4.0 ENVIRONMENTAL SETTING AND POTENTIAL RESOURCE CONFLICTS

As per the guidance from the provincial government related to the content of an Environmental Registration, this chapter provides a high-level discussion of the environmental setting and the potential resource conflicts associated with the Berry Pit Expansion (Project Expansion). It is informed by the assessment of the Land and Resource Use Valued Component (VC) in the Valentine Gold Environmental Impact Statement (EIS) (Marathon 2020) for the Valentine Gold Project (Approved Project) and has been updated as applicable.

4.1 ENVIRONMENTAL SETTING

The following sections summarize the existing physical, biological and socio-economic environments of the Approved Project and Project Expansion, presenting information from Chapters 5 to 19 of the Valentine Gold EIS as well as new information since the EIS was submitted. New information considered includes literature reviews and baseline surveys carried out in support of the Approved Project and Project Expansion. Note that the Project Area for the Project Expansion is the same as the Project Area that was assessed for the Approved Project (i.e., the mine site and access road) (Figure 1-6).

While construction of the Approved Project was initiated in October 2022, reference to existing conditions in this Environmental Registration / Environmental Assessment Update refers to pre-construction conditions (refer to Section 5.2.1). This approach has been taken for several reasons:

- The additional surveys that have been conducted and the updated publicly available data reflect pre-construction conditions
- The conservative assessment approach is to assume that the potential effects of Project Expansion and the potential effects of the Project Expansion in combination with the Approved Project are in consideration of an existing environment undisturbed by construction activities
- Existing conditions within the Project Area and the mine site in particular are changing continually as construction of the Approved Project advances (as was anticipated in the Valentine Gold EIS); therefore, existing conditions reflective of construction activities would be constantly shifting and challenging to characterize in a meaningful way for assessment purposes

4.1.1 Physical Environment

The Project Area is located within the Central Newfoundland Forest (CNF) Ecoregion (Newfoundland and Labrador Department of Environment and Climate Change [NLDECC 2017]). This ecoregion typically consists of rolling hills, dense forest, and organic deposits occurring in valleys and basins (Protected Areas Association [PAA 2008]). The CNF Ecoregion has the warmest summers and coldest winters on the Island of Newfoundland (Island), with the potential for night frost year-round (PAA 2008). Terrain (i.e., topography and landforms) varies and includes boggy areas, thin to thick glacial till layers and bedrock

outcrops. Scattered wetlands, specifically patterned fens and bogs are common in the Project Area and surrounding areas. Elevations range from 270 to 437 m above sea level (masl) across the mine site and from 160 to 437 masl across the Project Area.

Geologically, the Valentine Lake property is located within the Newfoundland Appalachian system, which displays typical southwest to northeast alignment, and was formed during closure of the Iapetus Ocean in the Cambrian to Ordovician periods, resulting in the accretion of Laurentia and Gondwana (Piercey et al., 2014). The Valentine Lake property is located within the Victoria Lake Group which is part of the Exploits Subzone of the Dunnage Zone. The Berry deposit sits on a sloped ridge top and is located approximately 3 km northeast of the Leprechaun deposit and 2 km southwest of the Marathon deposit, spanning a strike length of 1.5 km. Towards the north the topography falls off steeply, while towards the south the topography slopes gently downhill.

There are no historical baseline records for air quality or noise in the Project Area; however, given its rural nature, the pre-construction concentrations of air contaminants are likely to be low and close to average background concentrations for similar rural areas in Newfoundland and Labrador (NL) at most locations, most of the time. Ambient air quality monitoring was conducted within the Project Area from June 15-19, 2020, with measured concentrations of each contaminant below applicable regulatory standards. Occasionally, the concentration of an air contaminant, such as particulate matter, may be temporarily elevated and localized for a short period of time due to dust from traffic on nearby unpaved forestry and hydroelectric project access roads. Overall, pre-construction ambient air quality is expected to be very good most of the time in the Project Area.

Similarly, the sound levels in a rural environment are likely to be dominated by natural phenomena or activities, such as wind, rain and wildlife. Sound pressure levels depend upon the distance from the source and the acoustic characteristics of the area in which it is located. In the Project Area, pre-construction levels are expected to be low most of the time. Local sources of sound may include forestry and mineral exploration activities, vehicles, generators, snowmobiles/ATVs, or recreational boat engines. These activities and sources are not likely to exceed regulatory thresholds. Baseline sound pressure levels were measured at one location in the Project Area in June 2020 and the results were representative of a quiet rural to quiet suburban area, with limited to no existing sources of noise.

The mine site is situated along a boundary between the Exploits River Watershed and the Bay d'Espoir Watershed. The Victoria Lake Reservoir, to the south of the Project Area, is the headwater system for the Bay d'Espoir Watershed, which includes multiple hydroelectric projects downstream. The head of the Victoria River (altered in the 1960s by hydroelectric development) to the east of the Project Area, and Valentine Lake to the northwest, feed into the Exploits River, one of the most important Atlantic salmon rivers on the Island in terms of numbers of salmon returning. The Exploits River Watershed is the largest watershed on the Island, with a total area of 10,241 km^2.

Water discharge from the Exploits River is highly regulated by three dams located in Millertown, Grand Falls-Windsor and Bishops Falls. The mouth of Beothuk Lake (formerly Red Indian Lake) is controlled by a dam located in Millertown. Historically, Victoria Lake drained to Beothuk Lake via the Victoria River; however, with the construction of the Victoria Dam in 1967 to create the Victoria Lake Reservoir, the flow

from Victoria Lake was altered to flow in a generally southerly direction to Burnt Lake and Granite Lake, providing flow to the hydrogeneration station in Bay d'Espoir. In recent years, the Victoria Lake Reservoir has contributed very little flow to the Victoria River because the Victoria Dam operates as an overflow spillway, and spilling occurs infrequently.

4.1.2 Biological Environment

The CNF Ecoregion, where the Project Area is located, is primarily inland and has a more continental climate than other surrounding ecoregions. Balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), and black spruce (*Picea mariana*) are dominant tree species. No vascular plant species at risk (SAR) were observed during surveys conducted in support of the Approved Project or Project Expansion. Three species of conservation concern (SOCC) were observed in field surveys that supported the Valentine Gold EIS: short-scale sedge (*Carex deweyana)*, nodding water nymph *(Najas flexilis*) and perennial bentgrass (*Agrostis perennans*). In a follow up survey in 2021, two additional SOCC were found in the Project Area: slender spiked rush (*Eleocharis nitida*) and Host's sedge (*Carex hostiana).* No additional SOCC were identified in a 2022 vegetation survey in the area of the Project Expansion. Additional information on vegetation and wetland communities, including SAR and SOCC, is provided in Chapter 11 of this document and Section 9.2.2 of the Valentine Gold EIS.

The ecoregion includes a variety of wildlife mammal species commonly found in the boreal forest on the Island. Species confirmed in the Project Area include woodland caribou (*Rangifer tarandus*), moose (*Alces alces*), black bear (*Ursus americanus*), Canada lynx (*Lynx canadensis*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), American marten (*Martes americana atrata*), muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), southern red-backed vole (*Myodes rutilus*), meadow vole (*Microtus pennsylvanicus*), snowshoe hare (*Lepus americanus*), American red squirrel (*Tamiasciurus hudsonicus*), northern myotis (*Myotis septentrionalis*), and little brown myotis (*Myotis lucifugus)*. While not detected in the wildlife baseline studies conducted, mink (*Neovison vison*) and ermine (*Mustela erminea*) are expected to occur in the vicinity of the Project Area. Silver-haired bat (*Lasionycteris noctivagans)*, a migratory species, has been confirmed to occur in the Project Area during the fall migratory season.

Caribou on the Island has been assessed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and is listed on Schedule 1 of the federal *Species at Risk Act* (SARA) COSEWIC was established under SARA as an independent body of experts responsible for identifying and assessing wildlife species considered to be at risk. The Project Area overlaps, or is in proximity to, the ranges of four caribou herds including the Buchans, Grey River, Gaff Topsails and La Poile herds. Animals from the Buchans herd migrate through the mine site biannually, while resident caribou (Grey River herd) occur year-round within the Project Area. The La Poile herd has no overlap with the Project Area, and only a small portion of the winter range of the Gaff Topsails herd overlaps with the Project Area (less than 1 km^2 overlaps with the access road).

Wildlife mammal SAR with potential to occur near the Project Area include the American marten (Newfoundland population) and bats. The Newfoundland population of marten is listed as Threatened under Schedule 1 of SARA and the NL *Endangered Species Act* (NL ESA) and assessed as Special

Concern by COSEWIC (COSEWIC 2022). Northern myotis and little brown myotis are listed as Endangered under SARA (Government of Canada 2021).

The region includes a variety of avifauna species commonly found in the boreal forest on the Island. Broadly, the avifauna groups present in this area include passerines, waterfowl, upland gamebirds, and raptors. Some common species found in the Project Area include boreal chickadee (*Poecile hudsonicus*), black-and-white warbler (*Niotilta varia*), Canada jay (*Perisoreus canadensis*), Lincoln's sparrow (*Melospiza lincolnii*), and yellow-bellied flycatcher (*Empidonax flaviventris*). Three avifauna SAR were identified during field surveys for the Approved Project in the vicinity of the Project Area: olive-sided flycatcher (*Contopus cooperi*), common nighthawk (*Chordeiles minor*), and rusty blackbird (*Euphagus carolinus*). Field surveys completed in 2022 identified two additional SAR: gray-cheeked thrush (*Catharus minimus)* and red crossbill (*Loxia curvirostra**)***. Three avifauna SOCC, Caspian tern (*Hydroprogne caspia*), Nashville warbler (*Leiothlypis ruficapilla*), and bay-breasted warbler (*Setophaga castanea*), were also encountered in the Project Area during field surveys.

With respect to waterfowl, a Sensitive Wildlife Area along the Victoria River has been identified by the NL Department of Fisheries, Forestry and Agriculture (NLDFFA) and the NL Eastern Habitat Joint Venture as containing important waterfowl habitat (NL-EHJV 2008). This area was established for the protection of wetland habitat used as breeding, brood rearing, and staging grounds for waterfowl. While this area overlaps with the Project Area, NLDFFA has indicated that the waterfowl habitat that was likely the focus of this designation are "steadies" on the Victoria River system located well to the north of the mine site, and that a larger area was likely designated to highlight the need for continued drainage of the Victoria River watershed from Victoria Lake Reservoir to Beothuk Lake, to maintain wetland habitat for waterfowl species (B. Adams, pers. comm. 2020).

Sea-run Atlantic salmon (*Salmo salar)* and ouananiche (landlocked salmon), brook trout *(Salvelinus fontinalis*), Arctic char (*Salvelinus alpinus*), American eel *(Anguilla rostrata*), and threespine stickleback (*Gasterosteus aculeatus*) are known to occur within the regional assessment area (RAA) for fish and fish habitat (Cunjak and Newbury 2005; Porter et al. 1974). Brook trout, Arctic char, threespine stickleback, and ouananiche comprise the resident fish species (Marathon 2020). The streams, rivers, lakes and ponds in the RAA provide adequate spawning, rearing, migratory and overwintering habitat for these species to carry out their entire life processes in freshwater. Sea-run Atlantic salmon and American eel comprise the diadromous species in the RAA; their migratory habitat is interrupted, however, by several hydroelectric dams which, while providing upstream passage, may not facilitate optimal downstream migratory passage. The sea-run Atlantic salmon are part of the Northeast Newfoundland Atlantic Salmon population and are assessed as Not-at-Risk by COSEWIC (Government of Canada 2021). Victoria Lake Reservoir and Valentine Lake are not accessible to sea-run Atlantic salmon. American eel is assessed as Threatened by COSEWIC (Government of Canada 2021). There are no fish SAR known to occur in the Project Area (Marathon 2020).

Aquatic field studies completed to support the Valentine Gold EIS focused on the collection of fish and fish habitat data within the Project Area, including the access road. Fish sampling captured brook trout, landlocked Atlantic salmon, Arctic char and threespine stickleback within the ponds, lakes and streams of the Project Area. All life stages of each fish species are present within the vicinity of the Approved

Project. American eel is known to occur along the access road on the south side of Beothuk Lake, however, is not known to occur in Victoria Lake Reservoir or Valentine Lake.

Follow up surveys completed between 2021 and 2023 in support of the Approved Project and Project Expansion focused on characterizing fish and fish habitat in Valentine Lake, Victoria Lake Reservoir (Stantec 2022a; Stantec 2022b), and the area of the Project Expansion (Appendix 9A). Brook trout, landlocked salmon, Arctic char, and threespine stickleback were captured in waterbodies within the footprint of the Project Expansion. During surveys to support the Project and Expansion, Arctic char was only present in Valentine Lake. Bog holes were determined to be fishless.

4.1.3 Socio-economic Environment

The Project Expansion is located in a rural region of central Newfoundland with a history of exploration and mining activities. Other land and resource use in the area includes commercial forestry, multiple hydroelectric developments, outfitting, cabins, harvesting (e.g., trapping, hunting, domestic wood harvesting, berry picking and fishing), and recreational land use (e.g., hiking, boating, snowmobiling, and all-terrain vehicle [ATV] use). Adjacent land uses are described in Section 16.2.2 of the Valentine Gold EIS (Marathon 2020) and summarized in Section 4.2 of this document.

The Approved Project and Project Expansion are located in a rural region and not within the boundaries of a municipality; the closest communities are the Town of Millertown, the Town of Buchans and the Local Service District of Buchans Junction. These nearby communities, along with Badger, Grand Falls-Windsor, and Bishop's Falls, have been shaped primarily by natural resource-based industries, including mining, forestry, and hydroelectric developments. Logging has taken place in the region since the turn of the twentieth century; however, forestry in the area has decreased with the closing of Abitibi-Bowater Inc.'s pulp and paper mill in Grand-Falls-Windsor in 2009. Buchans and Millertown were founded in support of mining and forestry activities in the area, starting in the early 1900s and ending in the 1980s. Mineral exploration activity takes place throughout the general region.

The region is also used for recreational activities, including hunting, fishing, hiking, backcountry camping, snowmobiling, ATV use, and boating. There are a number of private cabins in the region, primarily around ponds, lakes and rivers. Additionally, there are 21 outfitters/ lodges that operate within a 35 km radius of the mine site. The Project Area occurs within several provincial hunting and trapping areas for big game (e.g., moose, caribou, black bear) and small game (e.g., coyote, hare, furbearers).

Angling occurs on a number of waterbodies in the region. There is an active recreational salmon fishery on the Exploits River, which flows northeast from Beothuk Lake. The Exploits River (including tributaries) is a scheduled salmon river, regulated by Fisheries and Oceans Canada under the *Fisheries Act* and the *Canada Wildlife Act.* Atlantic salmon fishway counts in the Exploits River were lower in 2022 than in 2021 (DFO 2022a). Rivers in insular Newfoundland may have retention limits based on Class assignation, and portions of the Exploits River are closed to salmon fishing for the 2022-2023 season (DFO 2022b). Other salmon rivers in the vicinity of the Project Area are considered 'Class 0' (catch and release) (DFO 2022b).

Currently, most salmon anglers fishing on the Exploits River use the lower river and tributaries from Grand Falls down to the river mouth. The middle river is used less often, and there is little access and angler activity at the upper river above Beothuk Lake Dam (Salmonid Council of Newfoundland and Labrador [SCNL, pers. comm. 2020]). Brook trout, Arctic char and ouananiche are also commonly fished in the region. Outfitters in the region reported salmon angling occurring at the Exploits River near Grand Falls-Windsor and Bishop's Falls, occasionally at the mouth of Victoria River near Beothuk Lake (Snow Shoe Lake Hunting and Fishing, pers. comm. 2020), and at the head of the Exploits River (near Exploits Dam). One outfitter also identified areas for ouananiche and brook trout angling along the route between Victoria Lake Reservoir and Bay d'Espoir, including Victoria River, Granite Lake, Meelpaeg Lake, Cowy Lake, Snowshoe Pond, Hospital Pond, Blizzard Pond, and Wilding Lake (Snowshoe Lake Hunting and Fishing, pers. comm. 2020).

The province manages 54 protected areas, including 31 provincial parks, 18 ecological reserves, two wilderness reserves, one wildlife reserve, and two other protected areas (NLDECC n.d.). There are three provincially protected areas in the region of the Approved Project and Project Expansion: Little Grand Lake Ecological Reserve (~27 km from the mine site and ~23 km from the access road); Little Grand Lake Wildlife Reserve (~28 km from the mine site and ~23 km from the access road); and T'Railway Provincial Park (~76 km from the mine site and ~26 km from the access road).

A Historic Resources Overview Assessment for the Approved Project was completed in 2017. Although no known archaeological sites were identified within the Project Area, a review of regional archaeological data indicates that the area surrounding the Approved Project has broad theoretical potential for archaeological resources, particularly those pertaining to the pre-contact period (especially late pre-contact), and the historical Beothuk and Mi'kmaq occupations of the southwestern Newfoundland interior.

The Federal EIS Guidelines for the Valentine Gold Project identified Qalipu Mi'kmaq First Nation (Qalipu) and Miawpukek First Nation (Miawpukek) as Indigenous groups that may be affected by the Approved Project. The Miawpukek Reserve is located at the mouth of the Conne River on the south coast of the Island, approximately 113 km from the Project Area. The area of the reserve is approximately 6.2 km^2. The total registered membership of Miawpukek is 3,063, of which approximately 33% live on reserve. Qalipu was registered as a band under the *Indian Act* in 2011. Although a registered band, Qalipu does not manage any reserve lands. Its members reside within 67 communities across the Island, with the nearest community to the Approved Project being Buchans (straight line distance) located 49 km to the mine site (direct route) and the nearest community by road being Millertown. Qalipu maintains satellite administrative offices in Glenwood, Grand Falls-Windsor, Stephenville, and St. George's, with a head office in Corner Brook. Qalipu currently has approximately 22,000 members.

The Miawpukek First Nation conducted a Mi'kmaq Knowledge, Land Use and Occupancy Study for the Approved Project in March 2022. The study included two primary forms of data collection: a map biography and an oral history interview with participants. The Study Area included a 50-km buffer from Approved Project infrastructure and a 30-km buffer from linear features. 432 sites of historic and current land use, ecological knowledge and occupancy were identified and 127 were mapped. The conclusions indicate that there is some land and resource use in the Study Area, but that much of Miawpukek's modern-day land use is concentrated in the area of their Conne River settlement.

4.2 POTENTIAL RESOURCE CONFLICTS

A detailed land and resource use assessment was completed as part of the Valentine Gold EIS for the Approved Project (Chapter 16, Marathon 2020) within the RAA, which extended 35 km around the Project Area. The Project Area, Local Assessment Area (LAA) and Regional Assessment Area (RAA) for the Project Expansion are the same as those for the Approved Project and Project Expansion activities are also consistent with the Approved Project, so the previous land and resource use assessment is considered applicable to the Project Expansion. The Valentine Gold EIS analysis considered whether the Approved Project would result in changes in land, resource, or recreational use in the Project Area, LAA and/or RAA (Figure 4-1).

4.2.1 Changes in Land Use

The development of the Project Expansion will not result in an increase in annual mine production for the mine site, however a small increase in traffic on the access road is anticipated (approximately a 5-8% increase in truck traffic). Development of the Berry deposit is essentially replacing the reduced reserve estimates from those described in the Valentine Gold EIS for the Marathon deposit.

With respect to changes in land use, the Valentine Gold EIS concluded that, with the implementation of mitigation measures, residual effects from the Approved Project were anticipated to be low in magnitude (i.e., a small, measurable change in land and resource use capacity), and land use activities could continue to occur at or near current levels (Marathon 2020). This analysis is also applicable to the Project Expansion. No Project Expansion-related changes in land use are expected to occur within the Project Area from the direct loss of area accessible to land and resource users, as this loss was assumed in the Valentine Gold EIS and, as such, no discernable changes are expected from the Approved Project. Changes in the LAA such as indirect sensory disturbances as a result of the Project Expansion are also unlikely to be discernable from those of the Approved Project.

There is a change in the duration of effects on land use in the LAA, as a result of the Project Expansion extending the overall life of mine by 1.4 years.

As with the Approved Project, during construction and decommissioning, residual effects are expected to be short-term and irregular in frequency; during operation, residual effects are expected to be medium-term (permanent for visual) and continuous in frequency. The residual effects will be reversible upon Project Expansion rehabilitation, with the exception of the visual disturbance associated with the waste rock pile, which will be irreversible. Land use within the RAA is considered resilient as it has a moderate to high capacity to recover from disturbance, including predicted effects from the Project Expansion.

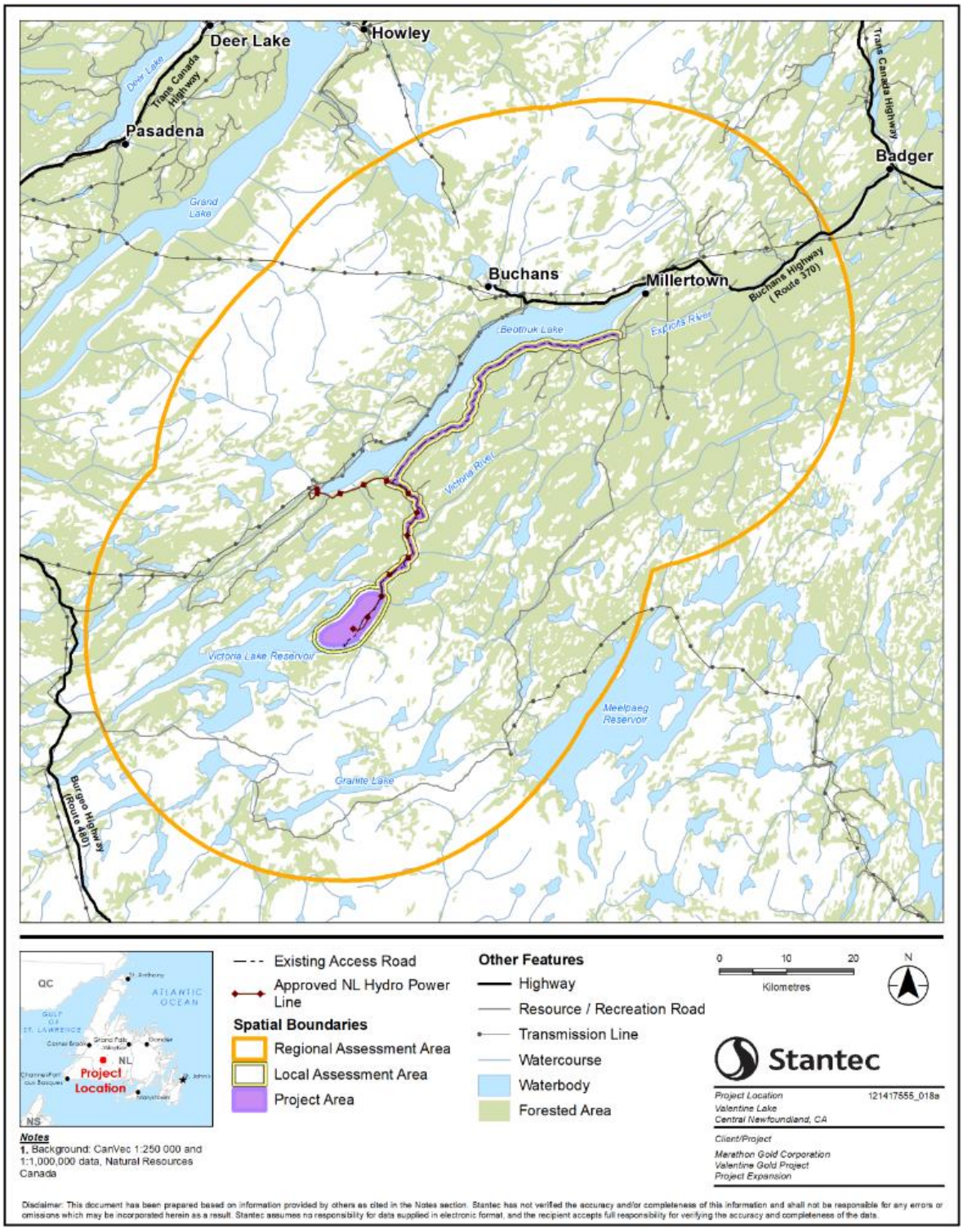

Figure 4-1 Project Area, LAA and RAA in the Consideration of Potential Resource Conflicts

4.2.2 Changes in Resource Use

With respect to changes in resource use, the Valentine Gold EIS concluded that, with the implementation of mitigation measures, residual effects from the Approved Project were anticipated to be negligible to low in magnitude. The Approved Project and Project Expansion are located in a remote area with low levels of resource use (Marathon 2020). This analysis is also applicable to the Project Expansion. No changes in effects on resource use due to Project Expansion are expected to occur within the Project Area from the direct loss of area, as this loss was assumed in the Valentine Gold EIS and, as such, no discernable additional changes are expected from the Approved Project. Changes in the LAA as a result of the Project Expansion, such as indirect sensory disturbances, are also not likely to be discernable from those of the Approved Project.

The Approved Project was predicted to have residual effects during construction and decommissioning that were expected to be short term and irregular in frequency, and to be medium-term (permanent for visual) and continuous in frequency during operation. The removal of forest land from the commercial forest area was predicted to potentially affect the determination of annual allowable cut levels. This was considered to be an adverse effect that would be continuous and occur over the medium term because the affected forest land would remain deforested for the duration of the Approved Project. The residual effects were predicted to be reversible upon Approved Project rehabilitation, with the exception of the visual disturbance associated with the waste rock pile, which will be irreversible. Resource use within the RAA was considered resilient as it has a moderate to high capacity to recover from disturbance, including from Approved Project-related effects. This analysis is also applicable to the Project Expansion.

