.94	3.28	2.57	3.20	2.11	2.60	2.18	2.27	2.49
Iron (Fe)-Total	mg/kg	-	-	3720	5040	3910	4290	2370	4890	3770	3200	3550
Lead (Pb)-Total	mg/kg	260	-	2.30	2.00	1.71	2.17	1.42	1.49	1.25	1.39	2.03
Lithium (Li)-Total	mg/kg	-	-	1.21	1.21	0.92	1.83	0.68	1.09	0.76	0.94	0.98
Magnesium (Mg)-Total	mg/kg	-	-	2920	2280	1950	2770	2290	2230	1830	2610	2670
Manganese (Mn)-Total	mg/kg	-	-	49.2	73.7	66.6	60.0	40.6	82.3	67.9	89.1	93.6
Mercury (Hg)-Total	mg/kg	24	-	0.055	0.060	0.055	0.065	0.060	0.047	0.042	0.051	0.056
Molybdenum (Mo)-Total	mg/kg	40	-	0.586	0.563	0.461	0.361	0.249	0.573	0.370	0.450	0.440
Nickel (Ni)-Total	mg/kg	89	-	2.58	3.19	2.40	5.66	2.53	2.74	2.07	2.34	2.51
Phosphorus (P)-Total	mg/kg	-	-	575	644	630	560	512	542	426	506	449
Potassium (K)-Total	mg/kg	-	-	1980	2170	1920	1870	1730	1860	1410	1860	1620
Rubidium (Rb)-Total	mg/kg	-	-	8.83	8.77	7.81	8.40	6.77	7.98	6.20	7.34	7.24
Selenium (Se)-Total	mg/kg	2.9	-	0.100	0.094	0.082	0.109	0.089	0.082	0.070	0.082	0.080
Silver (Ag)-Total	mg/kg	40	-	0.0296	0.0257	0.0217	0.0184	0.0173	0.0256	0.0191	0.0189	0.0184
Sodium (Na)-Total	mg/kg	-	-	191	272	265	180	194	307	209	247	215
Strontium (Sr)-Total	mg/kg	-	-	6.51	5.13	5.06	6.74	6.18	4.29	3.65	6.66	6.61
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0257	0.0228	0.0173	0.0263	0.0146	0.0200	0.0149	0.0170	0.0185

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-73	L2731272-74	L2731272-75	L2731272-76	L2731272-77	L2731272-78	L2731272-79	L2731272-80	L2731272-81
Sample Date				21-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22
Sample ID				MS-L-20_2022	MS-L-20_2022 WASHED	MS-L-21_2022	MS-L-21_2022 WASHED	MS-L-22_2022	MS-L-22_2022 WASHED	MS-L-23_2022	MS-L-23_2022 WASHED	MS-L-24_2022
Aluminum (Al)-Total	mg/kg	-	-	1210	1810	887	908	169	144	619	478	524
Antimony (Sb)-Total	mg/kg	40	-	0.014	0.022	0.011	0.012	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (As)-Total	mg/kg	12	-	0.247	0.419	0.228	0.246	0.054	0.049	0.087	0.075	0.057
Barium (Ba)-Total	mg/kg	2000	-	13.5	24.3	13.6	14.5	11.6	11.7	12.7	12.9	31.3
Beryllium (Be)-Total	mg/kg	8	-	0.070	0.104	0.055	0.058	<0.010	<0.010	0.034	0.027	0.078
Bismuth (Bi)-Total	mg/kg	-	-	0.053	0.089	0.043	0.074	<0.010	<0.010	0.012	<0.010	<0.010
Boron (B)-Total	mg/kg	-	-	2.3	3.0	1.3	1.4	<1.0	1.0	1.3	1.2	<1.0
Cadmium (Cd)-Total	mg/kg	22	-	0.121	0.287	0.0436	0.0440	0.167	0.214	0.212	0.201	0.191
Calcium (Ca)-Total	mg/kg	-	-	9470	16900	12200	12700	8970	9570	11000	10100	8370
Cesium (Cs)-Total	mg/kg	-	-	0.179	0.278	0.164	0.169	0.0402	0.0347	0.0924	0.0670	0.144
Chromium (Cr)-Total	mg/kg	87	-	2.76	4.42	2.33	2.44	0.391	0.358	1.47	1.23	0.992
Cobalt (Co)-Total	mg/kg	300	-	1.06	1.78	0.954	1.04	0.275	0.246	0.457	0.415	0.752
Copper (Cu)-Total	mg/kg	91	-	8.72	27.8	2.38	2.48	1.27	1.44	1.57	1.46	1.17
Iron (Fe)-Total	mg/kg	-	-	4580	7530	3760	4340	477	427	1090	908	597
Lead (Pb)-Total	mg/kg	260	-	2.10	3.63	1.86	1.95	0.500	0.501	1.32	1.13	1.37
Lithium (Li)-Total	mg/kg	-	-	1.44	2.04	1.18	1.32	<0.50	<0.50	0.79	0.61	<0.50
Magnesium (Mg)-Total	mg/kg	-	-	2400	4620	2760	3000	1760	1850	1600	1570	1310
Manganese (Mn)-Total	mg/kg	-	-	57.5	106	44.8	48.1	62.9	65.6	47.2	45.8	119
Mercury (Hg)-Total	mg/kg	24	-	0.071	0.067	0.059	0.057	0.049	0.049	0.057	0.058	0.074
Molybdenum (Mo)-Total	mg/kg	40	-	0.457	0.707	0.387	0.373	0.088	0.081	0.096	0.094	0.049
Nickel (Ni)-Total	mg/kg	89	-	2.55	4.14	1.97	2.11	0.53	0.50	0.99	0.85	1.45
Phosphorus (P)-Total	mg/kg	-	-	784	1390	572	549	428	388	674	607	445
Potassium (K)-Total	mg/kg	-	-	2290	3950	1940	1860	1890	1600	2090	1780	1490
Rubidium (Rb)-Total	mg/kg	-	-	9.22	15.6	7.85	8.28	4.37	3.76	6.84	5.70	8.01
Selenium (Se)-Total	mg/kg	2.9	-	0.084	0.146	0.097	0.102	0.106	0.101	0.081	0.079	0.066
Silver (Ag)-Total	mg/kg	40	-	0.0423	0.106	0.0249	0.0247	0.0118	0.0123	0.0106	0.0100	0.0125
Sodium (Na)-Total	mg/kg	-	-	214	450	256	273	235	226	306	260	343
Strontium (Sr)-Total	mg/kg	-	-	6.37	11.3	7.52	8.58	10.2	11.0	6.98	6.81	19.0
Tellurium (Te)-Total	mg/kg	-	-	<0.020	0.027	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0264	0.0417	0.0204	0.0216	0.0040	0.0040	0.0106	0.0087	0.0089