4.2.3 Changes in Recreational Use

With respect to changes in recreational use, the Valentine Gold EIS concluded that, with the implementation of mitigation measures, the magnitude of residual effects from the Approved Project on change in recreational use are anticipated to be negligible (i.e., no measurable change in current land and resource use capacity) to low (i.e., a small, measurable change in land and resource use capacity, although activities can take place at or near current levels). The Approved Project and Project Expansion are located in a remote area with low levels of existing recreational use, and alternative areas are available outside of the Project Area to support these activities.

Updated noise and air quality modeling was completed for the Project Expansion. Given that the expansion activities and the activities associated with the Approved Project are so closely interrelated with respect to emissions, the updated modeling combined both Projects. Results indicate there are no appreciable changes in noise levels or air quality from those presented in the Valentine Gold EIS (Chapter 6). Therefore, noise and dust effects to nearby users are anticipated to be below regulatory thresholds.

No changes in effects on recreational use due to the Project Expansion are expected to occur within the Project Area from the direct loss of area, as this loss was assumed in the Valentine Gold EIS and, as such, no discernable changes are expected from the Approved Project. Changes in the LAA as a result of

the Project Expansion, such as indirect sensory disturbances, are also not likely to be discernable from those of the Approved Project.

As with the Approved Project, residual effects during construction and decommissioning are expected to be short term and irregular in frequency, and medium term (permanent for visual) and continuous in frequency during operation. The residual effects will be reversible upon Project Expansion rehabilitation, with the exception of the visual disturbance associated with the waste rock pile, which will be irreversible. Recreational use within the RAA is considered resilient as it has a moderate to high capacity to recover from disturbance, including from predicted Project Expansion-related effects.

4.2.4 Summary of Expected Changes to Land, Resource and Recreational Use

Development of the Berry deposit will occur almost entirely within the Project Area assessed in the Valentine Gold EIS, an area that was conservatively assumed to be 100% lost. As such, Marathon predicts that the Project Expansion will result in minimal incremental adverse effects from those assessed in the Valentine Gold EIS for the Approved Project. A summary of expected changes to land, resource and recreational use as a result of the Project Expansion follows.

- In the Valentine Gold EIS, the Project Area was assumed to be 100% lost as a result of the Approved Project; therefore, incremental additional effects from the Project Expansion on change to land use, resource use, and recreational use are predicted to be negligible to low.
- During operation, there will be no additional loss of access to land or resources (i.e., through loss of natural habitats within the Project Expansion footprint) beyond those already primarily incurred during Approved Project construction; therefore, interactions with land and resource use with Project Expansion activities during operation are mainly associated with emissions, discharges and wastes (i.e., sound and air emissions [Chapter 6]) as well as topsoil, overburden and rock management (i.e., visual effects). These effects are expected to be consistent with those predicted for the Approved Project.
- Similarly, during Project Expansion decommissioning, there will be no new residual effects on loss of area or access. Interactions during decommissioning are associated with emissions, discharges and wastes, as well as the rehabilitation of land for the end users, which will be consisted with those assessed for the Approved Project.

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5.0 ENVIRONMENTAL EFFECTS ASSESSMENT METHODS AND APPROACH

5.1 SCOPE OF THE PROJECT EXPANSION TO BE ASSESSED

5.1.1 Scope of the Project Expansion

The scope of the Project Expansion to be assessed in this Environmental Registration / EA Update includes the components and activities described in Chapter 2, including the key activities associated with each phase of the Project Expansion (i.e., construction, operation, and decommissioning, rehabilitation and closure). Note that the Project Area for the Project Expansion is the same as that for the Approved Project, i.e., the mine site and access road.

5.1.2 Selection of Valued Components

The approach to identifying valued components (VCs) for the Project Expansion considered VCs selected for the Valentine Gold EIS and the VC's role in the ecosystem, the value placed on it by humans including those using the area, and the functional relationships within the environment. They were also selected in consideration of the limited nature of Project Expansion activities and the potential for interactions with the VCs identified for the Approved Project. Table 5.1 identifies the VCs considered in the Approved Project and the rationale for their selection or exclusion in the assessment of Project Expansion-related effects. In addition to the five VCs selected for assessment, summary chapters have been prepared for the socioeconomic VCs and other terrestrial VCs assessed in the Valentine Gold EIS to verify that the Project Expansion will not change the effects assessment or mitigation measures presented in the Valentine Gold EIS. A rationale for presenting these summaries is also presented in Table 5.1.

Table 5.1 Valued Components

Valued Component	Valentine Gold EIS Reference	Rationale	EA Registration Document Reference
Atmospheric Environment	Chapter 5	The Project Expansion is anticipated to result in changes to the atmospheric environment as well as require updates to modelling completed for the Valentine Gold EIS. An assessment of the Atmospheric Environment VC is provided in this document.	Chapter 6 Atmospheric Environment VC
Groundwater Resources	Chapter 6	The Project Expansion is anticipated to result in changes to groundwater resources as well as require updates to modelling completed for the Valentine Gold EIS (updated static model and new transient groundwater model and report). An assessment of the Groundwater Resources VC is provided in this document.	Chapter 7 Groundwater Resources VC
Surface Water Resources	Chapter 7	The Project Expansion is anticipated to result in changes to surface water resources as well as require updates to modelling and studies completed for the Valentine Gold EIS (water quality model, water balance, assimilative capacity, water management plan). An assessment of the Surface Water Resources VC is provided in this document.	Chapter 8 Surface Water Resources VC
Fish and Fish Habitat	Chapter 8	The Project Expansion is anticipated to result in changes to fish and fish habitat as well as require updates to surface water modelling completed for the Valentine Gold EIS. An assessment of Fish and Fish Habitat VC is provided in this document.	Chapter 9 Fish and Fish Habitat VC
Vegetation, Wetlands, Terrain and Soils	Chapter 9	The Valentine Gold EIS was prepared using a conservative approach that assumed all habitat within the mine site would be lost as a result of Project activities. This approach allows for refinements to the site layout, as these typically occur through detailed Project design and planning. Therefore, the majority of the loss of habitat associated with the Project Expansion was already largely assessed within the Valentine Gold EIS. Although vegetation, wetlands, terrain and soils is not considered a VC in this document, a summary of Project Expansion-related environmental effects, and mitigation and management measures related to these components is provided in Chapter 11, Other Terrestrial Components.	Chapter 11 Other Terrestrial Components

Table 5.1 Valued Components

Valued Component	Valentine Gold EIS Reference	Rationale	EA Registration Document Reference
Avifauna	Chapter 10	The Valentine Gold EIS was prepared using a conservative approach that assumed all habitat within the mine site would be lost as a result of Project activities. This approach allows for refinements to the site layout, as these typically occur through detailed Project design and planning. Therefore, the majority of the loss of habitat associated with the Project Expansion was already largely assessed within the Valentine Gold EIS. Marathon is planning to replace the polishing pond, previously described in the Valentine Gold EIS, with a submerged attached growth reactor (SAGR®) unit. Removal of the polishing pond will also reduce or eliminate opportunities for birds to congregate at the processing site. With the application of mitigation measures described in the Valentine Gold EIS, the number of direct mortalities resulting from the Project Expansion is expected to be small relative to existing sources of mortality within the RAA. The Project Expansion is not anticipated to result in a substantial change to mortality risk. Although not considered a VC in this document, a summary of Project Expansion-related environmental effects and mitigation and management measures related to avifauna is provided in Chapter 11, Other Terrestrial Components.	Chapter 11 Other Terrestrial Components
Caribou	Chapter 11	The Project Expansion is anticipated to result in changes to caribou and their habitat as well as require updates to modelling completed for the Valentine Gold EIS. Since completion of the EIS, additional animals have been collared and three models were updated that included more data than was available in previous models. An assessment of the Caribou VC is provided in this document.	Chapter 10 Caribou VC

Table 5.1 Valued Components

Valued Component	Valentine Gold EIS Reference	Rationale	EA Registration Document Reference
Other Wildlife	Chapter 12	The Valentine Gold EIS was prepared using a conservative approach that assumed all habitat within the mine site would be lost as a result of Project activities. This approach allows for refinements to the site layout, as these typically occur through detailed Project design and planning. Therefore, the loss of habitat associated with the Project Expansion was already largely assessed within the Valentine Gold EIS. With the application of mitigation measures described in the Valentine Gold EIS, the number of direct wildlife mortalities resulting from the Project Expansion is expected to be small relative to existing sources of mortality within the RAA. The Project Expansion is not anticipated to result in a substantial change to mortality risk for wildlife. Although not considered a VC in this document, a summary of Project Expansion-related environmental effects and mitigation and management measures relevant for wildlife is provided in Chapter 11, Other Terrestrial Components.	Chapter 11 Other Terrestrial Components
Community Services and Infrastructure	Chapter 13	The Project Expansion will result in an approximately 20% increase in operation mining personnel from that assessed in the Valentine Gold EIS. Despite this increase, it is not predicted that there will be an increase in demand for local housing, temporary accommodations, or local services and infrastructure. Although not considered a VC in this document, a summary of Project Expansion-related environmental effects and mitigation and management measures related to community services and infrastructure is provided in Chapter 12, Socio-Economic Components.	Chapter 12 Socio-Economic Components
Community Health	Chapter 14	Modelling that supports the community health assessment (i.e., air quality, noise, groundwater, and surface water components) has been updated for the Project Expansion. Although not considered a VC in this document, updated information has been reviewed and the assessment of the Community Health VC is discussed in Chapter 12, Socio-Economic Components.	Chapter 12 Socio-Economic Components
Employment and Economy	Chapter 15	The Project Expansion will result in an approximately 20% increase in operation mining personnel from that assessed in the Valentine Gold EIS. Despite this increase, it is not predicted that there will be a change in regional labour force, regional business, economic activities of outfitters, or economy. Although not considered a VC in this document, a summary of Project Expansion-related environmental effects and mitigation and management measures related to employment and economy is provided in Chapter 12, Socio-Economic Components.	Chapter 12 Socio-Economic Components

Table 5.1 Valued Components

Valued Component	Valentine Gold EIS Reference	Rationale	EA Registration Document Reference
Land and Resource Use	Chapter 16	The Valentine Gold EIS was prepared using a conservative approach and assumed that public access to the mine site would be lost because of Project activities. This approach allows for refinements to the site layout, as these typically occur through detailed Project design and planning. The loss or alteration of public access associated with the Project Expansion was already largely assessed within the Valentine Gold EIS. Sensory disturbances (i.e., noise, dust, visual) may result in minor changes from those predicted in the Valentine Gold EIS, and updated modelling of noise, dust and other emissions is provided in Chapter 6 – Atmospheric Environment. Although not considered a VC in this document, a summary of Project Expansion-related environmental effects and mitigation and management measures related to land and resource use is provided in Chapter 12, Socio-Economic Components.	Chapter 12 Socio-Economic Components
Indigenous Groups	Chapter 17	The Valentine Gold EIS was prepared using a conservative approach and assumed that public access to the mine site would be lost because of Project activities. This approach allows for refinements to the site layout, as these typically occur through detailed Project design and planning. The loss or alteration of public access associated with the Project Expansion was already largely assessed within the Valentine Gold EIS. Sensory disturbances (i.e., noise, dust, visual) may result in minor changes from those predicted for the Valentine Gold EIS, and updated modelling is provided in Chapter 6 of this document, the Atmospheric Environment VC. Modelling that supports the human health assessment for Indigenous Groups (i.e., air quality, noise, groundwater, and surface water components) has also been updated for the Project Expansion. Although not considered a VC in this document, updated information has been reviewed and a summary of Project Expansion-related environmental effects and mitigation and management measures relevant for Indigenous groups is provided in Chapter 12, Socio-Economic Components.	Chapter 12 Socio-Economic Components

Table 5.1 Valued Components

Valued Component	Valentine Gold EIS Reference	Rationale	EA Registration Document Reference
Historic Resources	Chapter 18	As noted in the Valentine Gold EIS, there are no known registered archaeological sites within the Approved Project Area and the location of the Project Expansion does not overlap with any identified areas of archaeological potential (Section 18.2.3.4 Valentine Gold EIS). Therefore, the Project Expansion does not result in changes to the characterization of residual adverse effects, proposed mitigation measures, or overall conclusions described in the Valentine Gold EIS for this VC.	NA - Not assessed further. However, Marathon has a Heritage and Cultural Resources Protection Plan, a component of the site-wide EPP, in place should heritage or cultural resources be found.
Dam Infrastructure	Chapter 19	The addition of the Project Expansion is not anticipated to result in changes to the Victoria Lake Reservoir or the Victoria Dam, nor is it expected to result in a change in dam stability for the Victoria Dam. The explosives facility will be located at the location of the former exploration camp. To confirm there will be no adverse effects to the Victoria Dam from blasting associated with the Project Expansion or location of the explosives facility, DynoConsult (Appendix 2D) and Terrane Geoscience (Appendix 2C) completed assessments on the new location and potential impacts to the dam. Both reports concluded no adverse effects as a result of the location change or directly to the dam. This is further discussed in Chapter 13 in relation to accidental events.	NA - Although not assessed further in this document, Marathon has attached a blast assessment report from DynoConsult andTerrane Geoscience (Appendices 2D and 2C).

5.1.3 Spatial and Temporal Boundaries

The methodology for defining the spatial boundaries for the effects assessment parallels that used in the Valentine Gold EIS. The spatial boundaries were selected based on the geographic extent of the measurable potential environmental, social, heritage and human effects of the Project Expansion (Table 5.2). The spatial boundaries defined for the five VCs and the two summary chapters (Chapters 11 and 12) identified for the Project Expansion are as follows:

- The Project Area encompasses the immediate area in which Approved Project and Project Expansion activities occur and is the same for all the VCs and components considered in this document.
- The Local Assessment Area (LAA) encompasses the area in which Approved Project and Project Expansion-related environmental effects (direct or indirect) can be predicted or measured for assessment. The LAA, which is specific to each VC or component, encompasses the Project Area and is selected in consideration of the geographic extent of effects on the given VC or component. Figure 5-1 shows LAAs for VCs and other components.
- The Regional Assessment Area (RAA) is the area established for context in the determination of significance of Approved Project and Project Expansion-specific effects and informs the assessment of cumulative effects. The RAA is VC specific and encompasses both the Project Area and the LAA (Figure 5-2).

Each of these spatial assessment boundaries is defined in Table 5.2.

Table 5.2 Spatial Assessment Boundaries

Project Area	
The Project Area encompasses the immediate area in which Approved Project and Project Expansion activities and components occur and is comprised of two distinct areas: the mine site and the access road. The mine site includes the area within which Approved Project and Project Expansion infrastructure will be located, and the access road is the existing road to the site, plus a 20-metre (m) wide buffer on either side. The Project Area is the anticipated area of direct physical disturbance associated with the construction, operation and decommissioning, rehabilitation and closure of the Approved Project and Project Expansion. For the purposes of the Project Expansion, activities will be limited to the mine site (Figure 5-1).	
Atmospheric Environment	The LAA incorporates a 40 km by 40 km area centered on the mine site plus a 500-m buffer on either side of the access road. This 40 km by 40 km area is the modelling domain used for dispersion modelling, and it includes receptors within and beyond the Project Area. The acoustic modelling, also centered on the mine site, covered a slightly smaller grid domain within the LAA/RAA of 30 km by 30 km.
	The RAA is the same as the LAA.
Groundwater Resources	The LAA is based on the likely extent of drawdown from open pit dewatering, and changes to flow or groundwater quality due to recharge from the tailings management facility (TMF) and waste rock piles. The LAA boundaries are based on the study areas described in the baseline hydrogeology reports presented in the Valentine Gold EIS Baseline Study Appendix 3: Water Resources (BSA.3) and results of groundwater flow modelling presented in Appendix 6A of the Valentine Gold EIS.
	The RAA is the same as the LAA.

Table 5.2 Spatial Assessment Boundaries

Project Area	
Surface Water Resource	The LAA incorporates the Project Area and watersheds that intersect with the Project Area and also includes portions of Victoria Lake Reservoir in the expected effluent mixing zones, which are typically considered to be up to several hundred metres from points of discharge in the lake. The LAA includes Valentine Lake and Victoria River to the point downstream where Project-affected tributaries converge with the main branch of the river and the Project access road extending from the Exploits River Crossing to the Project Area. It also includes a 250-m buffer on either side of the access road.
	The RAA incorporates the Project Area and LAA and extends to include where potential Project interactions may be observed. This is considered to include Valentine Lake, a portion of Victoria Lake Reservoir, Victoria River, and Beothuk Lake, including its discharge at the head of the Exploits River. This area encompasses the potential downstream receivers of surface water that may flow from the Project Area.
Fish and Fish Habitat	The LAA incorporates the Project Area and watersheds that intersect with the Project Area and includes portions of Victoria Lake Reservoir in the expected effluent mixing zones, which are typically considered to be up to several hundred metres from points of discharge in the lake. The LAA includes Valentine Lake and Victoria River to the point downstream where tributaries potentially affected by the Approved Project and Project Expansion converge with the main branch of the river. It also includes a 250-m buffer on either side of the access road.
	The RAA incorporates the Project Area and LAA and extends to include where potential Project interactions may be observed. This is considered to include Valentine Lake, a portion of Victoria Lake Reservoir, Victoria River, and Beothuk Lake, including its discharge at the head of the Exploits River. This area encompasses the potential downstream receivers of surface water that may flow from the Project Area.
Caribou	The LAA incorporates the Project Area plus a 1-km buffer surrounding the mine site and a 250-m buffer on either side of the access road.
	The RAA incorporates the combined population ranges (28,809 km^2) of the Buchans, Gaff Topsails, Grey River, and La Poile herds as determined by caribou telemetry data obtained from the NL Department of Fisheries, Forestry and Agriculture – Wildlife Division (NLDFFA-WD).
Other Terrestrial Components • Other Wildlife • Avifauna • Vegetation, Wetlands, Terrain and Soils	The LAA incorporates the Project Area plus a 1 km-buffer surrounding the mine site and a 250-m buffer on either side of the access road. The RAA incorporates the Project Area and the LAA, plus a 35-km buffer surrounding the Project Area encompassing Victoria River and Beothuk Lake, as well as the communities of Millertown, Buchans, and Buchans Junction.
Socio-economic Components	
• Community Services and Infrastructure • Community Health	The LAA/RAA includes those communities that may see increased demands from Project activities and construction and operation workforce, including Grand Falls-Windsor, Badger, Buchans, Buchans Junction, Bishop's Falls, and Millertown.

Table 5.2 Spatial Assessment Boundaries

Project Area	
• Employment and Economy	The LAA incorporates the Project Area and the following communities: Appleton, Badger, Bishop's Falls, Botwood, Buchans, Gander, Glenwood, Grand-Falls Windsor, Millertown, Norris Arm, Northern Arm, Peterview, as well as unorganized CD No. 6 Census Subdivisions (CSDs) A (which includes the Designated Place of Buchans Junction), C, D and E. The RAA for employment and economy is the Province of NL.
• Land and Resource Use	The LAA incorporates the Project Area plus a 1-km buffer surrounding the mine site and a 250-m buffer on either side of the access road. The RAA is comprised of a 35-km buffer surrounding the Project Area, encompassing Victoria River and Beothuk Lake, as well as the communities of Millertown, Buchans and Buchans Junction.
• Indigenous Groups	The LAA incorporates a 40km by 40 km area centered on the mine site plus a 250-m buffer on either side of the access road. This has been selected to capture the area where effects on current use are likely to be most prevalent (e.g., effects to harvested species and country foods, and sensory disturbance effects to nearby Indigenous land users). This LAA was selected to align with the assessment of the Atmospheric Environment VC (representing the largest area of sensory disturbance). The RAA encompasses the largest extent of the RAAs of the various VCs identified in this document to capture relevant potential effects.

Temporal boundaries for the effects assessment address the potential effects during the Project Expansion's construction, operation, and decommissioning, rehabilitation and closure phases over applicable timescales. The overall Project Expansion schedule is presented in Tables 2.2 and 2.3.

The temporal boundaries for the Project Expansion consist of the following phases:

- Construction Phase – four to six months, beginning in Q3 2024
- Operation Phase – Estimated nine-year operation life (2025-2033), with commissioning / start-up and mine / mill operation slated to start Q4 2025
- Decommissioning, Rehabilitation and Closure Phase – Closure rehabilitation to occur once it is no longer economical to mine or when resources are exhausted

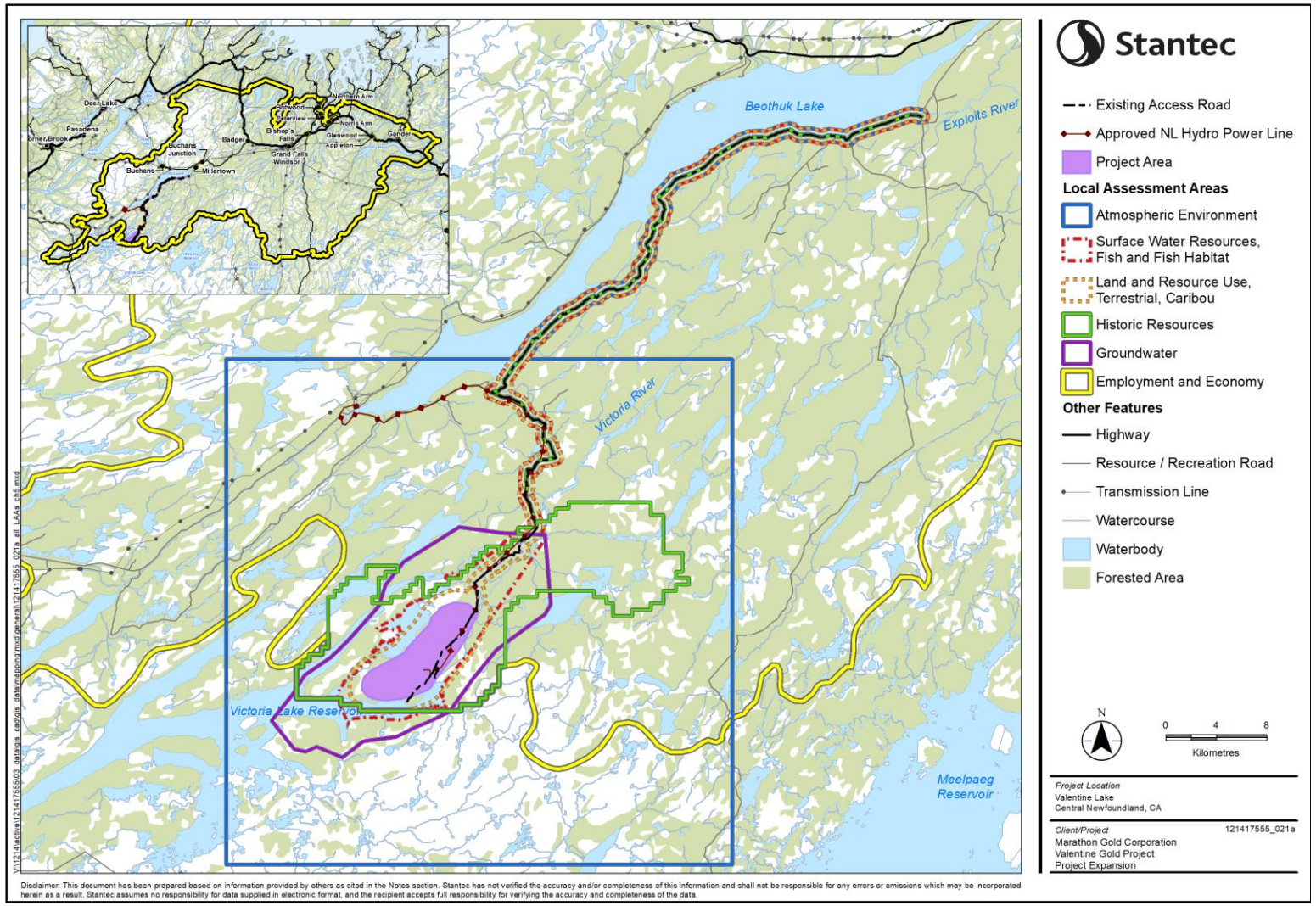

Figure 5-1 Combined LAAs for the Approved Project and Project Expansion

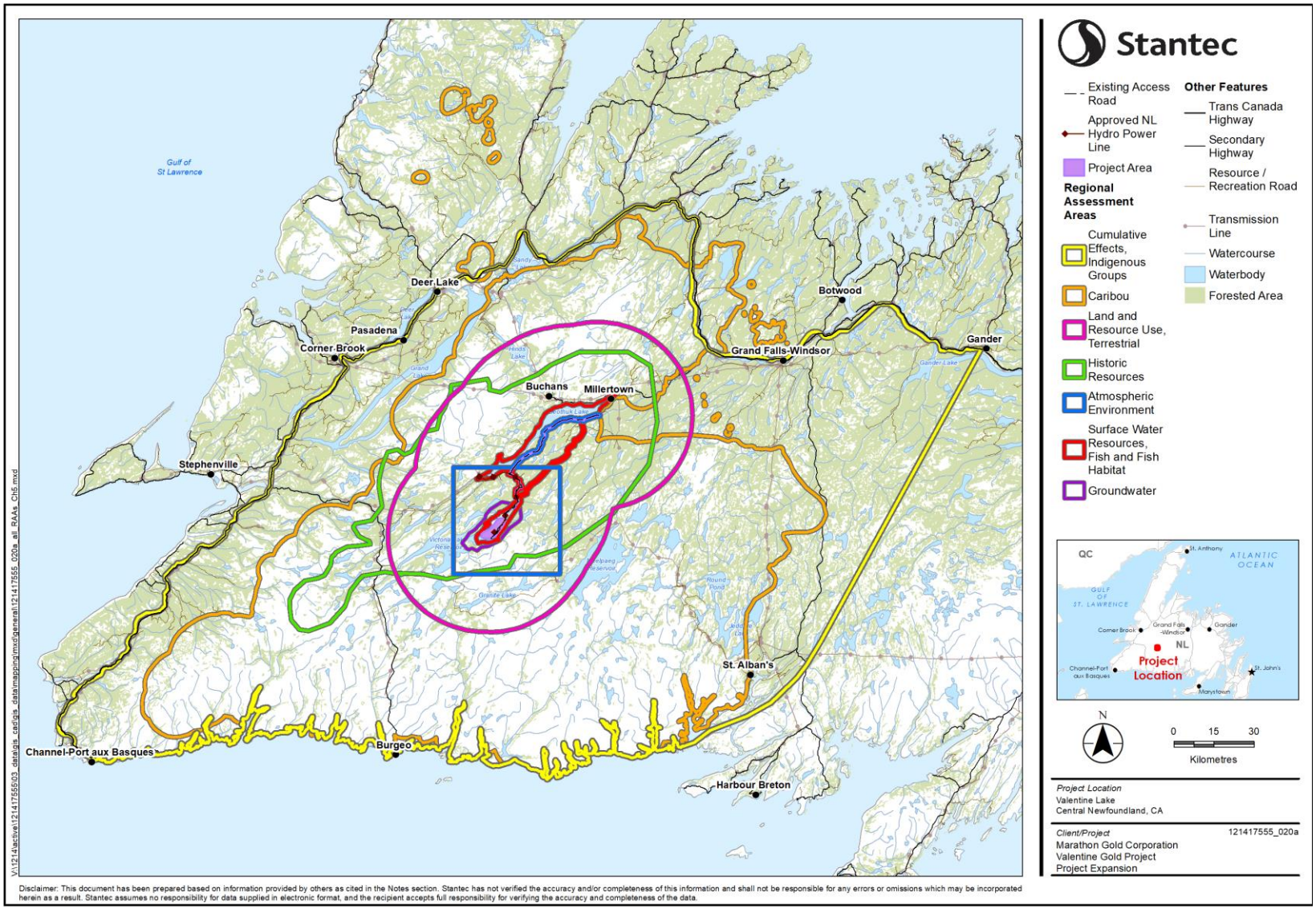

Figure 5-2 Combined RAAs for the Approved Project and Project Expansion

5.1.4 Regulatory and Policy Setting

Federal approval of the Approved Project was subject to EA Conditions of Release issued by the Impact Assessment Agency of Canada (IAAC). EA Conditions 2.16 and 2.17 of the Decision Statement for the Approved Project require Marathon to notify IAAC of proposed changes to the Approved Project, including a description of the proposed change(s), the environmental effects that may results from the change(s), modified or additional mitigation measures required to reduce adverse effects from the change(s), modified or additional follow-up requirements, and an explanation of how results may differ from the environmental effects predicted in the Valentine Gold EIS. Further information on federal EA requirements in relation to the Project Expansion are included in Section 1.4.1. Upon receipt and review of this Environmental Registration / EA Update, IAAC will be able to determine whether the Project Expansion is considered a change to a designated project (i.e., a change to the Approved Project).