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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			Lab ID	L2731272-82	L2731272-83	L2731272-84
			Sample Date	19-JUL-22	19-JUL-22	19-JUL-22
			Sample ID	MS-L-24_2022 WASHED	MS-L-25_2022	MS-L-25_2022 WASHED
		Guide Limits				
Analyte	Unit	#1	#2			
Aluminum (Al)-Total	mg/kg	-	-	353	709	679
Antimony (Sb)-Total	mg/kg	40	-	<0.010	<0.010	<0.010
Arsenic (As)-Total	mg/kg	12	-	0.035	0.124	0.116
Barium (Ba)-Total	mg/kg	2000	-	32.7	11.2	10.8
Beryllium (Be)-Total	mg/kg	8	-	0.056	0.036	0.034
Bismuth (Bi)-Total	mg/kg	-	-	<0.010	0.016	0.016
Boron (B)-Total	mg/kg	-	-	<1.0	1.8	1.2
Cadmium (Cd)-Total	mg/kg	22	-	0.216	0.0692	0.0666
Calcium (Ca)-Total	mg/kg	-	-	9060	13900	12700
Cesium (Cs)-Total	mg/kg	-	-	0.109	0.117	0.115
Chromium (Cr)-Total	mg/kg	87	-	0.649	2.35	2.47
Cobalt (Co)-Total	mg/kg	300	-	0.705	0.567	0.593
Copper (Cu)-Total	mg/kg	91	-	0.99	2.01	1.88
Iron (Fe)-Total	mg/kg	-	-	413	1820	1690
Lead (Pb)-Total	mg/kg	260	-	1.30	1.05	1.09
Lithium (Li)-Total	mg/kg	-	-	<0.50	0.88	0.86
Magnesium (Mg)-Total	mg/kg	-	-	1370	2570	2430
Manganese (Mn)-Total	mg/kg	-	-	137	31.7	30.9
Mercury (Hg)-Total	mg/kg	24	-	0.059	0.066	0.063
Molybdenum (Mo)-Total	mg/kg	40	-	0.044	0.575	0.341
Nickel (Ni)-Total	mg/kg	89	-	1.03	2.58	2.86
Phosphorus (P)-Total	mg/kg	-	-	353	616	541
Potassium (K)-Total	mg/kg	-	-	1090	1970	1660
Rubidium (Rb)-Total	mg/kg	-	-	5.63	5.16	4.60
Selenium (Se)-Total	mg/kg	2.9	-	0.067	0.075	0.082
Silver (Ag)-Total	mg/kg	40	-	0.0134	0.0147	0.0123
Sodium (Na)-Total	mg/kg	-	-	242	257	215
Strontium (Sr)-Total	mg/kg	-	-	20.0	6.84	6.37
Tellurium (Te)-Total	mg/kg	-	-	<0.020	<0.020	<0.020
Thallium (Tl)-Total	mg/kg	1	-	0.0071	0.0140	0.0134

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-1	L2731272-2	L2731272-3	L2731272-4	L2731272-5	L2731272-6	L2731272-7	L2731272-8	L2731272-9
Sample Date				17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	24-JUL-22	24-JUL-22	24-JUL-22	24-JUL-22	16-JUL-22
Sample ID				TR-L-01_2022	TR-L-01_2022 WASHED	TR-L-05_2022	TR-L-05_2022 WASHED	TR-L-07_2022	TR-L-07_2022 WASHED	TR-L-07_2022R	TR-L-07_2022R WASHED	TR-L-09_2022
Tin (Sn)-Total	mg/kg	300	-	0.15	0.11	0.11	0.12	0.13	0.12	0.14	0.11	0.11
Titanium (Ti)-Total	mg/kg	-	-	96.4	75.5	72.6	78.1	83.1	79.2	96.5	71.0	58.1
Uranium (U)-Total	mg/kg	33	-	1.17	1.01	1.25	1.27	1.15	1.09	1.15	0.952	1.19
Vanadium (V)-Total	mg/kg	130	-	2.45	1.95	1.59	1.69	1.96	1.82	2.33	1.57	2.00
Zinc (Zn)-Total	mg/kg	410	-	22.7	23.9	18.4	18.3	24.1	22.2	26.4	26.4	16.2
Zirconium (Zr)-Total	mg/kg	-	-	3.37	2.64	3.25	3.51	3.12	2.98	3.25	2.45	2.70

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-10	L2731272-11	L2731272-12	L2731272-13	L2731272-14	L2731272-15	L2731272-16	L2731272-17	L2731272-18
Sample Date				16-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	21-JUL-22	21-JUL-22
Sample ID				TR-L-09_2022 WASHED	TR-L-11_2022	TR-L-11_2022 WASHED	TR-L-12_2022	TR-L-12_2022 WASHED	TR-L-12_2022R	TR-L-12_2022R WASHED	TR-L-13_2022	TR-L-13_2022 WASHED
Tin (Sn)-Total	mg/kg	300	-	0.11	0.12	0.12	0.11	0.11	0.13	0.13	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	64.9	73.1	70.4	64.4	61.8	74.0	70.0	25.3	25.2
Uranium (U)-Total	mg/kg	33	-	1.23	0.764	0.773	0.619	0.583	0.659	0.690	0.134	0.128
Vanadium (V)-Total	mg/kg	130	-	2.41	1.63	1.70	1.59	1.48	1.86	1.78	0.66	0.62
Zinc (Zn)-Total	mg/kg	410	-	16.9	25.5	24.8	20.1	19.3	19.3	19.8	15.3	16.1
Zirconium (Zr)-Total	mg/kg	-	-	2.99	2.34	2.41	1.91	1.70	2.06	1.96	0.46	0.49

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-19	L2731272-20	L2731272-21	L2731272-22	L2731272-23	L2731272-24	L2731272-25	L2731272-26	L2731272-27
Sample Date				21-JUL-22	21-JUL-22	18-JUL-22	18-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	18-JUL-22
Sample ID				TR-L-14_2022	TR-L-14_2022 WASHED	TR-L-15_2022	TR-L-15_2022 WASHED	TR-L-16_2022	TR-L-16_2022 WASHED	TR-L-17_2022	TR-L-17_2022 WASHED	TR-L-20_2022
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	46.3	38.4	9.75	8.21	15.6	16.2	37.4	29.6	9.24
Uranium (U)-Total	mg/kg	33	-	0.430	0.374	0.0437	0.0408	0.0882	0.0873	0.142	0.135	0.0651
Vanadium (V)-Total	mg/kg	130	-	0.96	0.82	0.26	0.22	0.36	0.37	1.53	1.30	0.29
Zinc (Zn)-Total	mg/kg	410	-	28.5	27.9	22.1	25.3	30.6	26.8	14.3	10.0	29.2
Zirconium (Zr)-Total	mg/kg	-	-	1.26	1.12	0.22	<0.20	0.29	0.34	1.02	0.80	0.23

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

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			Lab ID	L2731272-28	L2731272-29	L2731272-30	L2731272-31	L2731272-32	L2731272-33	L2731272-34	L2731272-35	L2731272-36
			Sample Date	18-JUL-22	18-JUL-22	18-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22	17-JUL-22
			Sample ID	TR-L-20_2022 WASHED	TR-L-21_2022	TR-L-21_2022 WASHED	MS-L-01_2022	MS-L-01_2022 WASHED	MS-L-02_2022	MS-L-02_2022 WASHED	MS-L-02_2022R	MS-L-02_2022R WASHED
Analyte	Unit	Guide Limits #1	Guide Limits #2									
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	0.22	0.17	0.18	0.13	0.15	0.12
Titanium (Ti)-Total	mg/kg	-	-	8.93	15.6	17.8	153	120	146	104	127	90.3
Uranium (U)-Total	mg/kg	33	-	0.0641	0.202	0.216	1.54	1.33	1.72	1.52	1.56	1.21
Vanadium (V)-Total	mg/kg	130	-	0.25	0.46	0.53	4.88	3.67	4.55	3.29	3.84	3.37
Zinc (Zn)-Total	mg/kg	410	-	31.0	14.4	14.4	24.2	24.3	21.7	19.7	20.6	17.7
Zirconium (Zr)-Total	mg/kg	-	-	<0.20	0.58	0.59	4.21	3.49	4.60	3.84	3.99	3.22

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

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Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-37	L2731272-38	L2731272-39	L2731272-40	L2731272-41	L2731272-42	L2731272-43	L2731272-44	L2731272-45
Sample Date				19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22
Sample ID				MS-L-03_2022	MS-L-03_2022 WASHED	MS-L-04_2022	MS-L-04_2022 WASHED	MS-L-05_2022	MS-L-05_2022 WASHED	MS-L-05_2022R	MS-L-05_2022R WASHED	MS-L-06_2022
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	0.12	0.11	0.11	<0.10	0.16	0.11	0.16
Titanium (Ti)-Total	mg/kg	-	-	53.0	50.0	122	106	114	93.0	166	109	138
Uranium (U)-Total	mg/kg	33	-	0.213	0.209	0.435	0.450	0.488	0.461	0.679	0.479	0.664
Vanadium (V)-Total	mg/kg	130	-	1.34	1.27	3.78	2.92	3.08	2.45	4.55	2.98	3.88
Zinc (Zn)-Total	mg/kg	410	-	14.5	16.3	18.6	17.7	19.1	17.9	20.4	18.4	24.8
Zirconium (Zr)-Total	mg/kg	-	-	0.80	0.82	2.05	2.03	1.93	1.78	2.83	1.87	2.58