The NL EA Division considers the Project Expansion to be an undertaking as per the NL *Environmental Assessment Regulations (s.33(1)(2)*. Further information on provincial EA requirements in relation to the Project Expansion are included in Section 1.4.2. The federal requirements generally align with NL information requirements for the registration of an undertaking, hence the submission of a single document to fulfill both regulatory requirements.

Prior to submission of this Environmental Registration / EA Update, Marathon engaged with federal and provincial regulators; Qalipu First Nation and Miawpukek First Nation; communities; salmonid associations, the NL Outfitters Association, and other potentially affected stakeholders; and the public. Further information on engagement and feedback received during these engagement efforts is described in Chapter 3.

Various federal and provincial legislation that informs the scope of the assessment are provided in Table 5.3.

Table 5.3 Key Regulatory and Policy Setting

Component Assessed	Regulatory and Policy Setting
Atmospheric Environment	• Air quality in NL is regulated by the *Air Pollution Control Regulation* under the NL EPA. This Regulation and Act provide measures to regulate the release of air contaminants to the atmosphere from “sources”, provide testing and monitoring provisions, and establish maximum permissible ground-level concentrations of specified air contaminants in ambient air, among other requirements. The NL Ambient Air Quality Standards (NLAAQS) (Government of NL 2004) apply to ambient air and were established under the NL EPA in 2004. • The applicable federal air quality criteria considered in the assessment are the Canadian Ambient Air Quality Standards (CAAQS). The CAAQS were implemented to reduce emissions and ground-level concentrations of various air contaminants nationally. The Canadian Council of Ministers of the Environment (CCME) has endorsed the CAAQS for SO_2, $PM_{2.5}$, ozone (O_3), and NO_2, for the period from 2020 to 2025. • As there are no ambient standards in NL for these select air contaminants, the Ontario Air Contaminant Benchmark (ACB) List will be considered in assessing potential effects.

Table 5.3 Key Regulatory and Policy Setting

Component Assessed	Regulatory and Policy Setting
Groundwater Resources	• The Metal and Diamond Mining Effluent Regulations (MDMER), pursuant to the federal *Fisheries Act*, sets allowable discharge limits for specific metals as sampled by a prescribed schedule (see further detail below under Surface Water Resources). • The *Water Resources Act* gives the Water Resource Management Division (WRMD) of the NL Department of Environment and Climate Change (NLDECC) the responsibility and legislative power for the management of water resources in the province. • The *Environmental Control Water and Sewer Regulations*, under the *Water Resources Act*, which incorporate the allowable limits set by MDMER, will also apply to discharge of water and effluent from the Project Expansion.
Surface Water Resources	• The federal *Fisheries Act* (sections 32, 35 and 36) protects fish and fish habitat and prohibits the alteration, disruption or destruction of fish habitat, death of fish (by means other than fishing), and deposition of deleterious substances in all watercourses that are fish bearing (see further detail below under Fish and Fish Habitat). • The MDMER, a regulation pursuant to the *Fisheries Act*, provides exemptions to the general prohibition against depositing deleterious substances. MDMER sets out the maximum allowable limits for specific metals and other parameter concentrations in discharge resulting from the Project Expansion. MDMER also sets forth a variety of effluent monitoring requirements, as well as the Environmental Effects Monitoring (EEM) criteria to be implemented and reported on during the operational phase of the Project. MDMER limits for new metal and diamond mines (effective June 1, 2021) from Table 1 of Schedule 4 were used in this assessment. • Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL), 1999. CWQG-FAL provide limits for contaminants in water and are intended to maintain, improve, and/or protect environmental quality and human and ecological health for a variety of chemical parameters. The CWQG-FAL are applicable for freshwater at the site. • A Certificate of Approval (CoA) is issued by the Pollution Prevention Division of NLDECC for the construction phase and for the operation phase, and sets concentration limits for specific parameters in the discharge effluent. These limits are typically similar to those specified in MDMER. CoAs will be required for the construction and operation phases of the Project Expansion. • The *Water Resources Act* gives WRMD of NLDECC the responsibility for the management of water resources in the province. The *Environmental Control Water and Sewage Regulations* pursuant to the *Water Resources Act* regulate the discharge of sewage and other effluent. Schedule C of the regulation also specifies that the metal mining industry shall comply with MDMER.
Fish and Fish Habitat	• The federal *Fisheries Act,* sections 34.4(1) and 34.4(2)b, are applicable to the Project Expansion and are administered by Fisheries and Oceans Canada (DFO). The *Fisheries Act* includes prohibitions against works, undertakings or activities that result in the harmful alteration, disruption or destruction (HADD) of fish habitat (section 35(1)). Works can be approved by and carried on in accordance with conditions established by the Minister of Fisheries, Oceans and the Canadian Coast Guard (Fisheries Minister) (section 35(2)(b)). Some provisions such as s.36(3) and (4) are administered by Environment and Climate Change Canada (ECCC). The *Metal and Diamond Mining Effluent Regulations* pursuant to the *Fisheries Act* regulate the deposit of deleterious mine effluents, tailings and waste rock into waters frequented by fish, as authorized by ECCC.

Table 5.3 Key Regulatory and Policy Setting

Component Assessed	Regulatory and Policy Setting
	• The federal *Species at Risk Act* (SARA) provides protection for species at risk (SAR) in Canada, including aquatic species (see further detail below under Other Terrestrial Components). • Provincially, the NL EPA, the NL *Water Resources Act*, and the NL *Endangered Species Act* (NL ESA) are also applicable. • A CoA under the NL EPA sets concentration limits for specific parameters in the discharge effluent. These limits are typically in line with those set in the MDMER and in the NL *Environmental Control Water and Sewer Regulations*, 2003.
Caribou	• The RAA overlaps with Gros Morne National Park; federal legislation pertaining to the protection of wildlife and their habitat in the RAA include the *Canada National Parks Act* and *National Parks General Regulations.* • The NL *Wild Life Act,* RSNL 1990, c W-8, and *Wild Life Regulations*, NLR 1156/1996 and associated orders afford protection of wildlife (including caribou) and prohibits the hunting, taking or killing of wildlife or classes of wildlife, whether in particular places or at particular times or by particular methods, except under license or permit. The *Wild Life Act* allows for the management and the regulation of activities relating to the taking and trading of wildlife, primarily game animals and furbearer species. • Other provincial legislation, regulations, strategies, and management plans pertaining to the protection of wildlife and their habitat in the RAA can be found in section 11.1.1.2 of the Valentine Gold EIS.
Other Terrestrial Components • Other Wildlife • Avifauna • Vegetation, Soils and Terrain	• The *Species at Risk Act* (SARA) provides protection for SAR in Canada. The legislation provides a framework to facilitate recovery of species listed as Threatened, Endangered or Extirpated and to prevent species listed as Special Concern from becoming Threatened or Endangered. • The NL *Endangered Species Act* (NL ESA) provides protection to Endangered, Threatened or Vulnerable plant and animal species in NL. The Act facilitates the development of management plans and recovery strategies for Vulnerable, Threatened, Endangered, and Extirpated or Extinct species to prevent further declines and promote recovery. • On lands under provincial jurisdiction, federal SARA goals are typically reflected through provincial legislation, policy and guidelines. • *Little Grand Lake Provisional Ecological Reserve Regulations* • *Little Grand Lake Wild Life Reserve Regulations* • *Forestry Act* • 2015-2020 Newfoundland and Labrador Moose Management Plan (Government of Newfoundland and Labrador [NL] 2015) • Recovery Plan for the Threatened Newfoundland population of American marten *(Martes americana atrata*) (The Newfoundland Marten Recovery Team 2010) • Provincial Sustainable Forest Management Strategy 2014-2024 (Government of Newfoundland and Labrador [NL] 2014) • Sustainable Forest Management Planning Regulations, NLR 61/13 • The Federal Policy on Wetland Conservation (Government of Canada 1991) provides a federal mandate for wetland conservation. • The Newfoundland and Labrador Policy for Development in Wetlands (NLMAE 2001) describes developments that are not permitted within wetlands and defines activities that require permitting under section 48 of the *Water Resources Act*.
Socio-economic Components	• The provincial and federal regulatory requirements relevant to air and sound emissions and discharges to surface water from the Project (and thus relevant to community health) are described in Chapters 6 (Atmospheric Environment) and 7 (Surface Water Resources), respectively.

Table 5.3 Key Regulatory and Policy Setting

Component Assessed	Regulatory and Policy Setting
Socio-economic Components	• Applicable federal legislation related to land and resource use includes the *Canadian Navigable Waters Act* (CNWA). Under the CNWA, a navigable water is defined as a body of water where there is a reasonable likelihood that it will be used by vessels for any part of the year as a means of transport or travel for recreational or commercial purposes or for Indigenous peoples of Canada exercising their rights. However, it is not anticipated that Approved Project or Project Expansion features would result in a change to navigation within Valentine Lake or Victoria Lake Reservoir. Road crossings along the access road have culverts / bridges currently and upgrades to the access road are not anticipated to result in changes to navigation. Ponds located on the mine site are considered small and unnavigable. • NL *Forestry Act* – A cutting permit is required for cutting or removal of trees on forest lands or for activities that are likely to cause a wildfire. • NL *Fisheries Act* and Fishery Regulations – Fishery regulations specified under the *Fisheries Act* govern daily and yearly quotas, possession limits and length limit for species fished in the inland and tidal waters. • *Urban and Rural Planning Act* – while the Project Area does not overlap with areas regulated under this Act, nearby communities within the RAA are subject to these regulations. • NL *Wild Life Act* – This Act governs the establishment of hunting zones and regulations regarding seasons. The *Wild Life Act* includes regulations and orders pertaining to hunters and trappers who hold a valid licence and is the regulatory basis for the Newfoundland and Labrador Hunting and Trapping Guide. • Buchans, Millertown and Buchans Junction are within the RAA and regulated under the *Urban and Rural Planning Act, 2000*. • The NL Aboriginal Consultation Policy on Land and Resource Development Decisions (Government of NL 2013) • Aboriginal Consultation and Accommodation - Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (Aboriginal Affairs and Northern Development Canada 2011) • Reference Guide: Considering Aboriginal Traditional Knowledge in Environmental Assessments Conducted Under the *Canadian Environmental Assessment Act*, 2012 (CEA Agency 2015a) • Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archaeological, Paleontological or Architectural Significance under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2015b) • Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act,* 2012 (CEA Agency 2016) • Guidance for Evaluating Human Health Impacts in Environmental Assessment: Human Health Risk Assessment (Health Canada 2019a) • Guidance for Evaluating Human Health Impacts in Environmental Assessment: Country Foods (Health Canada 2018) • Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (Health Canada 2017) • Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality (Health Canada 2016a) • Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality (Health Canada 2016b)

5.2 ENVIRONMENTAL ASSESSMENT METHODS

In this document, Project Expansion-related environmental effects are assessed for each VC during each phase of the Project Expansion (i.e., construction, operation and maintenance, and decommissioning, rehabilitation and closure), with the focus on prediction of residual environmental effects (i.e., the environmental effects that remain after the implementation of planned mitigation measures). For this Environmental Registration / EA Update, the assessment also considers whether the effects of the Project Expansion, in combination with effects of the Approved Project, change the residual effects prediction made for the Approved Project.

The following subsections describe the methods used to conduct the assessment of potential Project Expansion related effects on each of the selected VCs (as identified in Section 5.1.2).

5.2.1 Description of Existing Environment

The existing environmental conditions are described for each VC, in the specific VC chapters, and are based on established biophysical and socioeconomic baseline studies (i.e., desktop analyses and field programs) conducted in support of the Valentine Gold EIS and this Environmental Registration / EA Update. Information on where to access studies developed as part of the EA for the Approved Project is contained in Table 1.8. Stantec conducted a variety of desktop and field studies to investigate and establish the existing (baseline) environmental conditions and to inform appropriate mitigation. This section summarizes the existing conditions presented for the Approved Project, as well as providing updates to existing conditions based on surveys completed since the Valentine Gold EIS was approved and on newly available public information, where available. While some construction activities have begun at select sites for the Approved Project (as of October 2022), the existing conditions described in Chapters 6-12 of this document refer to pre-construction conditions. This approach has been taken for several reasons:

- The additional surveys that have been conducted and the updated, publicly available data reflect pre-construction conditions
- The conservative assessment approach is to assume that the potential effects of Project Expansion and the potential effects of the Project Expansion in combination with the Approved Project are in consideration of an existing environment undisturbed by construction activities
- Existing conditions within the Project Area and the mine site in particular are changing regularly as construction of the Approved Project advances (and as predicted in the Valentine Gold EIS); therefore, existing conditions reflective of construction activities would be constantly shifting and challenging to characterize in a meaningful way for assessment purposes

5.2.2 Project Expansion Interactions and Pathways

For each VC, potential effects and effect pathways (both direct and indirect) are identified. The measurable parameters and units of measurement used to assess potential effects are also identified. Quantitative measurable parameters are used where possible, while qualitative parameters and units of measurement are used where the nature of the effect or available data does not allow for a quantitative

assessment. Potential environmental effects and measurable parameters have been selected based on the Valentine Gold EIS, which in turn were based on review of recent EAs for mining projects in NL and other parts of Canada, comments provided during public and Indigenous engagement, and professional judgment of the Environmental Registration / EA Report study team.

For each potential effect, the physical activities that might interact with the VC and result in the identified environmental effect are identified (the interactions table template is provided in Table 5.4). A VC-specific interactions table is completed in the respective VC sections. These interactions are indicated by a checkmark and are discussed in detail below the table in each VC chapter, in the context of standard and Project-specific mitigation or enhancement, and effects pathways and residual effects. Components and activities that are not predicted to interact with the VC are also identified and the lack of interaction is explained. Table 5.4 provides a generic list of physical activities that addresses the key physical activities associated with the Project Expansion.

Table 5.4 Template for Project Expansion Environment Interactions with VC

Physical Activities	Environmental Effects to Be Assessed			
	Effect 1	Effect 2	Effect 3	Effect 4
CONSTRUCTION				
Mine Site Preparation and Earthworks: Clearing and cutting of vegetation and removal of organic materials, development of roads, and excavation and preparation of stockpile areas within the Project Expansion footprint. For the open pit, earthworks include stripping, stockpiling of organic and overburden materials, and development of in-pit quarries to supply site development rock for infrastructure such as structural fill and road gravels. Also includes temporary surface water and groundwater management, and the presence of people and equipment on site.				
Construction / Installation of Infrastructure and Equipment: Construction of infrastructure as required for the Project Expansion. Also includes: • Installation of water control structures (including earthworks) • Presence of people and equipment on-site				
Emissions, Discharges and Wastes[A]: Noise, air emissions / GHGs, light, water discharge, and hazardous and non-hazardous wastes.				
OPERATION				
Open Pit Mining: Blasting, excavation and haulage of rock from the open pits using conventional mining equipment.				

Table 5.4 Template for Project Expansion Environment Interactions with VC

Physical Activities	Environmental Effects to Be Assessed			
	Effect 1	**Effect 2**	**Effect 3**	**Effect 4**
,**Topsoil, Overburden and Rock Management**: Four types of piles: • Topsoil • Overburden • Waste rock • Low-grade ore Rock excavated from the open pit that will not be processed for gold will be used as engineered fill for site development, maintenance and rehabilitation, assuming it is non-acid generating, deposited in mined out basins of Berry pit, or deposited in a waste rock pile.				
Tailings Management: Following treating tailings via cyanide destruction, tailings will be thickened and pumped to an engineered tailings impoundment in years 1 to 9, then pumped to the exhausted Berry open pit in year 10 to the end of operation. Marathon plans to upgrade the water treatment process by replacing the proposed polishing pond with a smaller SAGR unit that provides improved treatment of nitrogen species.				
Water Management (Collection, treatment and release)**:** Site contact water and process effluent will be managed on site and treated prior to discharge to the environment. Where possible, non-contact water will be diverted away from mine features and infrastructure, and site contact and process water will be recycled to the extent possible for use on site.				
Utilities, Infrastructure and Other Facilities: Most utilities, infrastructure and facilities remain unchanged, and are as described in the Valentine Gold EIS (Marathon 2020) and assessed as part of the Approved Project. Relocation of the explosives facility, maintenance of Berry haul roads and site snow clearing will be required for the Project Expansion. Note that while the location of the explosives facility has changed, the design and activities associated with the facility have not.				
Emissions, Discharges and Wastes[A]: Noise, air emissions / GHGs, light, water discharge, and hazardous and non-hazardous wastes.				
Employment and Expenditures: Operation of the combined Approved Project and Project Expansion is estimated to require a peak workforce of approximately 524 fulltime equivalents (FTEs) (44 FTEs above the Valentine Gold EIS estimate) and an average of 366 FTEs.				
DECOMMISSIONING, REHABILITATION AND CLOSURE				
Decommissioning of Mine Features and Infrastructure				
Progressive Rehabilitation: Erosion stabilization and re-vegetation of completed overburden and/or waste rock piles; infilling or flooding				

Table 5.4 Template for Project Expansion Environment Interactions with VC

Physical Activities	Environmental Effects to Be Assessed			
	Effect 1	Effect 2	Effect 3	Effect 4
of exhausted mining areas; and completing revegetation studies and trials.				
Closure Rehabilitation: Active rehabilitation based on successes of progressive rehabilitation activities. Includes: grading and revegetating cleared areas, where practicable; breaching and regrading ponds to reestablish drainage patterns; erosion stabilization and revegetation of completed overburden and/or waste rock piles; and infilling or flooding of open pit.				
Post-Closure: Long-term monitoring				
Emissions, Discharges and Waste[A]				

Notes:
✓ = Potential interaction
– = No interaction
[A] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project Expansion activities. Rather than acknowledging this by placing a checkmark against each of these activities, "Wastes and Emissions" is an additional component under each Project Expansion phase.

5.2.3 Mitigation and Management Measures

Technically and economically feasible mitigation measures constituting standard practice are considered in the evaluation of Project Expansion effects. Mitigation can also include VC-specific measures to address VC-specific issues, such as habitat offsetting / compensation, or planned environmental management and response measures. Where applicable, the extent to which technological innovations may help mitigate environmental effects are identified.

The mitigation measures to reduce or control potential environmental effects identified for the Approved Project are provided in Appendix 2E of this document. Additional mitigation and management measures that may be required for the Project Expansion are identified and described in each VC chapter and also included in Appendix 2E.

5.2.4 Assessment of Effects and Characterization of Residual Effects

The effects assessment characterizes the residual environmental effects using the following criteria: direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological or socio-economic context. The general definitions of these criteria are presented and, in some cases, customized in each VC-specific chapter (Table 5.5). For Chapters 11 and 12 that present a summary discussion of terrestrial components and socioeconomic components, respectively, details on the residual effects characterizations are the same as that presented in the Valentine Gold EIS for the individual VCs discussed in these chapters and are found in Appendix 5A. Quantitative measures were developed,

where possible, to characterize residual effects. Qualitative considerations were used where quantitative measurement was not possible.

Table 5.5 Characterization of Residual Effects on [VC or Component Name]

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Neutral –** no net change in measurable parameters for the [VC or Component name] relative to baseline **Positive –** a residual effect that moves measurable parameters in a direction beneficial to [VC or Component name] relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to [VC or Component name] relative to baseline
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible –** no measurable change **Low –** [To be defined by VC or Component] **Moderate –** [To be defined by VC or Component] **High –** [To be defined by VC or Component]
Geographic Extent	The geographic area in which a residual effect occurs	**Project Area –** residual effects are restricted to the Project Area **LAA –** residual effects extend into the LAA **RAA –** residual effects interact with those of other projects in the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable –** seasonal aspects are unlikely to affect [VC or Component] **Applicable –** seasonal aspects may affect [VC or Component]
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period of time required until the measurable parameter or the VC returns to its existing (baseline) condition, or the residual effect can no longer be measured or otherwise perceived	**Short term –** residual effect restricted to no more than the duration of the construction phase (16 to 20 months) or decommissioning, rehabilitation and closure phase **Medium term –** residual effect extends through the operation phase (12 years) **Long term –** residual effect extends beyond the operation phase (greater than 12 years) **Permanent –** recovery to baseline conditions unlikely
Reversibility	Describes whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and rehabilitation **Irreversible –** the residual effect is unlikely to be reversed

Table 5.5 Characterization of Residual Effects on [VC or Component Name]

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

Significance criteria or thresholds are provided in each VC chapter and are consistent with the thresholds presented in the Valentine Gold EIS. Significance criteria or thresholds are used to assess residual environmental effects and to identify the threshold(s) beyond which a residual effect would be considered significant. The thresholds are defined in consideration of federal and provincial regulatory requirements, standards, objectives, or guidelines, and as applicable to the VC. Where thresholds are not set by guidelines or regulations, a threshold is developed using the measurable parameters or qualitative considerations established for the VC, along with professional judgement of the assessors. Thresholds define the acceptable limits of a change via a measurable parameter, or a state of the VC beyond which it would be considered significant. Threshold determinations are also based on resource management objectives, community standards, scientific literature, and / or ecological processes (e.g., desired states for fish or wildlife habitats or populations). Quantitative thresholds are preferred; however, qualitative thresholds for significance may be used where quantitative thresholds are lacking.

5.2.5 Cumulative Effects Assessment

In the Valentine Gold EIS, a comprehensive cumulative effects assessment (CEA), pursuant to federal guidance, was completed for the VCs identified for the Approved Project (Marathon 2020). For the CEA, residual effects that were likely to interact cumulatively with residual environmental effects from other physical activities (past, present and/or reasonably foreseeable) were identified and assessed. The approach used for conducting the CEA was informed by the *Operational Policy Statement for Assessing Cumulative Environmental Effects* under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2016), *Technical Guidance for Assessing Cumulative Environmental Effects* under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2014), and the Federal EIS Guidelines and Provincial EIS Guidelines for the Approved Project. The effects of historic past projects and activities contribute to baseline conditions upon which Approved Project effects were assessed, and this is also applicable to the Project Expansion. For example, environmental conditions prior to the creation of the Victoria Reservoir and the Baie d'Espoir Generating Station in the mid-1960s cannot be considered as baseline given the magnitude of change and the time elapsed since those changes occurred. Nor are environmental conditions prior to historic mining projects in the area considered baseline.