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

(yellow) Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
(pink) Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-46	L2731272-47	L2731272-48	L2731272-49	L2731272-50	L2731272-51	L2731272-52	L2731272-53	L2731272-54
Sample Date				20-JUL-22	24-JUL-22	24-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	24-JUL-22	24-JUL-22
Sample ID				MS-L-06_2022 WASHED	MS-L-07_2022	MS-L-07_2022 WASHED	MS-L-08_2022	MS-L-08_2022 WASHED	MS-L-09_2022	MS-L-09_2022 WASHED	MS-L-10_2022	MS-L-10_2022 WASHED
Tin (Sn)-Total	mg/kg	300	-	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	87.9	66.8	57.7	86.9	56.1	58.0	48.2	52.1	45.6
Uranium (U)-Total	mg/kg	33	-	0.483	0.360	0.320	0.376	0.298	0.309	0.320	0.314	0.312
Vanadium (V)-Total	mg/kg	130	-	2.32	1.90	1.53	2.37	1.52	1.65	1.37	1.54	1.28
Zinc (Zn)-Total	mg/kg	410	-	24.5	19.8	21.0	15.9	15.1	13.8	15.7	14.6	15.4
Zirconium (Zr)-Total	mg/kg	-	-	1.82	1.28	1.10	1.49	1.00	1.10	0.91	1.09	0.99

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-55 21-JUL-22 MS-L-11_2022	L2731272-56 21-JUL-22 MS-L-11_2022 WASHED	L2731272-57 21-JUL-22 MS-L-12_2022	L2731272-58 21-JUL-22 MS-L-12_2022 WASHED	L2731272-59 19-JUL-22 MS-L-13_2022	L2731272-60 19-JUL-22 MS-L-13_2022 WASHED	L2731272-61 19-JUL-22 MS-L-14_2022	L2731272-62 19-JUL-22 MS-L-14_2022 WASHED	L2731272-63 20-JUL-22 MS-L-15_2022
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	67.5	59.8	71.8	61.8	47.1	43.4	64.0	56.2	92.4
Uranium (U)-Total	mg/kg	33	-	0.699	0.649	0.792	0.753	0.149	0.146	0.227	0.188	0.377
Vanadium (V)-Total	mg/kg	130	-	2.06	1.72	2.22	1.91	1.25	1.09	1.75	1.21	2.60
Zinc (Zn)-Total	mg/kg	410	-	15.6	16.5	20.9	20.7	15.2	14.4	18.5	18.1	18.8
Zirconium (Zr)-Total	mg/kg	-	-	2.11	1.86	2.25	1.95	0.71	0.64	1.03	0.80	1.70

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2731272-64	L2731272-65	L2731272-66	L2731272-67	L2731272-68	L2731272-69	L2731272-70	L2731272-71	L2731272-72
Sample Date				20-JUL-22	20-JUL-22	20-JUL-22	19-JUL-22	19-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22	20-JUL-22
Sample ID				MS-L-15_2022 WASHED	MS-L-16_2022	MS-L-16_2022 WASHED	MS-L-17_2022	MS-L-17_2022 WASHED	MS-L-18_2022	MS-L-18_2022 WASHED	MS-L-19_2022	MS-L-19_2022 WASHED
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	70.8	64.4	45.6	92.1	42.3	53.8	38.4	44.2	49.7
Uranium (U)-Total	mg/kg	33	-	0.313	0.340	0.276	0.409	0.186	0.262	0.219	0.233	0.269
Vanadium (V)-Total	mg/kg	130	-	1.82	1.86	1.31	2.93	1.11	1.54	1.11	1.25	1.36
Zinc (Zn)-Total	mg/kg	410	-	17.4	19.8	18.0	19.6	18.4	18.2	16.2	24.3	24.5
Zirconium (Zr)-Total	mg/kg	-	-	1.24	1.12	0.90	1.51	0.68	1.04	0.86	0.84	0.96

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.

Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - TISSUE

			Lab ID	L2731272-73	L2731272-74	L2731272-75	L2731272-76	L2731272-77	L2731272-78	L2731272-79	L2731272-80	L2731272-81
			Sample Date	21-JUL-22	21-JUL-22	21-JUL-22	21-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22	19-JUL-22
			Sample ID	MS-L-20_2022	MS-L-20_2022 WASHED	MS-L-21_2022	MS-L-21_2022 WASHED	MS-L-22_2022	MS-L-22_2022 WASHED	MS-L-23_2022	MS-L-23_2022 WASHED	MS-L-24_2022
		Guide Limits										
Analyte	**Unit**	**#1**	**#2**									
Tin (Sn)-Total	mg/kg	300	-	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	59.6	91.9	49.3	55.2	10.5	9.43	39.4	32.2	41.3
Uranium (U)-Total	mg/kg	33	-	0.545	0.844	0.405	0.411	0.0640	0.0556	0.0880	0.0736	0.111
Vanadium (V)-Total	mg/kg	130	-	1.90	2.77	1.40	1.53	0.27	0.24	1.23	0.97	0.85
Zinc (Zn)-Total	mg/kg	410	-	22.1	44.8	14.5	15.1	29.6	38.2	33.5	36.2	29.2
Zirconium (Zr)-Total	mg/kg	-	-	1.39	2.23	1.10	1.27	<0.20	<0.20	1.01	0.76	0.50

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Metals - TISSUE

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID L2731272-82 Sample Date 19-JUL-22 Sample ID MS-L-24_2022 WASHED	Lab ID L2731272-83 Sample Date 19-JUL-22 Sample ID MS-L-25_2022	Lab ID L2731272-84 Sample Date 19-JUL-22 Sample ID MS-L-25_2022 WASHED
Tin (Sn)-Total	mg/kg	300	-	<0.10	<0.10	<0.10
Titanium (Ti)-Total	mg/kg	-	-	24.8	45.5	42.4
Uranium (U)-Total	mg/kg	33	-	0.0762	0.131	0.127
Vanadium (V)-Total	mg/kg	130	-	0.53	1.30	1.34
Zinc (Zn)-Total	mg/kg	410	-	32.9	13.0	13.1
Zirconium (Zr)-Total	mg/kg	-	-	0.33	0.84	0.81

Guide Limit #1: CCME - Soil(coarse)-IACR 1 in 100000-CL-Groundwater Unprotected

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
AG-DRY-CCMS-N-VA	Tissue	Silver in Tissue by CRC ICPMS (DRY)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

HG-DRY-CVAFS-N-VA	Tissue	Mercury in Tissue by CVAAS (DRY)	EPA 200.3, EPA 245.7

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7.

MET-DRY-CCMS-N-VA	Tissue	Metals in Tissue by CRC ICPMS (DRY)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

MOISTURE-TISS-VA	Tissue	% Moisture in Tissues	Puget Sound WQ Authority, Apr 1997

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

TI-DRY-CCMS-N-VA	Tissue	Ti in Tissue by CRC ICPMS (DRY)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

1	2	3	4

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

APPENDIX D SUMMARY OF STATISTICAL RELATIONSHIPS BETWEEN DUSTFALL METALS AND SOIL/LICHEN METALS

Appendix Table D-1. Candidate models describing the soil-metal concentrations in 2022.