In this document, known new activities occurring in the LAA and RAA (Table 5-6) have been updated since the Approved Project was released from EA processes, and the CEA for the Project Expansion considers the interaction of residual effects from these previously unassessed activities, with residual effects of the combined Approved Project and Project Expansion. The residual effects assessment for each VC includes the combined effects from the Approved Project and the Project Expansion (i.e., the

'cumulative' interactions between effects arising from the Approved Project and the Project Expansion are considered in the individual VC effects assessments). Cumulative effects are therefore described as those resulting from the combined residual effects of the Project Expansion and Approved Project effects in combination with the effects of recent past, current, and reasonably foreseeable future projects and activities.

As with the Approved Project, future projects that are reasonably foreseeable are those that:

- Have obtained the necessary authorizations to proceed or are in the process of obtaining the required authorizations
- Have been publicly announced with the intention to seek the necessary authorizations to proceed

Two conditions must be met to initiate a CEA on a VC:

- The Project Expansion is assessed as having an adverse residual environmental effect on a VC
- The adverse residual effect from the Project Expansion overlaps spatially and temporally with residual effects of other physical activities on a VC

Where one of the two conditions has not been met, a CEA has not been completed.

A project and activity inclusion table (Table 5.6), updated since the Valentine Gold Project was approved, and a georeferenced map (Figure 5-3), show known past, ongoing and reasonably foreseeable future projects and physical activities that could overlap spatially and temporally with the Project Expansion. Figure 5-4 shows the extents of Forest Management Districts 12 and 13 and locations of harvested / planned commercial cutblocks between 2020-2023.

Table 5.6 Ongoing, Past and Likely Future Projects/ Activities Considered in the CEA

Projects/Activities	Description	Distance to Mine (km)	Status for Approved Project (2020)	Status for Project Expansion (2023)
Ongoing or Past Projects /Activities				
Buchans Barite Plant	• Between 1982 and 1984 Asarco operated a barite plant supplying drilling mud to oil and gas exploration activities off NL's coast . The plant closed in 1984	47 km	Closed	Closed
Barite Mud Services Inc.(Former Buchans Mine Tailings Processing)	• Recovers barite from the tailings remaining from past mining operations • From 2005-2009, Atlantic Barite Ltd. began seasonal (May-October) operation at the Buchans Barite Plant • In 2014, Barite Mud Service Inc. resumed seasonal operation • Barite Mud Services currently employs 18 workers	47 km	Ongoing / Seasonal	Ongoing / Seasonal
Buchans Mine	• The first base metals (copper, zinc, and lead) mine in NL. Opened in 1926 by the Buchans Minerals Corporation, with continuous mining in the area by various companies until 1984	48 km	Closed	Closed
Buchans-Mary March Project	• Several contiguous properties, totaling approximately 39,000 ha • Phase I of a drill program in 2019 by Canstar • Further geochemical and geophysical studies anticipated for this site	51 km	Exploration ongoing	Exploration ongoing
Duck Pond Mine	• Copper/zinc mine near Millertown - Island's largest underground mine • Construction began in 2005, operations (2006-2015) • Teck ceased mining operation in 2015, decommissioning ongoing	51 km	Operation ceased, in closure and rehabilitation phase	Operation ceased, in closure and rehabilitation phase
Hope Brook Mine	• Gold mine located 20 km west of Burgeo, NL • Mined from 1987 to 1997 - total production reported as 752,163 ounces • Copper concentrate mined from 1993-1997 • In 2002 mine site was returned to the province	91 km	Operation ceased, under the care of the Province	Operation ceased, under the care of the Province
Gullbridge Mines	• Copper mine from 1967 to 1971- North American Talc Company • The mine was located near Gull Pond	111 km	Closed	Closed

Table 5.6 Ongoing, Past and Likely Future Projects/ Activities Considered in the CEA

Projects/Activities	Description	Distance to Mine (km)	Status for Approved Project (2020)	Status for Project Expansion (2023)
Jumpers Brook - Terra Nova Granite (2007) Inc.	• Located at Jumpers Brook near Bishop's Falls in central NL • Produced blank monuments, architectural and landscape products, and countertop slabs mainly for export markets until 2010	137 km	Closed	Closed
Beaver Brook Antimony Mine	• Operation restarted in March 2019, ending care and maintenance since January 2013 • Expected to mine 160,000 tonnes of antimony ore per year over 3.5 years and processed into stibnite concentrate	139 km	Ongoing	Care and Maintenance
Mineral Exploration	• In 2020 approximately 100 mineral exploration companies were active in NL • Major mining exploration companies within the cumulative effects RAA include: Buchans Resources, NorZinc, Prominex / Buchans Resources, Spruce Ridge Resources, Antler Gold, Sokoman Iron, Moosehead, Matador Mining, First Gold Mining, Quadro Resources, Mountain Lake Minerals, and Silvertip Exploration (Government of NL 2019b)	N/A	Ongoing	Ongoing
Forestry	• Early forestry was used to support the fishery; fuel, boat building, construction of stages and flakes for splitting, salting, and drying fish • An integral part of the NL economy, was once concentrated in the central area of the Island to support the construction of the trans-island railway-completed in 1898 • Most of the productive forest consists of balsam fir and black spruce • NL is divided into 24 Forest Management Districts (FMDs), the Project Area is located within FMD 12 and 13 • Management of forestry activities include timber harvesting, construction of forest access roads, and silviculture activities such as planting, thinning, and site preparation • Based on the five-year plan for FMD 12 (2016-2020), 1,400,000 m^3 of timber is planned to be harvested and approximately 140 km of access road constructed • For FMD 13, 150,000 m^3 of timber will be harvested and approximately 12 km of forest access road constructed	N/A	Ongoing	Ongoing. There is a new Zone 5 operating plan in place for the period 2021-2025. The Plan indicates that 1,332,436 m^3 will be harvested and approximately 182 km of roads will be constructed in District 12. For District 13, 113,262 m^3 will be harvested and 11 km of access road will be constructed. An amendment to this plan indicates that 33,000m^3 of softwood

Table 5.6 Ongoing, Past and Likely Future Projects/ Activities Considered in the CEA

Projects/Activities	Description	Distance to Mine (km)	Status for Approved Project (2020)	Status for Project Expansion (2023)
	• Within the cumulative effects RAA, there has been forestry activity, including the construction of extensive forestry access roads			and residual hardwood will also be harvested from the east side of the Victoria River. Mitigations specific to limiting adverse effects on caribou and marten are outlined in conditions of release from the EA process for this five-year plan.
Abitibi-Consolidated Inc. Mill	• The mill at Grand Falls-Windsor operated from 1909-2009 • The land surrounding the mill site was expropriated and is managed by the Crown • The province issued a Call for Expressions of Interest in 2013 to develop unallocated timber resources. The formal process concluded, but the provincial government continues to consider proposals from other proponents	119 km	Closed	Closed
Hunting and Outfitting	• Hunting provides recreational opportunities for residents and non-residents, and contributes to the province's wildlife management programs and economy through local spending, and the outfitting industry (NLDFLR 2019a) • Primary species of interest for hunting are moose, caribou, black bear, small game and migratory birds (e.g., geese, ducks and snipe)	N/A	Ongoing	Ongoing
Trapping	• A variety of furbearer species subject to trapping activity are present	N/A	Ongoing	Ongoing

Table 5.6 Ongoing, Past and Likely Future Projects/ Activities Considered in the CEA

Projects/Activities	Description	Distance to Mine (km)	Status for Approved Project (2020)	Status for Project Expansion (2023)
Angling / Fishing	• Inland waters are divided into scheduled Atlantic salmon rivers, scheduled rainbow and brown trout waters, and non-scheduled inland waters • Angling occurs on a number of waterbodies in the cumulative effects RAA, mainly for salmon and brook trout, however, Arctic char are also targeted on select waterbodies • Recreational salmon fishing occurs within the cumulative effects RAA, however, only catch-and-release, Class 0 salmon rivers are present within the RAA • The Exploits River has the highest runs of sea-run Atlantic salmon in Newfoundland (Veinott et al. 2018). The lower river and tributaries from Grand Falls down to the river mouth are commonly used for salmon angling • The cumulative effects RAA comprises part of the Trout Angling Zone 1 and an outfitter operates within the RAA, offering guided, land locked salmon and brook trout fishing tours on Beothuk Lake	N/A	Ongoing / Seasonal	Ongoing / Seasonal
Aquaculture	• The aquaculture industry in NL began in the late 1800s, with modern aquaculture attempts in the 1970s • NL's aquaculture industry is focused on: steelhead trout, Atlantic salmon, blue mussels, and Atlantic cod • Within the cumulative effects RAA, aquaculture occurs on the southern coast, with 27 aquaculture licences in the cumulative effects RAA • The nearest aquaculture license is 89 km from the Project Area	89 km	Ongoing / Seasonal	Ongoing / Seasonal There are 36 active aquaculture sites in the RAA, and one licensed fish processor

Table 5.6 Ongoing, Past and Likely Future Projects/ Activities Considered in the CEA

Projects/Activities	Description	Distance to Mine (km)	Status for Approved Project (2020)	Status for Project Expansion (2023)
Off-road Vehicles (Snowmobiling and ATV)	• Recreational off-road vehicles are used in the cumulative effects RAA on official trails, and unofficially on Crown and private lands (e.g., forestry roads and power lines) in the cumulative effects RAA for • The use of snowmobiles and all-terrain vehicles (ATVs) is regulated by the Motorized Snow Vehicles and All-Terrain Vehicles Act and the Motorized Snow Vehicles and All-Terrain Vehicles Regulations • Snowmobiling occurs throughout the Island. The NL Snowmobile Federation (NLSF) has 12 to 20 volunteer clubs across the Island who are responsible for the maintenance of 3,300 km of trails (NLSF 2020) • There are two groomed snowmobile trails in the cumulative effects RAA leading to Buchans and Millertown • The T'Railway Provincial Park is located within the cumulative effects RAA and stretches almost 900 km, from St. John's to Port aux Basques along the main line of the old abandoned Canadian National railbed. ATVs and snowmobiles use the T'Railway year-round	N/A	Ongoing / Seasonal	Ongoing / Seasonal
Hydroelectric Development	• The cumulative effects RAA has substantial hydroelectric development, including the following hydroelectric generating stations: – Bay d'Espoir * – Buchans – Deer Lake – Grand Falls – Hinds Lake – Lookout Brook – Rose Blanche – Sandy Brook – Star Lake • The closest development to the Project is the Victoria Dam and Victoria Lake Reservoir, part of the Bay d'Espoir Hydroelectric Development and located 500 m from the Project Area	500 m (Victoria Dam and Reservoir)	Ongoing	Ongoing

Table 5.6 Ongoing, Past and Likely Future Projects/ Activities Considered in the CEA

Projects/Activities	Description	Distance to Mine (km)	Status for Approved Project (2020)	Status for Project Expansion (2023)
Existing Linear Features (i.e., highways / roads and power lines)	• Linear activities, e.g., highways, roads, extensive forestry roads and power lines, occur throughout the cumulative effects RAA • Primary roads connect Buchans and Millertown to provincial highways and the Trans-Canada Highway (TCH) • The TCH goes directly through Grand Falls-Windsor • There is ongoing maintenance and upgrades to roads within the cumulative effects RAA	N/A	Ongoing	Ongoing
Likely Future Projects /Activities				
Cape Ray Gold Project	• Located near Channel-Port aux Basques, NL • Matador Mining Ltd. proposes to construct, operate, decommission, and reclaim a gold / silver mine and milling complex (Nordmin Resource and Industrial Engineering Ltd. [Nordmin] 2016) • Production capacity will be approximately 600 t/d from underground operations and 1,500 t/d from open pit mining (Nordmin 2016) • It is estimated that the project will create approximately 100 to 150 jobs (at peak) during construction and approximately 30 full-time jobs during operation (Nordmin 2016)	126 km	Under environmental regulatory review process. Scheduled to operate from receipt of approval for six years	Project has been withdrawn
Buchans Resources Limited Project	• On March 1, 2019, Buchans Resources Limited announced a new Mineral Resource Estimate for its Lundberg base metal deposit, located at the former Buchans Mine (Lucky Strike deposit) (Government of NL 2019a) • A NI 43-101 Technical Report was filed in April 2019, reporting a resource of more than 1.25 billion pounds zinc equivalent (Government of NL 2019a) • No Registration document has been submitted to regulators describing this proposed project; therefore, no project area has been defined, nor has the existing environment been described. • A description of the Lundberg deposit on their website states that resources are contained within an optimized model pit shell measuring 860 m by 650 m and extends to a maximum depth of 240 m (Buchans Resources 2020), equal to less than 100 ha of surface area, which is less than both the Marathon and Leprechaun pits	48 km	A new updated Preliminary Economic Assessment or a Preliminary Feasibility Study is being considered; specific timing unknown	Exploration work initiated in 2021 and ongoing

Table 5.6 Ongoing, Past and Likely Future Projects/ Activities Considered in the CEA

Projects/Activities	Description	Distance to Mine (km)	Status for Approved Project (2020)	Status for Project Expansion (2023)
Star Lake to Valentine Gold Transmission Line TL271 Project	• A power line from Star Lake Terminal Station to the Valentine Terminal Station located at the Valentine Gold Project mine site will be constructed and operated by NL Hydro • It was subject to the NL EA process and will require other environmental approvals with NL Hydro as the proponent	45 km route between terminals	To be developed in 2022 in support of the Project	Project Released from EA in June 2022
Victoria River Quarry	• Newcrete Investments is proposing to develop a 5.5 hectare quarry adjacent to Victoria River, located approximately 50 km southwest of the Town of Buchans, and approximately 7 km northeast of Victoria Lake Reservoir.	<500 m	NA	EPR guidelines issued on March 29, 2023
Mining Claim Areas	• A number of mining claims have been staked in the general area of the Approved Project and Project Expansion and occur within the RAA, since submission of the Valentine Gold EIS (September 2020)	NA	NA	See Figure 5.3
Various Quarries	• A number of quarries not requiring EA have been approved in the RAA since submission of the Valentine Gold EIS (September 2020)	NA	NA	See Figure 5.3

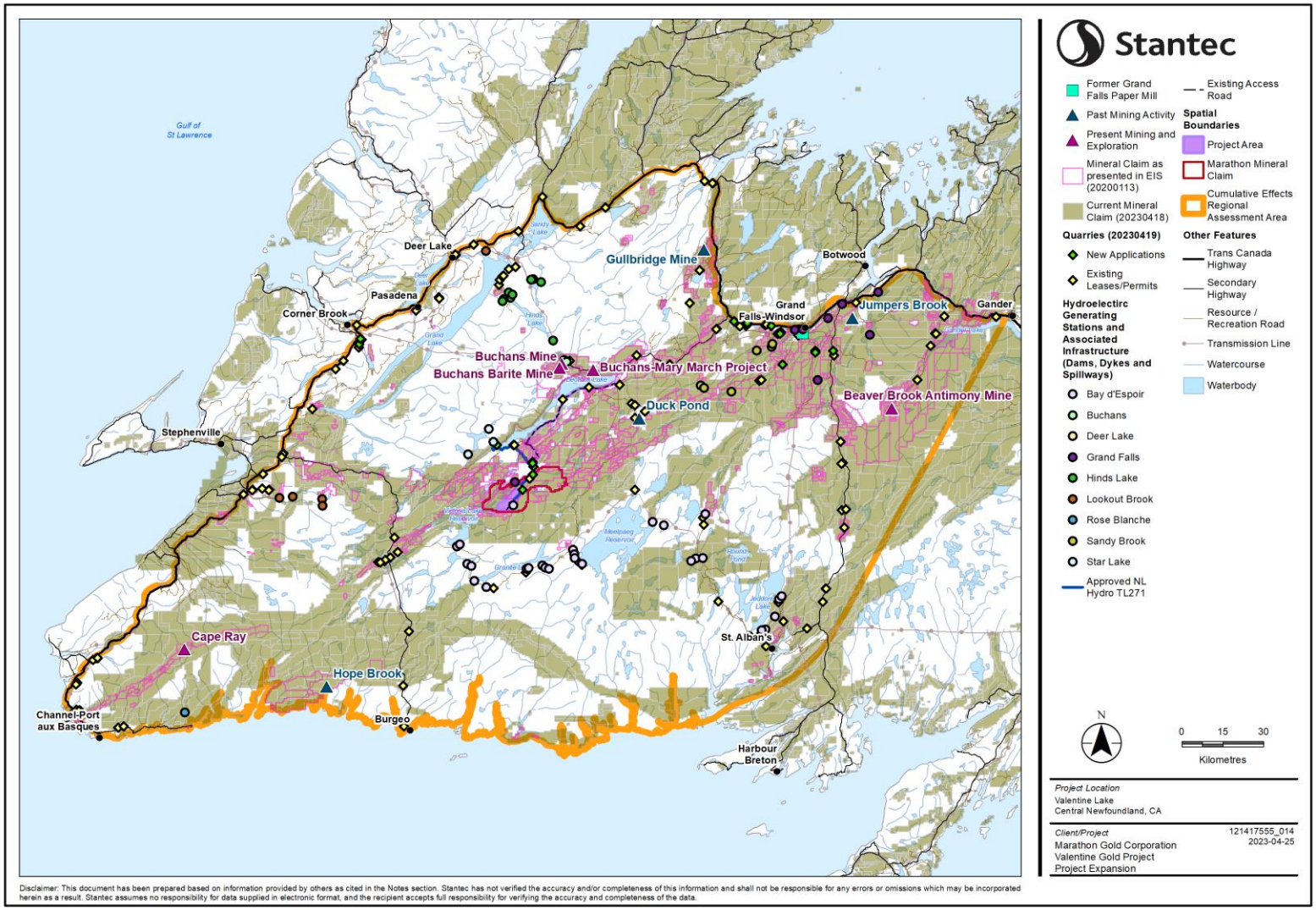

Figure 5-3 Projects and Activities Considered in the CEA

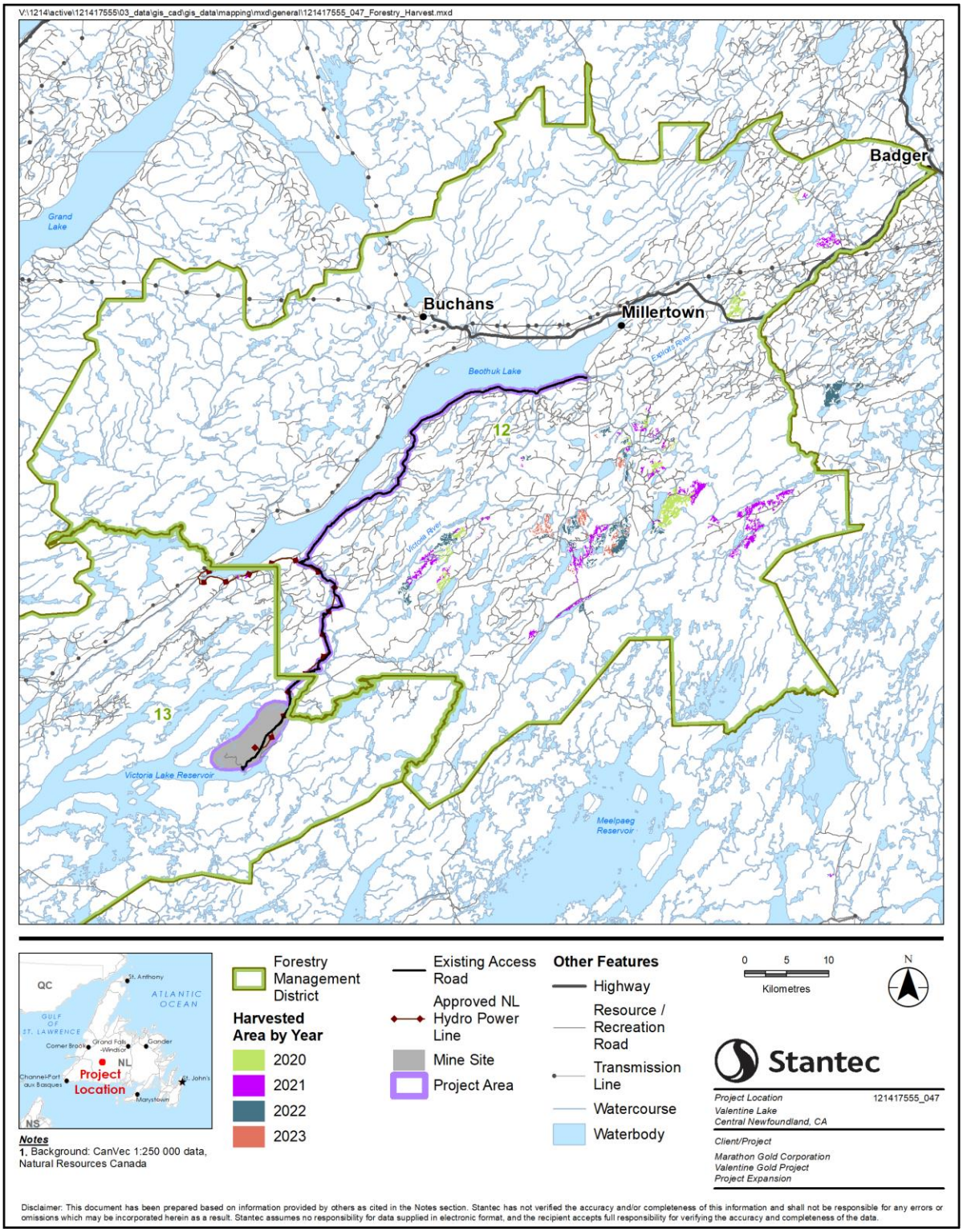

Figure 5-4 Forest Management Districts 12 and 13

5.2.6 Potential Accidents and Malfunctions

Environmental effects on VCs that may result from potential accidents and malfunctions are assessed in a similar fashion to Project Expansion environmental effects. Events that may occur outside the normal planned function or activity of the Project Expansion are described, and mitigation measures (e.g., incident avoidance measures, design safeguards) and contingency plans to reduce or eliminate the risks of such events are identified. Potential effects are characterized using the same terms used for Project-related environmental effects. The significance of the environmental effects is then determined using the same thresholds used for Project-related environmental effects. Details on the types of accident or malfunction events considered are discussed in Chapter 13. Information presented in Chapter 13 will be used to update the Approved Project's emergency and contingency response plans, as applicable.

5.2.7 Effects of the Environment on the Project

Effects that may occur as a result of the environment acting on the Project Expansion are summarized in this document (Chapter 14). Potential environmental forces and hazards may include climate (e.g., extreme precipitation and storms, hurricanes, droughts and floods), climate change, seismic events and landslides, and forest fires. The influence that these environmental forces and hazards may have on the Project Expansion are predicted and described, and the measures to be taken to limit or avoid potential adverse effects are the same as those described in detail in the Valentine Gold EIS (Chapter 22).

5.2.8 Proposed Follow-up and Monitoring Programs

The follow-up and monitoring programs that have been identified for the Approved Project are described in Section 2.9. Additional follow-up and monitoring programs that may be required for the Project Expansion are identified and described in the individual VC chapters. VC-specific follow-up and monitoring programs include those proposed to verify the accuracy of key EA predictions and the effectiveness of mitigation measures. These programs will be developed in consultation with government agencies, Indigenous groups, and stakeholders, where relevant, and will include compliance monitoring as necessary to verify compliance with applicable regulatory requirements, including the terms and conditions of environmental permits, approvals or authorizations that may be issued in support of the Project Expansion.

5.3 REFERENCES

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6.0 ATMOSPHERIC ENVIRONMENT

The atmospheric environment as a valued component (VC) consists of four subcomponents: air quality, greenhouse gases (GHGs), sound quality and lighting. The atmospheric environment was assessed to determine if changes in the atmospheric environment may result from the construction, operation, and decommissioning, rehabilitation and closure of the Berry Pit Expansion (Project Expansion).

As with the Valentine Gold Environmental Impact Statement (EIS) (Marathon 2020), air quality was selected as a subcomponent of the atmospheric environment because of its intrinsic importance to the health and wellbeing of humans, wildlife, vegetation and other biota. The atmosphere is an important pathway for the transport of contaminants to the freshwater, terrestrial and human environments.

GHGs were selected as a subcomponent of the atmospheric environment because a change in GHGs is of scientific and regulatory concern. In the atmosphere, GHGs absorb and re-emit infrared radiation from the planetary surface, thereby warming the lower levels of the atmosphere and acting as a thermal blanket for the planet.

The acoustic environment was selected as a subcomponent of the atmospheric environment because Project-related noise can affect human health and wellbeing, and wildlife and wildlife habitat.

Lighting was selected as a subcomponent of the atmospheric environment because exterior Project Expansion lighting can affect nighttime sky views and migrating wildlife, as well as visual aesthetic changes and physiological changes in humans.

6.1 EXISTING ENVIRONMENT

6.1.1 Summary of Existing Environment from the Approved Project

In the Valentine Gold EIS, the existing environment for the Atmospheric Environment VC was described for climate, air quality, GHGs, sound quality, and lighting (Marathon 2020). This section summarizes the existing conditions presented for the Valentine Gold Project (Approved Project) in the Valentine Gold EIS for each of these areas.