Trace Metal	DD[1]	Distance	DD * Distance	pH	DD * pH	AICc[2]	ΔAICc[3]
Arsenic	**√[2]**	**–**	**–**	**√**	**–**	**82.01**	**0**
	√	–	–	√	√	83.53	1.52
	√	√	–	–	–	151.11	69.10
	√	√	√	–	–	153.52	71.51
Cadmium	**√**	**–**	**–**	**√**	**–**	**80.74**	**0**
	√	–	–	√	√	81.37	0.64
	√	√	–	–	–	98.68	17.94
	√	√	√	–	–	100.28	19.54
Copper	**√**	**–**	**–**	**√**	**–**	**96.03**	**0**
	√	–	–	√	√	97.33	1.39
	√	√	–	–	–	145.25	49.21
	√	√	√	–	–	147.31	51.28
Lead	**√**	**–**	**–**	**√**	**–**	**75.25**	**0**
	√	–	–	√	√	77.20	1.95
	√	√	–	–	–	112.36	37.11
	√	√	√	–	–	114.77	39.52
Selenium	**√**	**–**	**–**	**√**	**–**	**-3,317.38**	**0**
	√	–	–	√	√	-3,315.38	2.00
	√	√	–	–	–	10.10	3,327.48
	√	√	√	–	–	15.74	3,333.12
Zinc	√	–	–	√	√	100.07	0
	√	**–**	**–**	**√**	**–**	**100.79**	**0.73**
	√	√	–	–	–	133.73	33.66
	√	√	√	–	–	134.09	34.02

[1] DD = dustfall deposition of corresponding trace metal.

[2] AICc = Akaike's Information Criteria.

[3] ΔAICc = difference in AICc between the given model and the lowest AICc.

[4] Yellow and bold = best model based on an ΔAIC of two or less and the most parsimonious model.

Appendix Table D-2. Relationships between trace metals in dustfall deposition and soil-metal concentrations.

Trace Metal[1]	Slope of Dustfall Metals Versus Soil Metals[4]		Slope of Soil pH Versus Soil Metals[3,4]	
	Estimate	*P*	Estimate	*P*
Arsenic (n = 50)	**-0.82**	**<0.0001**	**0.70**	**<0.0001**
Cadmium (n = 49)	-0.11	0.45	**0.28**	**0.0004**
Copper (n = 49)	**-0.49**	**<0.0001**	**0.50**	**<0.0001**
Lead (n = 47)	**-0.15**	**0.004**	**0.36**	**<0.0001**
Selenium[2]	—	—	—	—
Zinc (n = 48)	**-0.53**	**0.004**	**0.43**	**<0.0001**

1 n = sample sizes for analysis. Significant relationships are in bold.

2 No analyses were conducted on selenium due to many samples being below the detection limit.

3 pH was analyzed as a continuous variable.

4 The marginal effect (i.e.., slope) of dustfall is provided from the relationship model identified as the best model in Appendix Table E-1.

Appendix Table D-3. Candidate models describing the lichen-metal concentrations in 2022.

Trace Metal	DD[1]	Distance	DD * Distance	AICc[2]	ΔAICc[3]
Arsenic	√[2]	√	—	**72.99**	**0**
	√	√	√	75.36	2.37
Cadmium	√	√	—	**106.54**	**0**
	√	√	√	108.93	2.39
Copper	√	√	√	**66.11**	**0**
	√	√	—	69.40	3.29
Lead	√	√	√	**76.38**	**0**
	√	√	—	78.20	1.82
Selenium	√	√	—	**45.76**	**0**
	√	√	√	47.86	2.10
Zinc	√	√	—	**46.87**	**0**
	√	√	√	48.58	1.71

1 DD = dustfall deposition of corresponding trace metal.

2 AICc = Akaike's Information Criteria.

3 ΔAICc = difference in AICc between the given model and the lowest AICc.

4 Yellow and bold = best model based on an ΔAIC of two or less and the most parsimonious model.

Appendix Table D-4. Relationships between trace metals in dustfall deposition and lichen-metal concentrations.