6.1.1.1 Climate

The climate at the mine site was described based on the Environment and Climate Change Canada (ECCC) 1981 to 2010 climate normals data from the Buchans, Newfoundland and Labrador (NL), station. The Buchans station is located approximately 55 kilometres (km) north-northeast of the mine site. Annually, the daily average temperature ranges from -8.4 degrees Celsius (°C) to 16.3°C, with the lowest average temperatures occurring in February and the highest occurring in July. The extreme daily minimum and maximum temperatures also occurred in those months: -33.5°C in February and 33°C in July. The total annual average precipitation at the Buchans station is 1,236 millimetres (mm) which includes 359 centimetres (cm) of snow and 877 mm of rain. Monthly average precipitation ranges

between 86 to 123 mm, with the least occurring in April and the most occurring in December (Marathon 2020).

Because wind is not measured at the Buchans station, hourly wind data from 2015 to 2019 were obtained from the Deer Lake station, located approximately 95 km north of the mine site. Winds prevail from the southwest (SW) and northeast (NE) directions. The small variability in wind direction at Deer Lake is due to local topography. The Deer Lake station (at Deer Lake Airport) is in the Humber River Valley, which influences the winds in the area (i.e., the prevailing wind directions observed at Deer Lake are parallel to direction of the Humber River Valley [SW-NE direction]). The highest wind speeds occur most frequently from the southwest direction and the lowest wind speeds occur most frequently from the north and northeast directions. Calm periods are also common with wind speeds less than 0.5 metres per second (m/s), accounting for more than 22% of the observed winds at Deer Lake (Marathon 2020).

6.1.1.2 Air Quality

Ambient air quality in NL is monitored through an air quality monitoring network that is operated by the government and industry. At the time of the Valentine Gold EIS, the 2018 Ambient Air Monitoring Report showed no exceedances of the NL Ambient Air Quality Standards for sulphur dioxide (SO_2), nitrogen dioxide (NO_2), or carbon monoxide (CO) or the Canadian Ambient Air Quality Standard (CAAQS) for fine particulate matter with an aerodynamic diameter less than 2.5 µm ($PM_{2.5}$). However, there were six exceedances of the 8-hour ozone Canadian Council of Ministers of the Environment CAAQS at the Grand Falls-Windsor monitoring station in 2018.

Stantec also conducted ambient air quality monitoring at one location within the Project Area over the period of June 15-19, 2020. Three 24-hour samples for total suspended particulate matter with an aerodynamic diameter less than 30 µm (TSP) (including trace metals) and respirable particulate matter with an aerodynamic diameter less than 10 µm (PM_{10}) were collected over the period of June 15-17, 2020, and two passive samples (one for NO_2 and one for SO_2) were collected over the period of June 16-19, 2020. The baseline measured concentrations of NO_2, SO_2, TSP, PM_{10} and metals were well below applicable 24-hour ambient air quality regulatory criteria for NL.

6.1.1.3 Greenhouse Gases

Provincial and national greenhouse gas emissions are published annually in Canada's National Inventory Report. In the Valentine Gold EIS, the data published for the 2018 reporting year were presented (ECCC 2020a). The GHG emissions from NL were 11,000 kilotonnes (kt) of carbon dioxide equivalent (kt CO_2e), using the global warming potentials (GWPs) of 1 (carbon dioxide [CO_2]), 25 (methane [CH_4]), and 298 (nitrous oxide [N_2O]). National GHG emissions were 729,000 kt CO_2e. Therefore, NL contributed 1.5% of national GHG emissions.

6.1.1.4 Sound Quality

The mine site is in a remote area with limited human activity, and no other substantive anthropogenic noise sources within 50 km. The mine site is located approximately 49 km southwest of the Town of Buchans and 60 km southwest of the Town of Millertown. Within the Local Assessment Area / Regional Assessment Area (LAA / RAA), there are approximately 35 seasonal dwellings (three active outfitters, two inactive outfitters and 30 cabins), which represent the nearest sensitive receptors to the Approved Project.

Baseline sound pressure levels were measured near the Project Area as part of the Valentine Gold EIS. A summary of the daytime (L_d), nighttime (L_n), and day-night average (L_{dn}) sound pressure levels, and of the estimated baseline value of percent highly annoyed (%HA) presented in the Valentine Gold EIS is provided in Table 6.1.

Table 6.1 Baseline L_d, L_n, L_{dn}, and %HA Values

Parameter	June 16	June 17
Daytime Sound Level, L_d (dBA)	44.4	44.6
Nighttime Sound Level L_n (dBA)	39.6	38.1
Day-night Average Sound Level (dBA)	47.4	46.9
Baseline Percent Highly Annoyed (%HA)	1.57	1.47
dBA = decibel A scale		

6.1.1.5 Lighting

As noted in Section 5.2.2.4 of the Valentine Gold EIS, the mine site is located approximately 49 km southwest of the Town of Buchans and 60 km southwest of the Town of Millertown. There are no communities, year-round residential receptors, or major roadways located within the LAA / RAA. There are approximately 35 seasonal cabins / outfitter locations located within the LAA / RAA (Marathon 2020).

The existing ambient light levels within the Project Area were characterized by conducting ambient light monitoring, reviewing satellite observations of artificial light (World Atlas 2015), and making assumptions based on the Project location, nearby communities, nearby sources of light, and Stantec's professional experience.

As noted in the Valentine Gold EIS, three attributes are used to describe the potential environmental effects of light:

- Light trespass refers to the transmission of light from fixtures within a facility to the environment and receptors outside the facility. The unit of measure for light incidence either in or outside the facility is a lux. A lux is equal to one lumen lighting up an area of 1 square metre (m^2), or 1 lumen/m^2. A 60-watt incandescent light bulb emits approximately 800 lumens. Light trespass reaches problematic levels, for example, when lights (also referred to as luminaires) located on the outside of an industrial facility shine in through the windows of nearby residential homes at levels that could disrupt sleep or distract from normal levels.

- Glare refers to intense, harsh or contrasting lighting conditions associated with incoming light that reduces the ability of humans, birds and other organisms to see clearly. The most common example of glare is oncoming high-beam vehicle headlights that provide ample light for the driver in the oncoming vehicle, and at the same time result in poor visibility, potentially reaching hazardous conditions for the driver meeting the other vehicle. The unit of measure is luminance, which is equal to lumens per steradian, also referred to as the candela (cd).
- Sky glow refers to the illumination of the clouds by light sources on the surface of the Earth, such as street lighting, and haze in the atmosphere that replaces the natural nighttime sky with a translucent to opaque lighted dome. The sky appears washed out, or brownish-purple and may be devoid of visible stars in the extreme. Sky glow is the cumulative effect of all the lights at the surface with the light being either emitted upward or being reflected upward by the surface plus the emission from photochemical activity in the atmosphere. The unit of measure for the brightness of the sky, including sky glow, is magnitudes per square arcsecond (mag/arcsec^2). A sky glow measurement representative of a clear sky in a rural area with few lights present would be approximately 21 to 22 mag/arcsec^2 and within a city or urban area that is fairly well lit up being approximately 18-19 mag/arcsec^2 (Berry 1976).

The three attributes of light (light trespass, glare, and sky glow) form the framework for describing the existing environment in the Project Area for the Valentine Gold EIS.

For the Valentine Gold EIS, light monitoring was conducted during the night of June 16, 2020, at one location near the center of the mine site during clear skies when the moon was not in the sky. Ambient light monitoring included measurements of illuminance (lux) and sky glow (mag/arcsec^2). Illuminance was measured using a conventional, integrating hemispherical light meter (Extech EA33) with a resolution of 0.01 lux. Sky glow was measured using a Unihedron Sky Quality Meter with lens (SQM-L). Details pertaining to the baseline lighting survey are provided in the Valentine Gold EIS. Results showed that measurements of incident light were less than 0.01 lux and sky glow ranged from 21.84 to 22.81 mag/arcsec^2. Based on the ambient light levels (both sky glow and light trespass), the LAA is considered a dark, rural environmental zone, Category E1 as described in the Valentine Gold EIS (Marathon 2020).

As noted in the Valentine Gold EIS, there are essentially no existing sources of artificial light contributing to the existing ambient light environment within the Project Area. The measured sky glow levels within this area is 22.0 mag/arcsec^2, a range that is representative of an unpolluted starry sky where, on clear nights with no haze, many thousands of stars would be visible, and the Milky Way would be clearly visible (Berry 1976; US DOE 2017; Marathon 2020).

6.1.2 Existing Environment Update

While some Approved Project construction activities have begun at select sites (as of October 2022), the existing conditions described in this chapter refer to pre-construction conditions. This approach has been taken for several reasons:

- The updated publicly available data reflects pre-construction conditions
- The conservative approach to the assessment is to assume that the potential effects of Project Expansion take place in an existing environment undisturbed by construction activities, thereby potentially overstating, rather than understating, the potential effects of expansion
- Existing conditions within the Project Area, and the mine site in particular, are constantly changing as construction of the Approved Project advances

6.1.2.1 Climate

Since the 30-year climate normals data from ECCC (1981-2010) have not been updated since the Valentine Gold EIS was submitted, there are no updates to the existing climate from that presented for the Approved Project. A summary of the existing climate near the Project Area is provided above in Section 6.1.1.1.

6.1.2.2 Air Quality

There has been no additional ambient air quality monitoring conducted at the mine site since the Valentine Gold EIS was submitted. The NL Department of Environment and Climate Change (NLDECC), however, conducted ambient air quality monitoring at the Grand Falls-Windsor ambient air quality monitoring station (AAQMS). As described in the Valentine Gold EIS, this station is the closest representative station to the mine site. NLDECC released the 2022 Ambient Air Monitoring Report in April 2023. There was one exceedance each of the $PM_{2.5}$ and PM_{10} maximum 24-hr concentration standards and six exceedances of the ozone maximum 8-hr concentration standard. The exceedances of particulate matter were due to smoke from a forest fire in central Newfoundland. The ambient concentrations of ozone at the Grand Falls-Windsor station historically exceed the maximum 8-hr concentration standard, with 6 exceedances noted in 2018 and 21 noted in 2021 (NLDECC 2023).

Stantec completed dispersion modelling, which was submitted to NLDECC in 2022. The modelling was conducted in support of provincial permitting for construction-related diesel-powered electric generators. This work was completed in accordance with Provincial approval requirements. Additional information on the modelling and results is provided in the report Valentine Gold Project: Air Dispersion Modelling for Temporary Generators, dated November 23, 2022 (Stantec 2022).

Reporting on emissions of air contaminants from the diesel generators operating at the mine site during construction in 2022 was also completed and submitted to the NLDECC. Additional information on the 2022 generator emissions reporting is provided in the report Valentine Gold Mine: 2022 Generator Emissions Reporting, dated June 9, 2023 (Stantec 2023).

6.1.2.3 GHGs

The GHG emissions for 2021, published in the 2023 National Inventory Report (ECCC 2023), are presented in Table 6.2.

Table 6.2 Provincial and National GHG Emissions (2021)

Parameter	Units	CO_2	CH_4	N_2O	Other GHGs [a] (expressed as CO_{2e})	Total (expressed as CO_{2e})
NL GHG Emissions	kt/y	7,314	29	0.35	190	**8,336**
National GHG Emissions	kt/y	537,174	3,620	101	12,513	**670,428**
NL contribution to National GHG Emissions	%	1.4	0.8	0.3	1.5	**1.2%**

Notes:
kt/y = kilotonne per year; CO_{2e} = CO_2 equivalent
[a] Other GHGs include sulphur hexafluoride, hydrofluorocarbons, perfluorocarbons, and nitrogen trifluoride
Source: ECCC National Inventory Report (NIR) (ECCC 2023)

Since 2018, Canadian GHG emissions have decreased. The NL GHG emissions account for approximately 1.2% of the national GHG emissions.

The GWPs applied in the Valentine Gold EIS and in Table 6.1 were those adopted by ECCC for the National Inventory Report (ECCC 2023): 1 (CO_2), 25 (CH_4), 298 (N_2O). The same GWPs were applied for the Project Expansion.

6.1.2.4 Sound Quality

The main changes in the existing environment since submission of the Valentine Gold EIS relate to the ongoing construction and exploration activities associated with the Approved Project; however, as indicated above, existing conditions described in this chapter refer to pre-construction conditions. There has been no additional ambient noise monitoring at the mine site since the Valentine Gold EIS was submitted.

Since the measurements provided in Table 6.1 occurred before the ongoing exploration and construction activities, these measurements are considered representative of baseline conditions for the Project Area.

6.1.2.5 Lighting Levels

As indicated in Section 5.2.2.4 of the Valentine Gold EIS, the mine site is located approximately 49 km southwest of the Town of Buchans and 60 km southwest of the Town of Millertown. There are no communities, year-round residential receptors, or major roadways located within the LAA / RAA. There is one change in the approximately 35 seasonal cabins / outfitter locations located within the LAA / RAA since the Valentine Gold EIS was submitted. The closest cabin to the mine site will be relocated in the near future per an agreement with Marathon.

While there has been no additional light monitoring at the mine site since the Valentine Gold EIS was submitted, no additional pre-construction sources of artificial light have been identified that would contribute to the existing ambient light environment within the mine site. Therefore, the information presented in the Valentine Gold EIS is still considered representative of existing conditions relative to light levels.

6.2 PROJECT EXPANSION INTERACTIONS AND PATHWAYS

Table 6.3 lists the potential Project Expansion effects on the atmospheric environment and provides a summary of the Project Expansion effect pathways and measurable parameters and units of measurement to assess potential effects. These are consistent with those used for the Approved Project in the Valentine Gold EIS. Potential environmental effects and measurable parameters were selected based on review of recent environmental assessments for mining projects in NL and other parts of Canada, comments provided during engagement, and professional judgment.

Table 6.3 Potential Effects, Effect Pathways and Measurable Parameters for Atmospheric Environment

Potential Environmental Effect	Effect Pathway	Measurable Parameters and Units of Measurement
Change in Air Quality	• Atmospheric dispersion of air contaminant emissions from Approved Project and Project Expansion construction, operation and decommissioning, rehabilitation and closure	• Ambient concentrations of particulate matter (TSP, PM_{10}, $PM_{2.5}$), gases (CO, NO_2, SO_2), NH_3, HCN, and metals in $\mu g/m^3$
Change in Greenhouse Gas Emissions	• GHGs released to the atmosphere from Approved Project and Project Expansion equipment and activities, during Approved Project and Project Expansion construction, operation and decommissioning, rehabilitation and closure	• GHG emissions (CO_2, CH_4, N_2O, PFCs, HFCs, SF_6, NF_3) in tonnes per CO_2 equivalent per year ($t\ CO_{2e}$)
Change in Sound Quality	• Noise emissions from Approved Project and Project Expansion equipment and activities during Approved Project and Project Expansion construction, operation and decommissioning, rehabilitation and closure	• L_d and L_n measured in dBA; day-night equivalent sound pressure level measured in dBA; and change in %HA, measured in percent
Change in Light Levels	• Light levels from the Approved Project and Project Expansion equipment and activities during Approved Project and Project Expansion construction, operation and decommissioning, rehabilitation and closure	• Levels of light trespass as measured in Lux; levels of glare as measured in cd; levels of sky glow as measured in $mag/arcsec^2$; viewshed analysis as measured based on receptor line of sight to Approved Project and Project Expansion components

Notes:
$\mu g/m^3$ = microgram per cubic metre; HCN = hydrogen cyanide; NF_3 = nitrogen trifluoride; NH_3 = ammonia;
PFC = perfluorocarbons; SF_6 = sulfur hexafluoride

Table 6.4 identifies the physical activities associated with the Project Expansion that could interact with the VC and result in the identified environmental effect. These interactions are indicated by checkmark and are discussed in detail in Section 6.4, in the context of effects pathways, standard and Project-specific mitigation / enhancement, and residual effects. Note that, for this VC, interactions have only been identified for the activity of "Emissions, Discharges and Wastes" for each Project Expansion phase. As noted in Table 6.4, Emissions, Discharges and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project Expansion activities. Rather than acknowledging this with a checkmark against all these activities, "Emissions, Discharges and Wastes" is an additional component under each Project Expansion phase.

Table 6.4 Project Expansion Environment Interactions with Atmospheric Environment

Physical Activities	Environmental Effects to Be Assessed			
	Change in Air Quality	Change in GHGs	Change in Sound Quality	Change in Light Levels
CONSTRUCTION				
Mine Site Preparation and Earthworks: Clearing and cutting of vegetation and removal of organic materials, development of roads and excavation and preparation of excavation bases within the Project Expansion footprint. For the open pit, earthworks include stripping, stockpiling of organic and overburden materials and development of in-pit quarries to supply site development rock for infrastructure such as structural fill and road gravels. Also includes temporary surface water and groundwater management, and the presence of people and equipment on site.	-	-	-	-
Construction / Installation of Infrastructure and Equipment: Construction of infrastructure as required for the Project Expansion. Also includes: • Installation of water control structures (including earthworks) • Presence of people and equipment on-site	-	-	-	-
Emissions, Discharges and Wastes[A]: Noise, air contaminant emissions / GHGs, light, water discharge and hazardous and non-hazardous wastes.	✓	✓	✓	✓
OPERATION				
Open Pit Mining: Blasting, excavation and haulage of rock from the open pits using conventional mining equipment. Blasting frequency is not anticipated to increase as a result of the Project Expansion, however blasting will occur over a longer time period due to the extension of mine life associated with the Project Expansion.	-	-	-	-

Table 6.4 Project Expansion Environment Interactions with Atmospheric Environment

Physical Activities	Environmental Effects to Be Assessed			
	Change in Air Quality	Change in GHGs	Change in Sound Quality	Change in Light Levels
Topsoil, Overburden and Rock Management: Four types of piles: • Topsoil • Overburden • Waste rock • Low-grade ore Rock excavated from the open pit that will not be processed for gold will be used as engineered fill for site development, maintenance and rehabilitation, assuming it is non-acid generating, deposited in mined out basins of Berry pit, or will be deposited in a waste rock pile.	-	-	-	-
Tailings Management: Following treatment of tailings via cyanide destruction, tailings will be thickened and pumped to an engineered tailings management facility (TMF) in years 1 to 9, then pumped to a mined-out basin of the Berry pit from Year 10 to the end of operation, instead of the Leprechaun pit. Tailings stored in-pit will be flooded during final closure. Marathon plans to upgrade the water treatment process by replacing the proposed polishing pond with a smaller SAGR unit that provides improved treatment of nitrogen species.	-	-	-	-
Water Management (Collection, treatment and release)**:** Site contact water and process effluent will be managed on site and treated prior to discharge to the environment. Where possible, non-contact water will be diverted away from mine features and infrastructure, and site contact and process water will be recycled to the extent possible for use on site.	-	-	-	-
Utilities, Infrastructure and Other Facilities: Most utilities, infrastructure and facilities remain unchanged, and are as described in the Valentine Gold EIS (Marathon 2020) and assessed as part of the Approved Project. Relocation of the explosives facility, maintenance of Berry haul road and site snow clearing will be required for the Project Expansion. • Note that while the location of the explosives facility has changed, the design and activities associated with the facility have not	-	-	-	-
Emissions, Discharges and Wastes[A]: Noise, air emissions / GHGs, light, water discharge and hazardous and non-hazardous wastes	✓	✓	✓	✓

Table 6.4 Project Expansion Environment Interactions with Atmospheric Environment

Physical Activities	Environmental Effects to Be Assessed			
	Change in Air Quality	Change in GHGs	Change in Sound Quality	Change in Light Levels
Employment and Expenditure Operation of the combined Approved Project and Project Expansion is estimated to require a peak workforce of approximately 524 fulltime equivalents (FTEs) (44 FTEs above the Valentine Gold EIS estimate) and an average of 366 FTEs	-	-	-	-
DECOMMISSIONING, REHABILITATION AND CLOSURE				
Decommissioning of Mine Features and Infrastructure	-	-	-	-
Progressive Rehabilitation: Erosion stabilization and re-vegetation of completed overburden and / or waste rock piles; infilling or flooding of exhausted mining areas; and completing revegetation studies and trials.	-	-	-	-
Closure Rehabilitation: Active rehabilitation based on successes of progressive rehabilitation activities. Includes: grading and revegetating cleared areas, where practicable; breaching and regrading ponds to reestablish drainage patterns; erosion stabilization and revegetation of completed overburden and / or waste rock piles; and infilling or flooding of open pit.	-	-	-	-
Post-Closure: Long-term monitoring	-	-	-	-
Emissions, Discharges and Wastes[A]	✓	✓	✓	✓

Notes:
✓ = Potential interaction; – = No interaction
[A] Emissions, Discharges and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project Expansion activities. Rather than acknowledging this by placing a checkmark against each of these activities, "Emissions, Discharges and Wastes" is an additional component under each Project Expansion phase.

6.3 MITIGATION AND MANAGEMENT MEASURES

Marathon has developed a series of environmental management plans to avoid and mitigate the effects of Approved Project development on the environment. Commitments to mitigation measures noted in Section 5.4 of the Valentine Gold EIS regarding atmospheric environment will also apply to the Expansion Project. A full listing of the mitigation and management commitments for the Approved Project can be found in Appendix 2E. These measures will also be applied to the Project Expansion, as applicable. No new mitigation measures specifically pertaining to the Project Expansion have been identified for the Atmospheric Environment VC.

6.4 SUMMARY OF APPROVED PROJECT RESIDUAL EFFECTS

The Valentine Gold EIS concluded that residual Approved Project-related effects to air quality during the construction and operation phases of the Approved Project would result in air contaminant emissions, although the magnitudes of the releases would be limited and well managed. Construction-related emissions (primarily dust from site preparation and material handling, as well as combustion gases from equipment) could decrease air quality; however, with the implementation of mitigation (e.g., dust management), the change in air quality was not expected to be substantive. Air contaminant releases from construction activities were expected to be lower in magnitude than from operation activities. Air contaminant releases from construction were therefore not anticipated to result in frequent exceedances of the ambient air quality standards (i.e., <1% of the time).

The potential change to air quality in the LAA / RAA during operation was assessed by predicting ground-level concentrations from the modelling of Approved Project-related releases combined with measured background concentrations and comparing these against ambient air quality criteria. The combined concentrations for most air contaminants modelled (due to Approved Project-related air contaminant releases combined with measured ambient background concentrations) were below the adopted ambient air quality standards outside the Project Area, with the exception of the 24-hour PM_{10} predictions. The exceedances of the 24-hour PM_{10} standard were likely a result of fugitive releases from the TMF, based on the location of occurrence of the maximum predicted concentrations (i.e., 500 to 900 metres [m] to the east of the TMF). These exceedances were predicted to occur in a small area and were expected to be infrequent (i.e., <1% of the time) and of short duration.

Residual Approved Project-related effects to GHG emissions during construction and operation represented a small contribution to provincial and national GHG emissions. The direct GHG emissions during site construction included those from heavy off-road equipment, on-road trucks and vehicles, stationary generators, blasting, and land clearing. Indirect GHG emissions during site construction included the shipping of supplies to site. On the maximum annual basis, the construction emissions contributed approximately 0.30% and 0.005% to provincial and national GHG emission totals, respectively. GHG emissions during operation included emissions from heavy off-road equipment, on-road trucks and vehicles, stationary combustion, and blasting.

Indirect GHG emissions during operation included electricity consumption and shipping related to supplies and product deliveries. The operation contributed approximately 0.84% and 0.013% to the provincial and national emission totals, respectively. Mitigation measures for GHG emissions mostly related to lower fuel consumption, which was directly proportional to lower GHG emissions. Some of these measures included equipment / vehicle maintenance to increase fuel efficiency, reducing idling times, and reducing cold starts.

Residual Approved Project-related effects on sound quality would result from noise emissions during construction, operation, and decommissioning, rehabilitation and closure of the Project; however, the magnitude of the releases would be limited and well managed. Construction and decommissioning-related emissions would occur through the use of heavy machinery and from earth moving and material handling. Emissions during operation were expected to be similar and would also include processing

activities related to gold extraction and refinement. Acoustic modelling was completed to predict sounds levels at nearby receptors due to Approved Project activities. The predicted sound pressure levels were added to measured baseline data collected within the Project Area to estimate the change in sound quality. The predicted sound pressure levels at the nearby receptors were expected to be well below Health Canada targets for annoyance (change in %HA < 6.5) and sleep disturbance (45 dBA partially open windows and 57 dBA for fully closed windows) during both construction and operation.

The Valentine Gold EIS predicted that residual Approved Project-related effects to light levels could result from the use of nighttime safety lighting required for the site buildings (e.g., accommodations camp, mill buildings), surrounding vehicle parking lots, and along the site roads within the Project Area. However, it was anticipated that an increase in Approved Project-related light emissions (light trespass and glare) was not likely to exceed the Commission Internationale de L'Éclairage (CIE) criteria for a suburban environment. Based on this light assessment, the levels of light trespass and glare would be maintained at levels representative of a rural environment provided the final lighting was developed using the recommended minimum lighting levels provided by the North America's Illuminating Engineering Society Lighting Handbook for outdoor worksite lighting, and in consideration of the CIE criteria. With proper design, existing levels of sky glow would also be maintained at levels representative of rural areas beyond the Project Area.

A viewshed analysis was also conducted that considered nearby receptor locations with a direct line of sight to the Approved Project. The results of the viewshed analysis indicated that one receptor within the LAA / RAA may have a direct line of sight to some Approved Project components (note that the masking effect of trees and other vegetation was not considered in the analysis); however, those components are not likely to contain permanent lighting structures. Therefore, the nighttime views from that viewpoint would not likely be affected by Approved Project components within the Project Area.