Trace Metal[1]	Slope of Dustfall Metals Versus Soil Metals[3]		Slope of Distance vs Soil Metals[2,3]		Interaction with Distance[2]	
	Estimate	*P*	Estimate	*P*	Estimate	*P*
Arsenic (n = 56)	**0.43**	**0.0001**	**-9.40E-05**	**<0.0001**	—	—
Cadmium (n = 56)[3]	-0.10	0.49	2.66E-05	0.30	—	—
Copper (n = 56)	**0.30**	**0.0003**	**-3.68E-04**	**0.007**	**-4.00E-05**	**0.02**
Lead (n = 54)	**0.44**	**<0.0001**	**-6.01E-04**	**0.03**	**-4.62E-05**	**0.048**
Selenium (n = 56)[3]	-0.10	0.19	-1.30E-06	0.93	—	—
Zinc (n = 56)[3]	-0.01	0.87	1.80E-05	0.18	—	—

1 n = sample sizes for analysis. Significant and potential relationships/interactions are highlighted in bold.

2 Distance was analyzed as a continuous variable, standardized by subtracting the mean and dividing by the standard deviation.

3 If a significant relationship or interaction occurred with distance to the Poterntial Development Area (PDA), then the marginal effect (slope) of dustfall is provided from the relationship model identified as the best model in Appendix Table E-3. The slope from a simple regression model is provided if no significant relationship or interaction occurred with distance to the PDA.

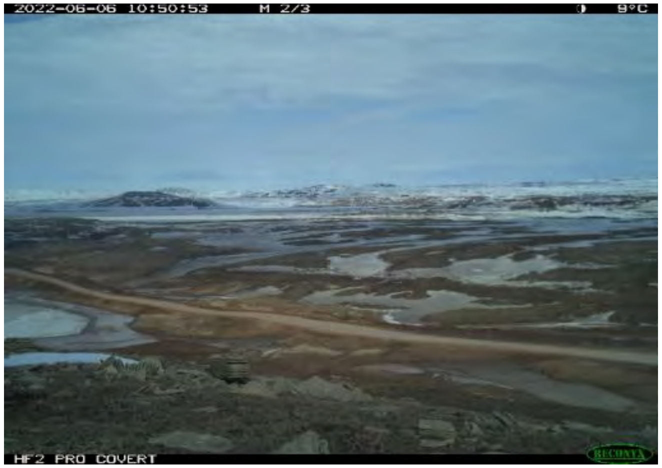
APPENDIX E REMOTE CAMERA LOCATIONS

Site Name	Camera Name	Location	Latitude / Longitude	Access	Site Photo
HOL 6	Baffin-1	KM 57	71.4832, -80.213	Helicopter, vehicle, foot	
HOL 16	Baffin-2	KM 95	71.3321, -79.4779	Helicopter, vehicle, foot	

Site Name	Camera Name	Location	Latitude / Longitude	Access	Site Photo
HOL 1	Baffin-3	KM 4	71.8710, -80.8828	Helicopter, vehicle, foot	
HOL 1	Baffin-4	KM 4	71.8710, -80.8828	Helicopter, vehicle, foot	

Site Name	Camera Name	Location	Latitude / Longitude	Access	Site Photo
HOL 6	Baffin-5	KM 57	71.4832, -80.213	Helicopter, vehicle, foot	
HOL 16	Baffin-6	KM 95	71.3321, -79.4779	Helicopter, vehicle, foot	

Site Name	Camera Name	Location	Latitude / Longitude	Access	Site Photo
HOL 3	Baffin-7	KM 27	71.7297, -80.4418	Helicopter, vehicle, foot	
HOL 4	Baffin-8	KM 42	71.6073, -80.347	Helicopter, vehicle, foot	

Site Name	Camera Name	Location	Latitude / Longitude	Access	Site Photo
HOL 10	Baffin-9	KM 85.5	71.3732, -79.6859	Helicopter, vehicle, foot	
HOL 4	Baffin-10	KM 42	71.6073, -80.347	Helicopter, vehicle, foot	

Site Name	Camera Name	Location	Latitude / Longitude	Access	Site Photo
HOL 10	Baffin-11	KM 85.5	71.3732, -79.6859	Helicopter, vehicle, foot	
HOL 3	Baffin-12	KM 27	71.7297, -80.4418	Helicopter, vehicle, foot	

APPENDIX F 2022 TEAMR REPORT COMMENTS AND FEEDBACK