Overall, the Valentine Gold EIS for the Approved Project concluded that, with the implementation of mitigation and management measures, residual environmental effects on Atmospheric Environment were predicted to be not significant. As described in the Valentine Gold EIS, Section 6.5.3, a significant residual effect on the atmospheric environment was defined as a Project-related effect that resulted in one or more of the following:

- Releases of air contaminants to the atmosphere that degrade the quality of ambient air such that the model predicted concentrations (combined with background levels) are likely to exceed applicable regulatory criteria for ambient air quality beyond the Project Area, and are of concern relative to the geographical extent of predicted exceedances, their frequency of occurrence, and the presence of potentially susceptible receptors
- GHG emissions during construction and operation, that represent a large contribution to provincial and national GHG emissions. Approved Project emissions were ranked as low in magnitude during construction and moderate during operation
- Noise levels at noise-sensitive receptors that are likely to frequently exceed the annoyance and sleep disturbance targets recommended by Health Canada
- Light emissions such that the CIE guidelines for light trespass and glare in a suburban environment are exceeded, and sky glow levels would be altered toward those of an urban environment

6.5 ASSESSMENT OF RESIDUAL EFFECTS FOR PROJECT EXPANSION

6.5.1 Assessment Criteria Methods

This section describes the criteria and methods used to assess environmental effects on the atmospheric environment. Residual environmental effects are assessed and characterized using criteria defined in Table 6.5, including direction, magnitude, geographic extent, timing, frequency, duration, reversibility and ecological or socio-economic context. The assessment also evaluates the significance of residual effects using threshold criteria or standards beyond which a residual environmental effect is considered significant. The definition of a significant effect for the Atmospheric Environment VC is provided in Section 6.5.3.

6.5.2 Residual Effects Characterization

Table 6.5 presents definitions for the characterization of residual environmental effects on the atmospheric environment. The criteria are used to describe the potential residual effects that remain after mitigation measures have been implemented. Quantitative measures were developed, where possible, to characterize residual effects. Qualitative considerations were used where quantitative measurement was not possible.

Table 6.5 Characterization of Residual Effects on Atmospheric Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Neutral –** no net change in measurable parameters for the atmospheric environment relative to baseline **Positive –** a residual effect that moves measurable parameters in a direction beneficial to atmospheric environment relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to atmospheric environment relative to baseline
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**For Air Quality:** **Negligible –** model predicted air contaminant concentrations due to Project-related emissions are less than 10% of baseline conditions and do not result in exceedances of the ambient air quality criteria **Low –** model predicted air contaminant concentrations due to Project-related emissions are greater than 10% of baseline conditions, but less than 50% of the ambient air quality criteria **Moderate –** model predicted air contaminant concentrations due to Project-related emissions are greater than 50% of the ambient air quality criteria, but the maximum air contaminant concentrations are less than the ambient air quality criteria **High –** the predicted air contaminant concentrations due to Project-related emissions combined with background frequently exceed the ambient air quality criteria

Table 6.5 Characterization of Residual Effects on Atmospheric Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
		For GHGs: **Negligible –** no measurable change in GHG emissions **Low –** although a change is measurable, based on Agency guidance (CEAA 2003 and ECCC 2020a) and professional judgment, relatively small changes are expected in provincial and national GHG emissions **Moderate –** based on Agency guidance (CEAA 2003) and professional judgment, notable changes are expected in provincial and national GHG emissions **High –** based on Agency guidance (CEAA 2003) and professional judgment, material changes are expected in provincial and national GHG emissions **For Sound Quality:** **Negligible –** no measurable change **Low –** a measurable change but within normal variability of baseline conditions **Moderate –** a measurable change compared with the baseline but within applicable regulatory criteria **High –** Singly or as a substantial contributor in combination with other sources causing exceedances of applicable regulatory criteria beyond the Project Area **For Lighting:** **Negligible –** no measurable change **Low –** effect is detectable but is limited through design mitigation **Moderate –** facility lighting is effectively controlled, but navigation, security and other required lighting have a measurable effect **High –** the design is uncontrolled by Project design criteria and has a pronounced effect
Geographic Extent	The geographic area in which a residual effect occurs	**Project Area –** residual effects are restricted to the Project Area **LAA / RAA –** residual effects extend into the LAA / RAA
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals (i.e., >1% of the time) **Continuous –** occurs continuously
Duration	The period required until the measurable parameter or the VC returns to its existing (baseline) condition, or the residual effect can no longer be measured or otherwise perceived	**Short term –** residual effect restricted to construction or decommissioning, rehabilitation and closure phases **Medium term –** residual effect extends through operation (12 years) **Long term –** residual effect extends beyond operation **Permanent –** recovery to baseline conditions unlikely

Table 6.5 Characterization of Residual Effects on Atmospheric Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Reversibility	Describes whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and rehabilitation **Irreversible –** the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

6.5.3 Significance Definition

A significant residual adverse effect for air quality is one where the predicted Project Expansion releases of air contaminants to the atmosphere degrade the quality of ambient air such that the model predicted concentrations (combined with background levels) are likely to exceed applicable regulatory criteria for ambient air quality beyond the Project Area, and are of concern relative to the geographical extent of predicted exceedances, their frequency of occurrence, and the presence of potentially susceptible receptors.

For GHGs, provincial and federal policies and regulations do not identify specific thresholds or standards that could be used to determine significance when assessing the residual effects of a single project's GHG emissions. The assessment considers the Strategic Assessment of Climate Change (ECCC 2020b) guidance by comparing estimated Project Expansion GHG emissions to the current provincial and federal GHG emission totals and targets. The Impact Assessment Agency of Canada (formerly the Canadian Environmental Assessment Agency [CEAA]) guidance (CEAA 2003) also recommends ranking Project emission contributions into low, moderate or high as presented in the magnitude definition in Table 6.3.

A significant residual adverse effect for sound quality is one where Project Expansion-related noise levels at noise-sensitive receptors are likely to frequently exceed the annoyance and sleep disturbance targets recommended by Health Canada (Health Canada 2017). If the predicted noise levels do not frequently exceed these targets, they are deemed to be not significant.

A significant residual adverse effect on ambient light is defined as an increase in Project Expansion-related light emissions such that the CIE guidelines for light trespass and glare in a suburban environment (E3 / E4 Environmental Zone [refer to Appendix 5A of the EIS]) are exceeded, and sky glow levels would be altered toward those of an urban environment.

6.5.4 Assessment of Residual Effects

The substantive sources of air contaminants, GHGs, noise emissions, and light levels that may occur during construction and operation of the Project Expansion are similar to those of the Approved Project. Increases in air contaminants, GHGs, noise emissions and light levels due to operations associated with the Project Expansion (e.g., additional heavy equipment, blasting, and waste rock and ore handling / storage) are expected. A change to the atmospheric environment due to the Project Expansion alone, however, is not characterized and assessed, since the expansion activities and the activities associated with the Approved Project are so closely interrelated with respect to emissions that could lead to changes in the atmospheric environment. Therefore, the assessment of potential effects on the atmospheric environment considers the Approved Project in combination with the Project Expansion (Section 6.6).

6.6 COMBINED RESIDUAL EFFECTS OF THE PROJECT EXPANSION AND APPROVED PROJECT

6.6.1 Change in Air Quality

The same methods were used to assess the change in air quality as those used in the Valentine Gold EIS, except where noted below. A summary of the methods is provided in the paragraphs below; additional details can be found in Section 5.5.1 of the Valentine Gold EIS (Marathon 2020).

In the Valentine Gold EIS, an air quality transport and dispersion model was used to estimate air contaminant releases and changes to ambient concentrations in the LAA / RAA. Specifically, the California meteorological (CALMET) / California Puff (CALPUFF) modelling system (Scire et al. 2000) was used to determine potential effects of the air contaminant releases during operation of the Approved Project on ambient air quality. The potential air contaminant releases during construction were estimated (not modelled) in the Valentine Gold EIS, since these releases were expected to be short-term and lower in magnitude than during operation. The application of the modelling system was generally conducted in accordance with the NL Guideline for Plume Dispersion Modelling (NLDMAE 2002). The CALMET model is used to provide hourly meteorological data required for the CALPUFF transport and dispersion model.

The same CALPUFF model was refined and updated to model air contaminant releases for the Approved Project in combination with the Project Expansion. In alignment with the approach in the Valentine Gold EIS, the potential air contaminant releases during construction of the Project Expansion were estimated (not modelled) for this updated assessment, since these releases are expected to be short-term and lower in magnitude than during operation.

The substantive sources of air contaminant emissions during construction and operation for the Project Expansion and Approved Project combined are similar to the Approved Project, as follows:

- Processing plant sources (operation)
- Fugitive dust from ore and material handling and processing (construction and operation)
- Fugitive dust from haul truck movements (construction and operation)
- Mobile and stationary equipment combustion exhausts (construction and operation)

- Blasting using ammonium nitrate / emulsion (construction and operation)[1]
- Fugitive dust from wind erosion of the TMF beaches and storage piles (waste rock and ore storage) (construction and operation)

Marathon provided updated fuel consumption for stationary and mobile combustion emission sources and activity data for the operation phase, specifically for the year 2028, which now represents the year of maximum emissions.

6.6.1.1 Construction

Air contaminant releases during construction of the Project Expansion in combination with the Approved Project are expected to be similar in intensity to the Approved Project. Although total emissions over the entire period of construction (of the Approved Project and Project Expansion) will be greater than those from the Approved Project alone, the intensity of releases at a given point in time during construction activities is not expected to be greater than that estimated for the Approved Project. Therefore, air contaminant concentrations are not expected to be greater than those of the Approved Project alone. This is because the construction activities associated with the Project Expansion are not expected to overlap temporally with the construction of other components of the Approved Project such that additional equipment would be required leading to an increase in releases. More specifically, based on current scheduling information, the development of the Marathon pit is expected to occur in later phases of construction and these activities would occur after the most intensive construction activities associated with Berry and Leprechaun pits are finished. Therefore, air contaminant releases during construction were not updated from the original Approved Project estimates.

Based on the anticipated air contaminant emissions rates and in consideration of proposed mitigation measures and management measures (previously committed to in relation to the Approved Project) as described in Appendix 15A for the construction phase, combined residual environmental effects of Project Expansion and Approved Project construction on air quality within the LAA / RAA are expected to be consistent with the Approved Project and thus have not been updated.

6.6.1.2 Operation

Similar to the methodology used for the Approved Project, changes to air quality as a result of the combined Project Expansion and Approved Project are assessed using an atmospheric dispersion model. The releases associated with the Approved Project and the Project Expansion were modelled in combination with ambient background air contaminant concentrations.

Details of the emissions estimates and dispersion modelling for the operation phase of the combined Projects are provided below.

[1] Ammonium nitrate emulsion is used in blasting; however, no emissions factor is available for this explosive. An emissions factor for ANFO was used instead for both the air quality and GHG emissions inventories.

Air Contaminant Emissions

Air contaminant emissions were estimated using design information provided by Marathon and emission factors published by regulatory agencies such as the United States Environmental Protection Agency (US EPA) or ECCC. The design information includes stack gas properties, exhaust gas concentrations in stacks or vents (for the processing plant), ore specifications, and activity data for the mining operation. This information was used in conjunction with published emissions factors to estimate air contaminant releases of particulate matter, trace metals, combustion gases, NH_3 and HCN. Particulate matter and trace metal releases from the processing plant stacks were estimated using the provided source characteristics, operating information, stack dust concentrations and ore specifications (for trace metals).

Since the Project Expansion activities will interact with the other operations and sources of air contaminants related to the Approved Project components, updates to the emissions estimates were completed to incorporate resulting changes, as follows:

- The addition / modification of sources related to the operation of the Berry pit including additional heavy equipment, blasting, and ore / material handling and processing
- Updates to the ore and tailings compositions for estimating releases of trace metals
- Updates to the haul routes and mobile equipment lists and locations (now distributed between three pits)

In addition to the updates related to the Project Expansion, other updates made to the emissions inventory include the following:

- Updates to NH_3 and mercury (Hg) emissions from the processing plant based on updated information provided by Marathon on stack concentrations in the carbon regeneration kiln, barring furnace and electrowinning exhaust stacks
- Refinement of the estimated releases of combustion products from diesel engines in mobile equipment to include load factors and updated US EPA Non-Road emission standards for SO_2
- Updates to the release estimates of fugitive particulate matter and trace metals from the tailings impoundment to incorporate updated estimation methodologies
- Updates to particulate matter release estimates for heavy equipment that include consideration of pit retention factors, where some of the particulate matter is retained within the pit and therefore does not enter the atmosphere

The updated emissions inventory is provided in Appendix 6A.

Additional details on the substantive sources of air contaminants and the emissions estimation methodologies for each activity are provided in the Valentine Gold EIS (Marathon 2020).

The source locations for the Approved Project and Project Expansion during operation are shown in Figure 6-1.

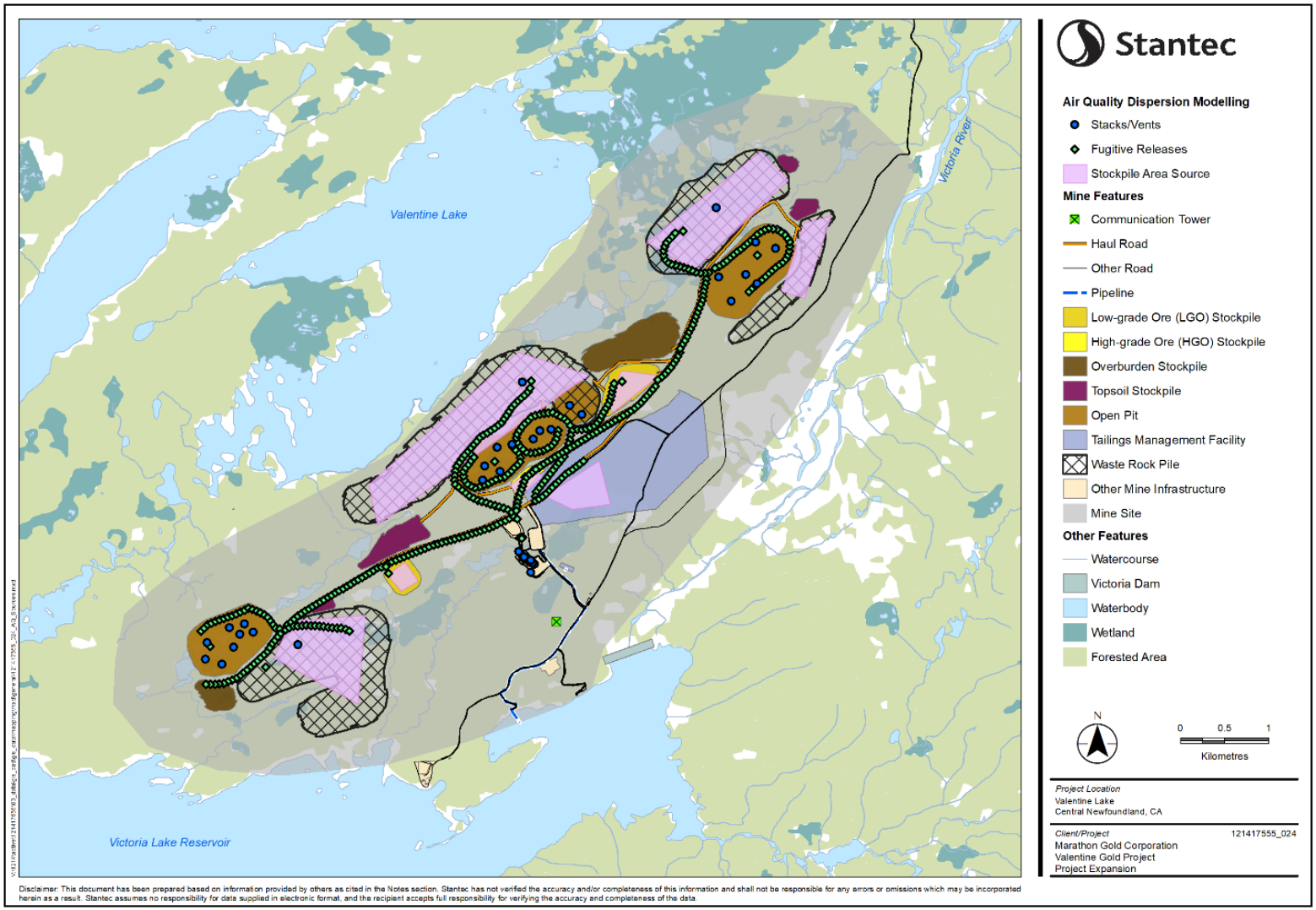

Figure 6-1 Source Locations – Project Expansion and Approved Project – Operation

A summary of the provided activity data for operation used for the emissions estimates for the Project Expansion combined with the Approved Project is provided in Table 6.6. The activity data used in the Valentine Gold EIS for the Approved Project alone is also provided for comparison.

Table 6.6 Activity Data - Operation

Activity	Value	
	Approved Project	**Project Expansion plus Approved Project**
Blasting		
Explosives used (t/blast)	51.0	51.0
Blasts per year	350	345[1]
Crushing and Screening		
Primary crushing rate (t/d)	11,000	11,000
Pebble Crushing (t/d)	2,500	2,500
Screening rate (t/d)	11,000	11,000
Material Handling Transfer and Loading Rates (t/d)		
Primary crusher discharge conveyor	11,000	11,000
Crushed ore stockpile feed conveyor	11,000	11,000
SAG mill feed conveyor	11,000	11,000
Pebble crusher conveyors	2,500	2,500
Crushed ore stockpile discharge apron feeder	11,000	11,000
Intensive leaching feed hopper	5.5	5.5
Marathon - waste rock	72,316	48,904[2]
Marathon - low grade stockpile	40,406	2,825
Leprechaun - waste rock	67,230	70,027
Leprechaun - low grade stockpile	40,406	471
Leprechaun - high grade stockpile	8,689	1,329
Berry - waste rock	NA	51,890
Haul Routes		
Distance travelled (km/a)	405,102	1,669,728[3]
Truck trips per year	548,636	632,642

Table 6.6 Activity Data - Operation

Activity	Value	
	Approved Project	**Project Expansion plus Approved Project**
Mobile Equipment Fuel Usage (m^3/a)		
Rotary Drill, Tracked, 200 mm diameter	NA	2,560
DTH (Down-the-Hole) Drill, Tracked, 144 mm diameter	NA	954
RC (Reverse Circulation) Drill, Tracked, 144 mm diameter	NA	156
DTH Drill, Tracked, 165 mm diameter	2,671	NA
Wheel Loader, 13 m^3 bucket	1,313	1,004
Hydraulic Excavator, 15 m^3 bucket	NA	3,230
Hydraulic Excavator, 12 m^3 bucket	3,678	2,556
Rigid Fram Hauler, 132 t payload	NA	20,714
Rigid Fram Hauler, 91 t payload	18,569	5,936
Track Dozer, 447 kW	986	1,082
Track Dozer, 325 kW	568	647
Wheel Dozer, 370 kW	NA	421

Notes:
t/blast = tonnes per blast
t/d = tonnes per day
km/a = kilometres per annum
m^3/a = cubic metres per annum
m^3 = cubic metre
t = tonne;
kW = kilowatt
NA not applicable, added for Project Expansion or no longer expected to be used for the Approved Project
[1] This reflects a small refinement in prediction of number of annual blasts
[2] This reflects a decrease in resource prediction and an extension in operational life for the Marathon pit
[3] This reflects an updated estimate, recognizing there are additional routes with the addition of the Berry pit

A summary of the annual air contaminant releases from the Project Expansion combined with the Approved Project is provided in Table 6.7.

Table 6.7 Annual Air Contaminant Release Estimates – Operation – Project Expansion plus Approved Project

Source/Activity	Emissions (t/a)											
	TSP	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**HCN**	**NH_3**	**As**	**Cd**	**Cu**	**Pb**
Pit Blasting	3.98	3.98	3.98	141	17.6	598	-	-	2.90E-05	2.43E-06	3.00E-04	8.45E-05
Stockpiles	80.5	40.2	16.1	-	-	-	-	-	8.05E-04	7.24E-05	8.05E-03	2.25E-03
TMF	348	174	26.1	-	-	-	-	-	4.39E-03	2.97E-04	6.16E-02	6.32E-03
Conveyors / Transfer Points	18.2	8.6	1.30	-	-	-	-	-	1.33E-04	1.11E-05	1.37E-03	3.86E-04
Loading / Unloading at Stockpiles	61.8	29.2	4.43	-	-	-	-	-	4.70E-04	3.98E-05	4.83E-03	1.45E-03
Ore Processing Equipment	99.1	36.8	5.58	-	-	-	-	-	7.23E-04	6.06E-05	7.46E-03	2.11E-03
Haul Route Fugitives	1,689	714	79	-	-	-	-	-	-	-	-	-
Processing Plant Sources[1]	129	111	58.1	-	-	-	47.1	2.35	9.40E-04	7.88E-05	9.70E-03	2.74E-03
Mobile Combustion Sources - Heavy Equipment	5.47	5.47	5.47	469	0.944	492	-	-	-	-	-	-
Total	**2,434**	**1,123**	**200**	**609**	**19**	**1,090**	**47.1**	**2.35**	**7.49E-03**	**5.62E-04**	**9.33E-02**	**1.53E-02**

Source / Activity	Hg	Ni	Zn	Ba	Sr	Be	Co	Li	Sb	Sn	Se	Cr
Pit Blasting	8.29E-07	2.61E-05	9.85E-05	8.53E-05	1.12E-04	4.18E-07	3.70E-05	5.62E-05	6.10E-05	9.41E-05	8.00E-05	1.37E-04
Stockpiles	2.41E-05	6.60E-04	1.79E-03	1.85E-03	2.47E-03	8.53E-06	5.63E-04	1.61E-03	1.77E-03	2.90E-03	2.41E-03	4.11E-03
TMF	7.53E-05	7.94E-03	1.55E-02	2.44E-02	1.74E-02	5.51E-05	1.91E-03	4.53E-03	4.75E-03	7.61E-03	8.73E-03	3.91E-02
Conveyors / Transfer Points	3.78E-06	1.19E-04	4.50E-04	3.89E-04	5.10E-04	1.91E-06	1.69E-04	2.56E-04	2.78E-04	4.30E-04	3.65E-04	6.25E-04
Loading / Unloading at Stockpiles	1.35E-05	4.30E-04	1.60E-03	1.46E-03	1.97E-03	6.67E-06	5.80E-04	9.14E-04	9.10E-04	1.51E-03	1.31E-03	2.14E-03
Ore Processing Equipment	2.06E-05	6.51E-04	2.45E-03	2.12E-03	2.78E-03	1.04E-05	9.22E-04	1.40E-03	1.52E-03	2.35E-03	1.99E-03	3.41E-03
Haul Route Fugitives	-	-	-	-	-	-	-	-	-	-	-	-
Processing Plant Sources	5.52E-04	8.46E-04	3.19E-03	2.76E-03	3.62E-03	1.35E-05	1.20E-03	1.82E-03	1.98E-03	3.05E-03	2.59E-03	4.43E-03
Mobile Combustion Sources - Heavy Equipment	-	-	-	-	-	-	-	-	-	-	-	-
Total	**6.91E-04**	**1.07E-02**	**2.51E-02**	**3.30E-02**	**2.89E-02**	**9.66E-05**	**5.37E-03**	**1.06E-02**	**1.13E-02**	**1.79E-02**	**1.75E-02**	**5.40E-02**

Notes:
NO_x = nitrogen oxides; t/a = ; As = arsenic
Cd = cadmium; Cu = copper
Pb = lead; Ni = nickel; Zn = zinc
Ba = barium; Sr = strontium
Be = beryllium; Co = cobalt; Li = lithium
Sb = antimony; Sn = tin
Se = selenium; Cr = chromium
[1] There was an error in transcribing the Processing Plant Sources annual air contaminant release estimates in Table 5.15 of the Valentine Gold EIS. The estimates presented above are correct for the Approved Project in combination with the Project Expansion.

A comparison of emissions from the Approved Project and the Approved Project combined with the Project Expansion is provided in Table 6.8.

Table 6.8 Comparison of Air Contaminant Emissions

Air Contaminant	CAS #	Emission Rate (tonnes/year)		Percent Change (%)
		Approved Project	Project Expansion plus Approved Project	
TSP	N/A-1	1,585	2,434	54%
PM_{10}	N/A-2	677	1,123	66%
$PM_{2.5}$	N/A-3	163	200	23%
NO_X	10102-44-0	820	609	-26%
SO_2	7446-09-5	251	19	-93%
CO	630-08-0	1,319	1,090	-17%
HCN	74-90-8	47.1	47.1	0%
NH_3	7664-41-7	48.0	2.35	-95%
As	7440-38-2	3.29E-03	7.49E-03	128%
Cd	7440-43-9	2.96E-04	5.62E-04	90%
Cu	7440-50-8	3.29E-02	9.33E-02	184%
Pb	7439-92-1	8.13E-03	1.53E-02	89%
Hg	7439-97-6	6.24E-04	6.91E-04	11%
Ni	7440-02-0	2.53E-03	1.07E-02	321%
Zn	7440-66-6	6.18E-03	2.51E-02	305%
Ba	7440-39-3	6.05E-03	3.30E-02	446%
Sr	7440-24-6	7.44E-03	2.89E-02	288%
Be	7440-41-7	3.27E-05	9.66E-05	195%
Co	7440-48-4	2.03E-03	5.37E-03	165%
Li	7439-93-2	6.57E-03	1.06E-02	61%
Sb	7440-36-0	8.30E-03	1.13E-02	36%
Sn	7440-31-5	1.24E-02	1.79E-02	45%
Se	7782-49-2	9.86E-03	1.75E-02	77%
Cr	7440-47-3	1.80E-02	5.40E-02	200%
Bi	7440-69-9	3.29E-03	6.08E-03	85%

Note:
Bi = bismuth

Changes in the air contaminant releases compared to the release estimates for Approved Project sources are due to the addition of the Project Expansion and related emission sources, as well as updates to the methodology used to estimate the emissions, as described above. Certain air contaminant releases increased and some decreased compared to the Approved Project, and these are described in more detail below.

Release estimates of particulate matter and trace metals increased due to addition of the Berry pit operations, associated haul truck traffic, updates to the tailings impoundment release estimates and changes in the ore and tailings specifications with the addition of the ore from the Berry pit.

Combustion gas release estimates decreased as a result of refinements to the approach used for the estimates; more specifically, new emission standards for SO_2 were used and load factors were applied to the mobile equipment diesel engines (i.e., load factors were not considered in the release estimates in the Valentine Gold EIS).

Release estimates of NH_3 from the processing plant decreased as a result of updated emissions and design information for specific sources at the processing plant. Releases of Hg from processing plant sources also decreased because of the updated emissions information; however, these decreases were offset by increases from other Project Expansion sources (as a result of changes in ore / tailings composition and additional sources associated with the Berry pit). The updated emissions information for NH_3 and Hg from the carbon regeneration kiln, barring furnace and electrowinning stacks was provided by Marathon.

Dispersion Modelling Results

The CALPUFF dispersion modelling system was used to predict the maximum ground level concentrations of the substances of interest in the LAA / RAA during the normal operation of the Project Expansion and the Approved Project. Additional information on CALPUFF is provided in the Valentine Gold EIS in Section 5.3.5.2 and Appendix 5B (Marathon 2020).

The maximum predicted concentrations (outside the Project Area) of the air contaminants of concern released during operation (Project Expansion with the Approved Project) combined with measured background concentrations (to account for existing conditions) are provided in Table 6.9.

The maximum predicted concentrations, combined with measured background, at the camps (exploration camp, accommodations camp, outfitters camp) and cabin locations in the LAA / RAA are provided in Table 6.10; these are the highest predicted concentrations that occur at camp / cabin locations within the LAA / RAA. This shows the maximum concentrations that could occur out of all camps / cabins in the LAA / RAA. Note that as part of the Project Expansion, the existing exploration camp will be dismantled and removed, and this location will be used for the explosives facility, at which point it will no longer constitute a sensitive receptor; the exploration camp has been retained in the model results for consistency with the Valentine Gold EIS. As well, the cabin location located closest to the Project Area (Figure 6-2) will be relocated in the near future per an agreement with Marathon. The locations vary depending on the air contaminant; maximum concentration does not necessarily occur at the nearest receptor; rather, this depends on the sources contributing to the maximum concentration.

The predicted concentrations are also presented graphically in the form of isopleth plots (concentration contour plots). Plots were prepared for 1-hour NO_2, 24-hour TSP, PM_{10}, $PM_{2.5}$ and HCN, and annual $PM_{2.5}$. An example contour plot generated for 24-hour TSP is provided in Figure 6-2. The other contour plots are provided in Appendix 6B. The highest predicted concentrations generally occur within 1 to 2 km of the Project Area boundary.

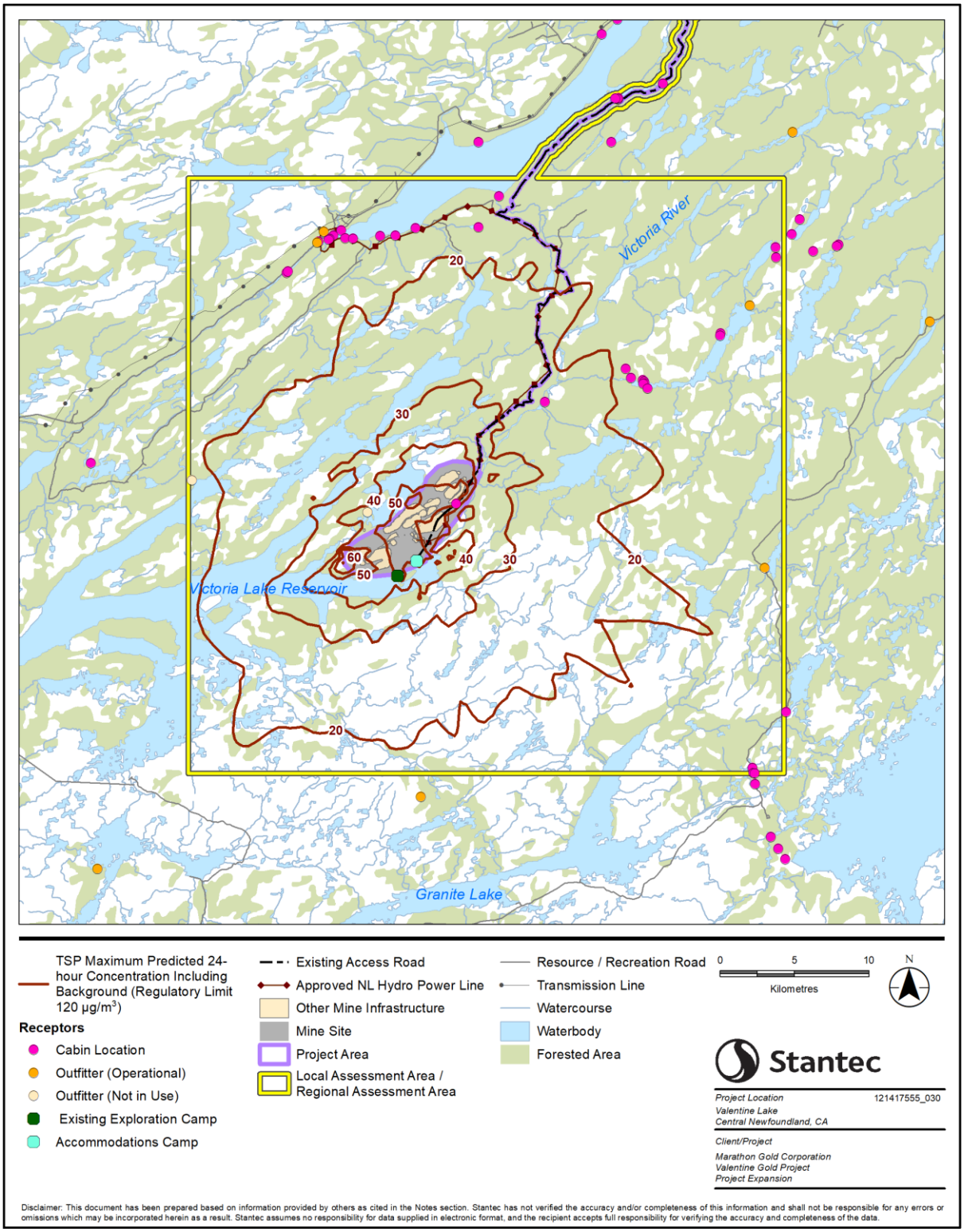

Figure 6-2 Maximum Predicted 24-Hour TSP Concentrations (Including Background)

Table 6.9 Maximum Predicted Concentrations – Project Expansion and Approved Project – Operation

Contaminant	Average Period	Background Concentrations (µg/m^3)	Predicted Concentrations (µg/m^3)	Predicted plus Background (µg/m^3)	NL AQ Standard (µg/m^3)	2020 CAAQS (µg/m^3)	2025 CAAQS (µg/m^3)	Ontario ACB (µg/m^3)	Percent of NL / Adopted Standard
TSP	24-hour	13.8	76.1	89.9	120	-	-	-	75%
	Annual	2.6	8.91	11.6	60	-	-	-	19%
PM_{10}	24-hour	13.0	38.2	**51.2**	50	-	-	-	**102%**
$PM_{2.5}$	24-hour	10.3	7.14	17.4	25	27.0	NA	-	70%
	Annual	3.8	0.895	4.74	8.8	8.8	NA	-	54%
NO_2	1-hour	3.8	79.4	83.2	400	112.9	79	-	21%
	24-hour	1.9	34.5	36.4	200	-	-	-	18%
	Annual	1.4	3.24	4.64	100	32.0	28.2	-	5%
SO_2	1-hour	2.6	18.8	21.4	900	183.4	170	-	2%
	3-hour	2.6	6.67	9.29	600	-	-	-	2%
	24-hour	neg.	4.12	4.12	300	-	-	-	1%
	Annual	neg.	0.0513	0.0513	60	13.1	10.5	-	<1%
CO	1-hour	206	649	855	35,000	-	-	-	2%
	8-hour	200	545	745	15,000	-	-	-	5%
NH_3	24-hour	neg.	0.250	0.250	100	-	-	-	<1%
HCN	24-hour	neg.	4.93	4.93	-	-	-	8	62%
As	24-hour	2.1E-03	4.19E-04	2.52E-03	0.3	-	-	-	<1%
Cd	24-hour	4.2E-04	2.83E-05	4.48E-04	2	-	-	-	<1%
Cu	24-hour	1.3E-03	5.83E-03	0.0071	50	-	-	-	<1%
Pb	24-hour	1.3E-03	6.13E-04	1.91E-03	2	-	-	-	<1%
	30-day	5.0E-04	2.37E-04	7.38E-04	0.7	-	-	-	<1%
Hg	24-hour	neg.	6.17E-05	6.17E-05	2	-	-	-	<1%

Table 6.9 Maximum Predicted Concentrations – Project Expansion and Approved Project – Operation

Contaminant	Average Period	Background Concentrations (µg/m^3)	Predicted Concentrations (µg/m^3)	Predicted plus Background (µg/m^3)	NL AQ Standard (µg/m^3)	2020 CAAQS (µg/m^3)	2025 CAAQS (µg/m^3)	Ontario ACB (µg/m^3)	Percent of NL / Adopted Standard
Ni	24-hour	2.1E-03	7.54E-04	2.85E-03	2	-	-	-	<1%
Zn	24-hour	2.1E-02	1.48E-03	2.25E-02	120	-	-	-	<1%
Ba	24-hour	2.1E-03	2.34E-03	4.44E-03	-	-	-	10	<1%
Sr	24-hour	2.1E-03	1.67E-03	3.77E-03	-	-	-	120	<1%
Be	24-hour	1.3E-03	5.27E-06	1.31E-03	-	-	-	0.01	13%
Co	24-hour	1.3E-03	2.19E-04	1.52E-03	-	-	-	0.1	2%
Li	24-hour	neg.	4.32E-04	4.32E-04	-	-	-	20	<1%
Sb	24-hour	2.1E-03	4.54E-04	2.55E-03	-	-	-	25	<1%
Sn	24-hour	1.3E-03	7.29E-04	2.03E-03	-	-	-	10	<1%
Se	24-hour	4.2E-03	8.31E-04	5.03E-03	-	-	-	10	<1%
Cr	24-hour	2.1E-03	3.72E-03	5.82E-03	-	-	-	0.5	1%
Bi	24-hour	2.1E-03	2.94E-04	2.39E-03	-	-	-	2.5	<1%

Notes:
NL AQ = Newfoundland and Labrador Air Quality Guideline
ACB = Air Contaminants Benchmarks

Table 6.10 Maximum Predicted Concentrations – Project Expansion and Approved Project – Camp / Cabin Locations – Operation

Contaminant	Average Period	Background Concentrations (µg/m³)	Predicted Concentrations* (µg/m³)	Predicted plus Background (µg/m³)	NL AQ Standard (µg/m³)	2020 CAAQS (µg/m³)	2025 CAAQS (µg/m³)	Ontario ACB (µg/m³)	Percent of NL / Adopted Standard
TSP	24-hour	13.8	13.8	46.5	120	-	-	-	50%
	Annual	2.6	2.6	7.90	60	-	-	-	18%
PM_{10}	24-hour	13.0	13.0	24.0	50	-	-	-	74%
$PM_{2.5}$	24-hour	10.3	10.3	7.05	25	27.0	NA	-	69%
	Annual	3.8	3.8	0.573	8.8	8.8	NA	-	50%
NO_2	1-hour	3.8	64.5	68.3	400	112.9	79	-	17%
	24-hour	1.9	20.4	22.3	200	-	-	-	11%
	Annual	1.4	2.67	4.07	100	32.0	28.2	-	4%
SO_2	1-hour	2.6	12.4	15.0	900	183.4	170	-	2%
	3-hour	2.6	4.38	7.00	600	-	-	-	1%
	24-hour	neg.	1.34	1.34	300	-	-	-	<1%
	Annual	neg.	0.0353	0.0353	60	13.1	10.5	-	<1%
CO	1-hour	206	432	638	35,000	-	-	-	2%
	8-hour	200	215	415	15,000	-	-	-	3%
NH_3	24-hour	neg.	0.189	0.189	100	-	-	-	<1%
HCN	24-hour	neg.	4.32	4.32	-	-	-	8	54%
As	24-hour	2.1E-03	1.49E-04	2.25E-03	0.3	-	-	-	<1%
Cd	24-hour	4.2E-04	1.23E-05	4.32E-04	2	-	-	-	<1%
Cu	24-hour	1.3E-03	1.54E-03	2.84E-03	50	-	-	-	<1%
Pb	24-hour	1.3E-03	4.32E-04	1.73E-03	2	-	-	-	<1%
	30-day	5.0E-04	1.67E-04	6.68E-04	0.7	-	-	-	<1%
Hg	24-hour	neg.	4.70E-05	4.70E-05	2	-	-	-	<1%

Table 6.10 Maximum Predicted Concentrations – Project Expansion and Approved Project – Camp / Cabin Locations – Operation

Contaminant	Average Period	Background Concentrations (µg/m^3)	Predicted Concentrations* (µg/m^3)	Predicted plus Background (µg/m^3)	NL AQ Standard (µg/m^3)	2020 CAAQS (µg/m^3)	2025 CAAQS (µg/m^3)	Ontario ACB (µg/m^3)	Percent of NL / Adopted Standard
Ni	24-hour	2.1E-03	1.73E-04	2.27E-03	2	-	-	-	<1%
Zn	24-hour	2.1E-02	5.27E-04	2.15E-02	120	-	-	-	<1%
Ba	24-hour	2.1E-03	5.25E-04	2.62E-03	-	-	-	10	<1%
Sr	24-hour	2.1E-03	5.83E-04	2.68E-03	-	-	-	120	<1%
Be	24-hour	1.3E-03	2.22E-06	1.30E-03	-	-	-	0.01	13%
Co	24-hour	1.3E-03	2.01E-04	1.50E-03	-	-	-	0.1	2%
Li	24-hour	neg.	2.86E-04	2.86E-04	-	-	-	20	<1%
Sb	24-hour	2.1E-03	3.13E-04	2.41E-03	-	-	-	25	<1%
Sn	24-hour	1.3E-03	4.75E-04	1.78E-03	-	-	-	10	<1%
Se	24-hour	4.2E-03	4.04E-04	4.60E-03	-	-	-	10	<1%
Cr	24-hour	2.1E-03	8.55E-04	2.95E-03	-	-	-	0.5	<1%
Bi	24-hour	2.1E-03	1.41E-04	2.24E-03	-	-	-	2.5	<1%

Note:
* Locations of maximum predicted concentrations (across camp / cabin locations) are dependent on the specific air contaminant. In general, the most impacted camp / cabins are within the Project Area or within 10 km of the Project Area. Key receptors are show on Figure 6-2 and on the contour plots in Appendix 6B.

Maximum predicted concentrations of most air contaminants modelled (from Project Expansion and Approved Project related air contaminant releases combined with measured ambient background concentrations) are below the provincial ambient air quality standards and the adopted ambient air quality standards outside the Project Area, with the noted exception of the 24-hour PM_{10} predictions.

Maximum predicted 24-hour concentrations of PM_{10} from Project Expansion and Approved Project related releases combined with the measured ambient background concentration are above the ambient air quality standard (adopted for the assessment) as presented in Table 6.9. The exceedances of the 24-hour PM_{10} standard are predicted to occur along the Project Area boundary to the southwest (near the Leprechaun pit) at six receptor locations (out of nearly 15,000 modelled). Exceedances are expected to be infrequent and of short duration. In total there were four days (out of 1,095 modelled) when exceedances of the 24-hour standard were predicted to occur (or less than 0.5% of the time). The predicted exceedances of the PM_{10} standard are likely a result of releases from the sources in and around the Leprechaun pit (haul trucks, blasting and waste rock storage), based on the location of occurrence of the maximum predicted concentrations (~1 km to the west of the Leprechaun pit along the fence line).

Generally, the predicted concentrations reach background levels within 10 to 15 km of the Project Area boundary. Maximum predicted air contaminant concentrations (including background) are also below the adopted standards at the camps (existing exploration camp, accommodations camp, outfitters camp) and cabin locations (at camp / cabin locations within the LAA / RAA), as shown in Table 6.10. As noted above, the existing exploration camp will be dismantled and removed as part of the Project Expansion and will no longer constitute a sensitive receptor. As well, the cabin location located closest to the Project Area (Figure 6-2) will be relocated in the near future per an agreement with Marathon.

The maximum predicted concentrations (including background) of $PM_{2.5}$, are also below the 24-hour CAAQS.

The maximum predicted concentrations resulting from releases associated with the Project Expansion in combination with the Approved Project are compared with the maximum predicted concentrations presented in the Valentine Gold EIS (Approved Project alone) in Table 6.11.

Table 6.11 Maximum Predicted Concentrations – Operation –Comparison of Approved Project with Approved Project Plus Project Expansion

Contaminant	Average Period	Background Concentrations (µg/m^3)	Predicted Concentrations Incl. Background (µg/m^3)		NL AQ Standard (µg/m^3)	2020 CAAQS (µg/m^3)	2025 CAAQS (µg/m^3)	Ontario ACB (µg/m^3)	Percent of NL / Adopted Standard	
			Approved Project	Project Expansion plus Approved Project					Approved Project	Project Expansion plus Approved Project
TSP	24-hour	13.8	118	89.9	120	-	-	-	99%	75%
	Annual	2.6	5.2	11.6	60	-	-	-	9%	19%
PM_{10}	24-hour	13.0	**65.2**	**51.2**	50	-	-	-	**130%**	**102%**
$PM_{2.5}$	24-hour	10.3	20.0	17.4	25	27.0	NA	-	80%	70%
	Annual	3.8	4.57	4.74	8.8	8.8	NA	-	52%	54%
NO_2	1-hour	3.8	194	83.2	400	112.9	79	-	48%	21%
	24-hour	1.9	77.2	36.4	200	-	-	-	39%	18%
	Annual	1.4	7.93	4.64	100	32.0	28.2	-	8%	5%
SO_2	1-hour	2.6	461	21.4	900	183.4	170	-	51%	2%
	3-hour	2.6	274	9.29	600	-	-	-	46%	2%
	24-hour	neg.	97.0	4.12	300	-	-	-	32%	1%
	Annual	neg.	3.42	0.0513	60	13.1	10.5	-	6%	<1%
CO	1-hour	206	1,863	855	35,000	-	-	-	5%	2%
	8-hour	200	1055	745	15,000	-	-	-	7%	5%
NH3	24-hour	neg.	5.10	0.250	100	-	-	-	5%	<1%
HCN	24-hour	neg.	4.93	4.93	-	-	-	8	62%	62%
As	24-hour	2.1E-03	4.95E-03	2.52E-03	0.3	-	-	-	2%	<1%
Cd	24-hour	4.2E-04	6.34E-04	4.48E-04	2	-	-	-	<1%	<1%
Cu	24-hour	1.3E-03	0.0185	7.13E-03	50	-	-	-	<1%	<1%

Table 6.11 Maximum Predicted Concentrations – Operation –Comparison of Approved Project with Approved Project Plus Project Expansion

Contaminant	Average Period	Background Concentrations (µg/m^3)	Predicted Concentrations Incl. Background (µg/m^3)		NL AQ Standard (µg/m^3)	2020 CAAQS (µg/m^3)	2025 CAAQS (µg/m^3)	Ontario ACB (µg/m^3)	Percent of NL / Adopted Standard	
			Approved Project	Project Expansion plus Approved Project					Approved Project	Project Expansion plus Approved Project
Pb	24-hour	1.3E-03	6.00E-03	1.91E-03	2	-	-	-	<1%	<1%
	30-day	5.0E-04	2.32E-03	7.38E-04	0.7	-	-	-	<1%	<1%
Hg	24-hour	neg.	4.48E-04	6.17E-05	2	-	-	-	<1%	<1%
Ni	24-hour	2.1E-03	3.37E-03	2.85E-03	2	-	-	-	<1%	<1%
Zn	24-hour	2.1E-02	3.01E-02	2.25E-02	120	-	-	-	<1%	<1%
Ba	24-hour	2.1E-03	1.20E-02	4.44E-03	-	-	-	10	<1%	<1%
Sr	24-hour	2.1E-03	9.47E-03	3.77E-03	-	-	-	120	<1%	<1%
Be	24-hour	1.3E-03	1.32E-03	1.31E-03	-	-	-	0.01	13%	13%
Co	24-hour	1.3E-03	2.25E-03	1.52E-03	-	-	-	0.1	2%	2%
Li	24-hour	neg.	3.44E-03	4.32E-04	-	-	-	20	<1%	<1%
Sb	24-hour	2.1E-03	5.87E-03	2.55E-03	-	-	-	25	<1%	<1%
Sn	24-hour	1.3E-03	7.41E-03	2.03E-03	-	-	-	10	<1%	<1%
Se	24-hour	4.2E-03	1.16E-02	5.03E-03	-	-	-	10	<1%	<1%
Cr	24-hour	2.1E-03	1.19E-02	5.82E-03	-	-	-	0.5	2%	1%
Bi	24-hour	2.1E-03	4.37E-03	2.39E-03	-	-	-	2.5	<1%	<1%

In most cases, the maximum predicted concentrations decreased slightly or remained similar to those predicted for the Approved Project (as originally presented in the Valentine Gold EIS). Specifically, maximum predicted particulate matter concentrations (TSP, PM_{10} and $PM_{2.5}$) decreased compared to the Approved Project even though overall emissions increased. This is likely a result of the characterization of the tailings impoundment fugitive releases which were refined in the model. In the original EIS, the TMF fugitive releases were modelled using a constant maximum emission rate (based on hourly release estimates) and a wind speed threshold factor in the model, meaning releases in the model only occur for specific hours with winds above the threshold value. For this updated modelling (for the Project Expansion combined with the Approved Project), the release estimates were modelled using an hourly variant emissions file, where the emissions are modelled on an hourly basis over the three-year period, based on the hourly estimates. For the updated model, the tailings impoundment fugitive emissions were also assumed to be negligible during the winter months with snow cover (December to April). This period was established based on the months with snow cover for western Newfoundland as defined in the NLDECC Guidance for Plume Dispersion Modelling (GD-PPD-019.2) (NLDECC 2012). These model refinements resulted in a reduction in the overall (highest) maximum predicted concentrations at specific receptor locations. Additional information on the hourly release estimates from wind erosion of the tailings impoundment beaches (particulate matter and bound trace metals) and the modelling methodology is provided in Section 5.5.1 and Appendix 5B of the Valentine Gold EIS (Marathon 2020).

Maximum predicted concentrations of combustion gases also decreased due to reductions in emission rates from refinements to the release estimates (as described above).

Based on the refined emissions estimates and release characterization in the model, the maximum predictions of particulate matter and combustion gases presented in the Valentine Gold EIS were likely over-predictions of actual ambient concentrations that would result during operation.

Summary

Due to refinements to the air contaminant release estimates (updated diesel engine emission standards and application of engine load factors) and source characterization in the model (tailings impoundment fugitive dust characterization), the maximum predicted ambient concentrations resulting from the Project Expansion and the Approved Project during operation are similar to or have decreased in comparison to those presented in the Valentine Gold EIS (Approved Project alone). Additional details on the updates to the emissions estimates and model source characterization are provided above.

Therefore, the conclusions in terms of magnitude, duration and significance are unchanged from those in the Valentine Gold EIS (for the Approved Project). The summary of residual effects on a change in air quality is provided in Section 5.5.1.3 of the Valentine Gold EIS (Marathon 2020) and below (Section 6.6.4).

For construction and during decommissioning, rehabilitation and closure, there are no substantive changes to the conclusions presented in the Valentine Gold EIS, as summarized in Section 6.6.4.

6.6.2 Change in Greenhouse Gases

The methodologies used to estimate GHG emissions for the Project Expansion and Approved Project are the same as those used for the Valentine Gold EIS. A summary of these methodologies is provided in the paragraphs below; details can be found in Section 5.5.2 of the Valentine Gold EIS (Marathon 2020).

The substantive sources of direct GHG emissions during construction and operation are unchanged. Mobile and stationary equipment combustion exhausts, blasting using ammonium nitrate / emulsion, and emissions from land clearing are the primary emission sources. These direct GHG emissions consist primarily of CO_2, with smaller amounts of CH_4 and N_2O.

Although total GHG emissions over the entire period of construction (of the Approved Project and Project Expansion) are expected to increase slightly, the changes in mine design are not expected to cause a substantive increase in fuel use. For this reason, the GHG emissions estimated for construction of the Approved Project have not been updated for the combined Projects.

Indirect emissions are associated with the consumption of purchased electricity and the shipping of supplies. There has not been an update to the amount of electricity consumed and, therefore, the estimate of 2,506 t CO_2e per year during operation remains valid.

Marathon provided the fuel consumption in stationary and mobile combustion emission sources for the operation phase of the combined Projects, specifically for the year 2028, which now represents the year of maximum activities and maximum emissions. A comparison of fuel usage is provided in Table 6.12.

Table 6.12 Summary of Change in Fuel Usage for the Approved Project in Combination with the Project Expansion

Category	Approved Project Fuel Usage (kL)	Approved Project Plus Project Expansion Fuel Usage (kL)	Change (%)
Stationary Combustion			
Diesel	672	1,113	+66%
Mobile Combustion			
Light-Duty Diesel Trucks	166	209	+26%
Heavy-Duty Diesel Vehicles	21,758	28,156	+29%
Light-Duty Gasoline Vehicles	37	37	No change
Off-Road Diesel Equipment	11,185	14,489	+30%
Note: kL = kilolitre			

For consistency with the Valentine Gold EIS, the same emission factors were used to estimate the mobile and stationary combustion emissions. These emission factors can be found in Table 5.18 and Table 5.19 of the Valentine Gold EIS, respectively (Marathon 2020).

The GHG emissions from explosives detonation have been updated using the latest explosive consumption estimates. The estimated explosives consumption increased by 38%. The explosives detonation emission factor was based on ANFO for consistency with the Valentine Gold EIS. While ammonium nitrate emulsion is the explosive to be used for blasting, it is anticipated to have a similar GHG emission factor to ANFO.

A summary of maximum estimated annual GHG emissions during operation of the Approved Project combined with the Project Expansion is presented in Table 6.13.

Table 6.13 Summary of Maximum Estimated Annual GHG Emissions During Operation of the Combined Projects

Activity	Units	CO_2	CH_4	N_2O	Total (expressed as CO_{2e})
Blasting[A]	t/y	3,308	-	-	3,308
Stationary Combustion[B]	t/y	2,984	0.15	0.45	3,106
On-Road Transportation[C]	t/y	76,130	3.98	2.36	76,933
Off-Road Mobile Equipment[C]	t/y	38,844	1.06	0.29	38,957
Electricity Consumption (indirect)[D]	t/y	2,506	-	-	2,506
Shipping of Delivered Supplies (indirect)[C]	t/y	926	0.05	0.03	935
Total Direct Emissions	*t/y*	*121,266*	*5.2*	*3.1*	*122,318*
Total Indirect Emissions	*t/y*	*3,432*	*0.05*	*0.03*	*3,441*
Total (direct + indirect)	*t/y*	*124,698*	*5.2*	*3.1*	*125,759*

Notes:
t/y = tonne per year
[A] Based on MAC emission factors (MAC 2014)
[B] Based on ECCC's 2019 Canada's Greenhouse Gas Quantification Requirements (ECCC 2019)
[C] Based on ECCC emission factors provided in Table A6-13 of the NIR (ECCC 2020a)
[D] Based on electricity consumption emission factor for NL (27 g carbon dioxide equivalent per kilowatt-hour [CO_{2e}/kWh]) from Table A13-2 the ECCC NIR (ECCC 2020a)

GHG emissions over the life of the mine (14.4 years) are estimated to be 690,051 t CO_2e.

With the updated Project Expansion information, the estimated contribution of maximum operating year GHG emissions for the combined Approved Project and Project Expansion to provincial and national totals are presented in Table 6.14.

Table 6.14 Estimated Contribution of Updated Operation GHG Emissions to National and Provincial Totals (2021)

Parameter	Units	CO_2	CH_4	N_2O	Total (expressed as CO_{2e})[A]
Updated Project Operation GHG Emissions (direct and indirect)	kt/y	125	0.005	0.003	126
NL GHG Emissions	kt/y	7,314	29	0.35	8,336
National GHG Emissions	kt/y	537,174	3,620	101	670,428
Updated Project Operation Contribution to NL GHG Emissions	%	1.7	0.02	0.9	1.5
Updated Project Operation Contribution to National GHG Emissions	%	0.02	<0.01	<0.01	0.02

Notes:
Provincial and national GHG emission totals from ECCC NIR (ECCC 2023)
[A] Provincial and national GHG emission totals include other fluorinated GHGs

As outlined in section 12.1 of the Management of Greenhouse Gas Reporting Regulations, a BACT analysis was conducted for the Approved Project, which identified mitigation measures for Approved Project GHG emissions >25,000 CO2e/year. The predicted annual GHG emissions for the combined Projects will also be >25,000 CO2e/year during the first eight years of operation. Since the BACT analysis also applies to the Project Expansion, as the same activities will be taking place as for the Approved Project, the applicable mitigation measures from the original BACT analysis will also be implemented during conduct of the Project Expansion for activities occurring within the Project Area.

6.6.3 Change in Sound Quality

The methods used to estimate sound quality impacts for the Approved Project combined with the Project Expansion are the same as those used for the Approved Project. A summary of the software and methods used is provided in the paragraphs below; details can be found in Section 5.3.5.4 and Section 5.5.3 of the Valentine Gold EIS.

Construction will now include the development of the Project Expansion infrastructure. Sound emissions are expected from the operation of heavy mobile equipment and vehicles for land clearing, earth moving activities, and material handling. Other vehicle activities, such as those associated with the access road (e.g., delivery of supplies, rotation changes) will also generate sound emissions. Sound emissions will also result from blasting during construction. Blast energy that liberates into the atmosphere can generate air overpressure and noise. Blasting is expected to be limited to daytime hours and will follow best management practices outlined in guidance documents such as the Blasters Handbook (ISEE 2016) and the Environmental Code of Practice for Metal Mines (ECCC 2009). These guidance documents provide

detailed information on designing and carrying out blasting to reduce sound emissions, and these will be consulted during blasting design.

Note that as part of the Project Expansion, the existing exploration camp will be dismantled and removed, and this location will be used for the explosives facility, at which point it will no longer constitute a sensitive receptor. The exploration camp has been retained in the model results for consistency with Valentine Gold EIS. Furthermore, the cabin location located closest to the Project Area (Figure 6-2) will be relocated in the near future per an agreement with Marathon.

Noise modelling conservatively assumed that construction activities would occur concurrently at the three pits. This will not likely be the reality, as timing of specific permits will vary, and operational realities will result in staggered construction activities and phases at the various pits. The conservative noise modeling will be refined during the permitting process to reflect actual construction schedules for Approved Project and Project Expansion infrastructure. Refined modelling will also support consultation with NL Department of Fisheries, Forestry and Agriculture (NLDFFA) – Wildlife Division related to acceptable levels of activities at Berry pit during caribou migration based on predicted sound pressure levels as per the Caribou Protection and Environmental Effects Monitoring Plan.

During operation, additional equipment will be required to operate the Berry pit. Sound emissions during Project Expansion operation will result from activities similar to those expected during construction. Material handling and earth moving will continue throughout mining, and some heavy truck traffic will increase relative to an increase in production levels in the initial few years of operation. Rock breaking, crushing and processing, and blasting will also occur during operation as was assessed for the Valentine Gold EIS.

Use of the access road for rotation changes or other travel to the Project Expansion is not anticipated to change from the Approved Project as presented in the Valentine Gold EIS.

6.6.3.1 Construction

An updated list of the equipment to accommodate the construction of three open pits is provided in Table 6.15.

The locations of the sources of sound associated with the combined Projects' construction are shown in Figure 6-3. The equipment sources related to mine construction were modelled as area sources covering the Leprechaun, Berry and Marathon pits, as well as the waste rock piles. Traffic related to material hauling between the pits, rock piles and processing plant were modelled as line sources.

The predicted L_d, L_n and L_{dn} sound pressure levels for the construction of the Approved Project and Project Expansion at the nearest sensitive receptors within the LAA / RAA are presented in Table 6.16. Receptor 32 is closest to the mine and therefore would experience the greatest change in sound levels from construction activities. There were no updated Project related sound pressure levels for the nighttime period since construction activities are not anticipated to occur at night. The predicted daytime average sound pressure levels for combined Project construction are also illustrated in Figure 6-4.

For the updated Project construction, the change in %HA associated with the combined Projects is compared with the threshold of 6.5% advised by Health Canada (2017). An example calculation of the change in %HA at a receptor is presented in the Valentine Gold EIS Appendix 5I.

The changes in %HA associated with the combined Project construction are presented in Table 6.17. For receptor 32, the change in %HA does not exceed the Health Canada guideline level of 6.5%. The combined Project construction is also not predicted to exceed sleep disturbance criteria of 45 dBA.

Table 6.15 Updated Summary of Equipment Sound Power Level During Construction (Approved Project and Project Expansion)

Equipment Type	Number	Sound Power Level (dB) by Octave Band (Hz)								Total Sound Power Level	
		63	125	250	500	1000	2000	4000	8000	dB	dBA
DTH Drill, Tracked, 144 mm diameter	2	122	123	118	119	115	113	108	101	127	121
RC Drill, Tracked, 144 mm diameter	2	122	123	118	119	115	113	108	101	127	121
Wheel Loader, 13 m^3 bucket	1	116	121	112	112	111	109	107	97	123	116
Hydraulic Excavator, 12 m^3 bucket	2	117	120	111	109	110	106	101	93	123	114
Rigid Frame Hauler, 91 t payload	5	114	117	116	116	114	111	104	98	123	119
Articulated Hauler, 36 t payload	2	128	125	116	112	110	108	105	96	130	117
Motor Grader, 4.9 m blade	2	116	115	111	107	112	106	102	93	120	115
Water / Gravel Truck	2	106	114	112	106	106	105	98	97	118	111
Track Dozer, 447 kW	2	108	112	104	105	107	109	97	87	116	113
Tonal Beeping (Reversing)	per Dozer	5	5	5	5	107	107	5	5	5	5
Track Dozer, 325 kW	2	108	112	104	105	107	109	97	87	116	113
Wheel Loader, 4.5 m^3 bucket	2	115	115	113	103	104	102	97	90	120	110
Hydraulic Excavator, 4.0 m^3 bucket	2	119	120	111	112	108	106	105	98	123	114
Fuel / Lube Truck	2	106	114	112	106	106	105	98	97	118	111
Hydraulic Excavator, 3.0 m^3 bucket	2	119	120	111	112	108	106	105	98	123	114
Crew Shuttle	2	109	106	104	102	100	97	92	84	112	105
Pickup Trucks	5	109	106	104	102	100	97	92	84	112	105
Light Plants	4	106	99	94	90	87	83	84	77	107	93
Water Pumps	2	111	104	98	101	102	100	93	86	113	106
On Highway Dump Truck	2	124	110	102	101	105	100	99	92	124	109
Flatbed Picker Truck	2	109	106	104	102	100	97	92	84	112	105
Emergency Response Vehicle	1	124	110	102	101	105	100	99	92	124	109

Table 6.15 Updated Summary of Equipment Sound Power Level During Construction (Approved Project and Project Expansion)

Equipment Type	Number	Sound Power Level (dB) by Octave Band (Hz)								Total Sound Power Level	
		63	125	250	500	1000	2000	4000	8000	dB	dBA
Maintenance Trucks	2	124	110	102	101	105	100	99	92	124	109
Mobile Crane	1	109	106	104	102	100	97	92	84	112	105
Float Trailer	1	124	107	103	107	110	108	100	95	124	114
Forklift and Tire Handler	1	109	106	104	102	100	97	92	84	112	105
Mobile Steam Cleaner	1	106	114	112	106	106	105	98	97	118	111
Scissor Lift	1	108	105	102	102	102	99	93	91	112	106
Mobile Manlift	1	96	91	92	91	87	88	86	79	100	94
Generator	6	111	121	115	107	107	108	108	105	123	115

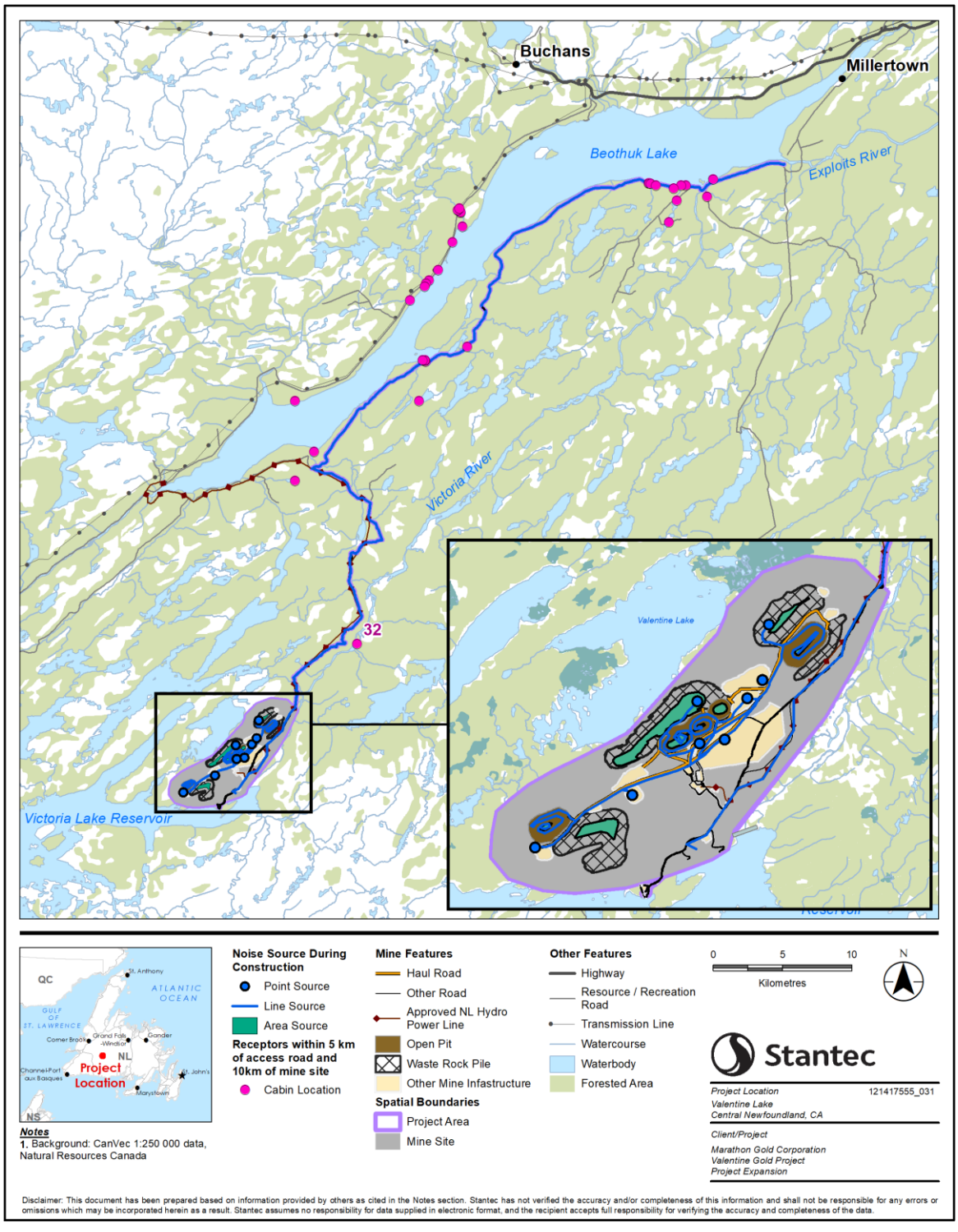

Figure 6-3 Location of Noise Sources during Construction of Approved Project Plus Project Expansion

Table 6.16 Predicted L_d, L_n and L_{dn} for Combined Project Construction at Nearby Receptors

Receptor[A]	Receptor Description	Project Daytime Sound Level, L_d (dBA)	Project Nighttime Sound Level, L_n (dBA)	Combined Project Day-Night Sound Level, L_{dn} (dBA)
32	Cabin Location	28.0	-	33.3
33	Cabin (to be moved)	46.0	-	44.0
35	Accommodations Camp	43.3	-	41.3
36	Existing Exploration Camp	41.2	-	39.2

Notes:
[A] See Figure 6-3 for receptor locations
"-" The L_n is not applicable during the construction phase of the Combined Project as construction activities will not occur during nighttime hours (i.e., between 10 pm and 7 am).
See Valentine Gold EIS, Appendix 5I for an example calculation of L_{dn}

Table 6.17 Combined Project Construction – Updated Change in %HA at Close Receptor

Receptor ID	Baseline		Project Predicted L_{dn} (dBA)	Total (Baseline plus Project)		Change in %HA (Between Total and Baseline)
	L_{dn} (dBA)*	%HA		L_{dn} (dBA)	%HA	
32	46.9	1.47	33.3	47.1	1.50	0.03
33	46.9	1.47	44.0	48.7	1.85	0.38
35	46.9	1.47	41.3	47.9	1.68	0.21
36	46.9	1.47	39.2	47.6	1.60	0.13

Note:
* The lowest measured baseline L_{dn} was considered in the assessment. See the Valentine Gold EIS Report for determination of the baseline.

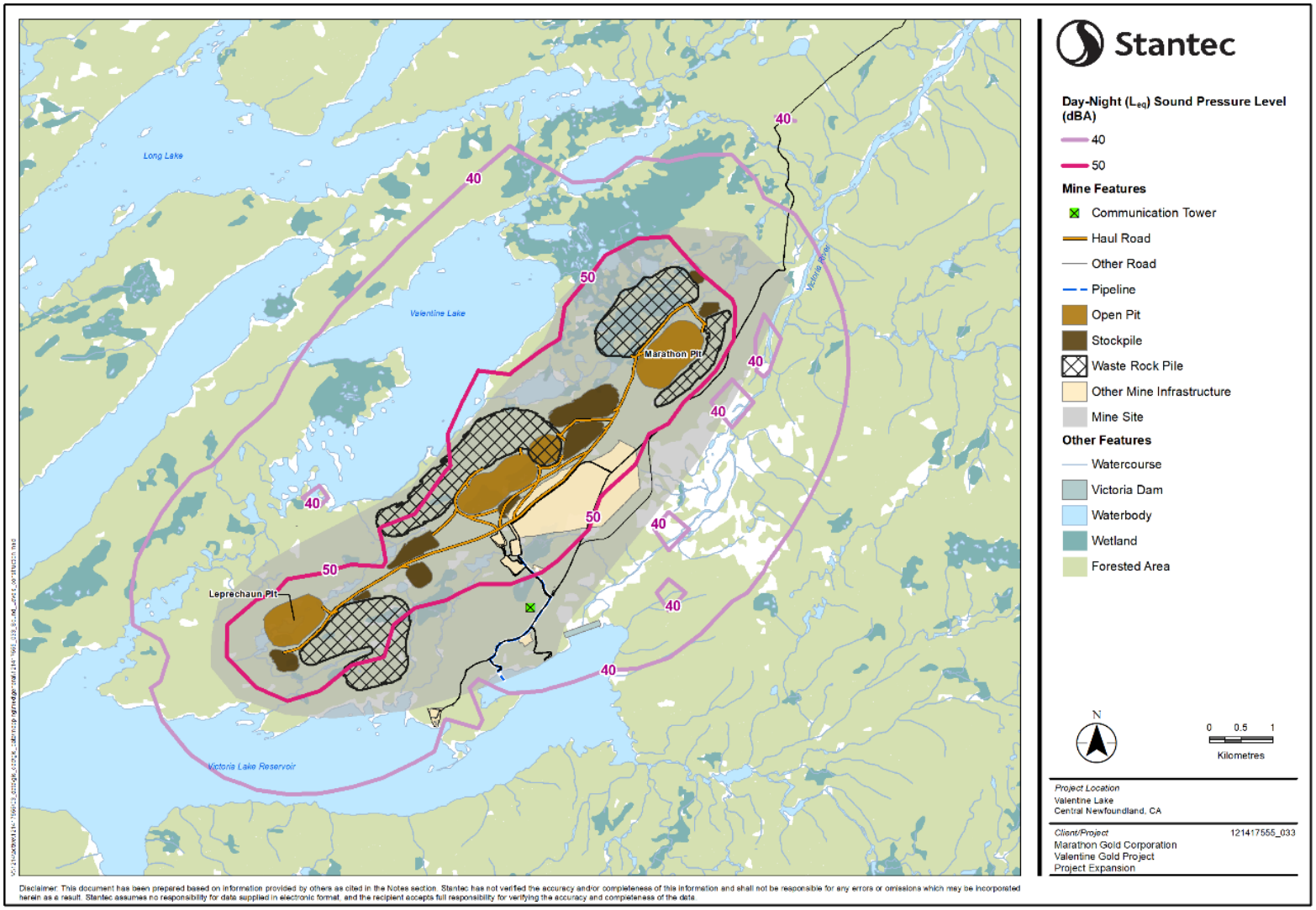

Figure 6-4 Predicted Daytime- (L_d) Updated Sound Pressure Levels from Combined Project Construction

Operations

An updated list of the equipment, quantities, and estimates of the sound power levels that could be used during Approved Project combined with Project Expansion operation is provided in Table 6.18. It is assumed that the equipment at the processing plant has not changed; therefore, only mobile equipment at the pits to storage piles have changed. Transportation to and from the mine site was also not expected to change and was not included in this assessment.

The locations of the sources of sound associated with the combined Project operations are shown in Figure 6-5. The equipment sources related to mine operations were modelled as area sources covering the Leprechaun, Berry and Marathon pits, as well as the waste rock piles. The vehicle traffic between the mines, rock piles and processing plant were modelled as line sources. The dumping of material (e.g., at the waste rock pile) was treated as a point source.

The predicted L_d, L_n and L_{dn} sound pressure levels for combined Project operations at the nearest sensitive receptors within the LAA / RAA are presented in Table 6.19. The predicted daytime average sound pressure levels for combined Project operations are also illustrated in Figure 6-6.

For combined Project operation, the change in %HA associated with the combined Projects is compared with the threshold of 6.5% advised by Health Canada (2017). An example calculation of the change in %HA at a receptor is presented in the Valentine Gold EIS Appendix 5I.

The changes in %HA associated with the combined Project operation are presented in Table 6.20. The change in %HA does not exceed the Health Canada guideline level of 6.5%. The operation of the Approved Project combined with the Project Expansion is also not predicted to exceed sleep disturbance criteria of 45 dBA, except where noted below.

Table 6.18 Updated Summary of Equipment Sound Power Level During Operations

Equipment Type	Number	Sound Power Level (dB) by Octave Band (Hz)								Total Sound Power Level	
		63	125	250	500	1000	2000	4000	8000	dB	dBA
DTH Drill, Tracked, 144 mm diameter	4	122	123	118	119	115	113	108	101	127	121
RC Drill, Tracked, 144 mm diameter	3	122	123	118	119	115	113	108	101	127	121
Rotary Drill, Tracked, 200 mm diameter	4	122	123	118	119	115	113	108	101	127	121
Wheel Loader, 13 m^3 bucket	2	116	121	112	112	111	109	107	97	123	116
Hydraulic Excavator, 12 m^3 bucket	4	117	120	111	109	110	106	101	93	123	114
Hydraulic Excavator, 15.5 m^3 bucket	3	116	119	115	114	111	109	104	96	123	117
Rigid Frame Hauler, 91 t payload	11	114	117	116	116	114	111	104	98	123	119
Rigid Frame Hauler, 132 t payload	22	117	122	117	113	111	109	104	99	125	117
Articulated Hauler, 36 t payload	2	128	125	116	112	110	108	105	96	130	117
Motor Grader, 4.9 m blade	3	116	115	111	107	112	106	102	93	120	115
Water / Gravel Truck	3	106	114	112	106	106	105	98	97	118	111
Track Dozer, 447 kW	3	108	112	104	105	107	109	97	87	116	113
Tonal Beeping (Reversing)	per Dozer	5	5	5	5	107	107	5	5	5	5
Track Dozer, 325 kW	2	108	112	104	105	107	109	97	87	116	113
Wheel Loader, 4.5 m^3 bucket	2	115	115	113	103	104	102	97	90	120	110
Hydraulic Excavator, 4.0 m^3 bucket	3	119	120	111	112	108	106	105	98	123	114
Fuel / Lube Truck	3	106	114	112	106	106	105	98	97	118	111
Wheel Dozer, 370 kW	2	106	114	112	106	106	105	98	97	118	111
Hydraulic Excavator, 3.0 m^3 bucket	2	119	120	111	112	108	106	105	98	123	114
Hydraulic Excavator, 1.75 m^3 bucket	1	105	108	107	104	104	103	98	91	113	109
Track Dozer, 160 kW	1	117	118	109	101	102	98	96	92	121	108
Crew Shuttle	6	109	106	104	102	100	97	92	84	112	105

Table 6.18 Updated Summary of Equipment Sound Power Level During Operations

Equipment Type	Number	Sound Power Level (dB) by Octave Band (Hz)								Total Sound Power Level	
		63	125	250	500	1000	2000	4000	8000	dB	dBA
Pickup Trucks	10	109	106	104	102	100	97	92	84	112	105
Light Plants	18	106	99	94	90	87	83	84	77	107	93
Water Pumps	10	111	104	98	101	102	100	93	86	113	106
On Highway Dump Truck	2	124	110	102	101	105	100	99	92	124	109
Flatbed Picker Truck	2	109	106	104	102	100	97	92	84	112	105
Emergency Response Vehicle	1	124	110	102	101	105	100	99	92	124	109
Maintenance Trucks	4	124	110	102	101	105	100	99	92	124	109
Mobile Crane	1	109	106	104	102	100	97	92	84	112	105
Float Trailer	1	124	107	103	107	110	108	100	95	124	114
Forklift and Tire Handler	2	109	106	104	102	100	97	92	84	112	105
Mobile Steam Cleaner	2	106	114	112	106	106	105	98	97	118	111
Scissor Lift	1	108	105	102	102	102	99	93	91	112	106
Mobile Manlift	1	96	91	92	91	87	88	86	79	100	94
Generator	6	111	121	115	107	107	108	108	105	123	115

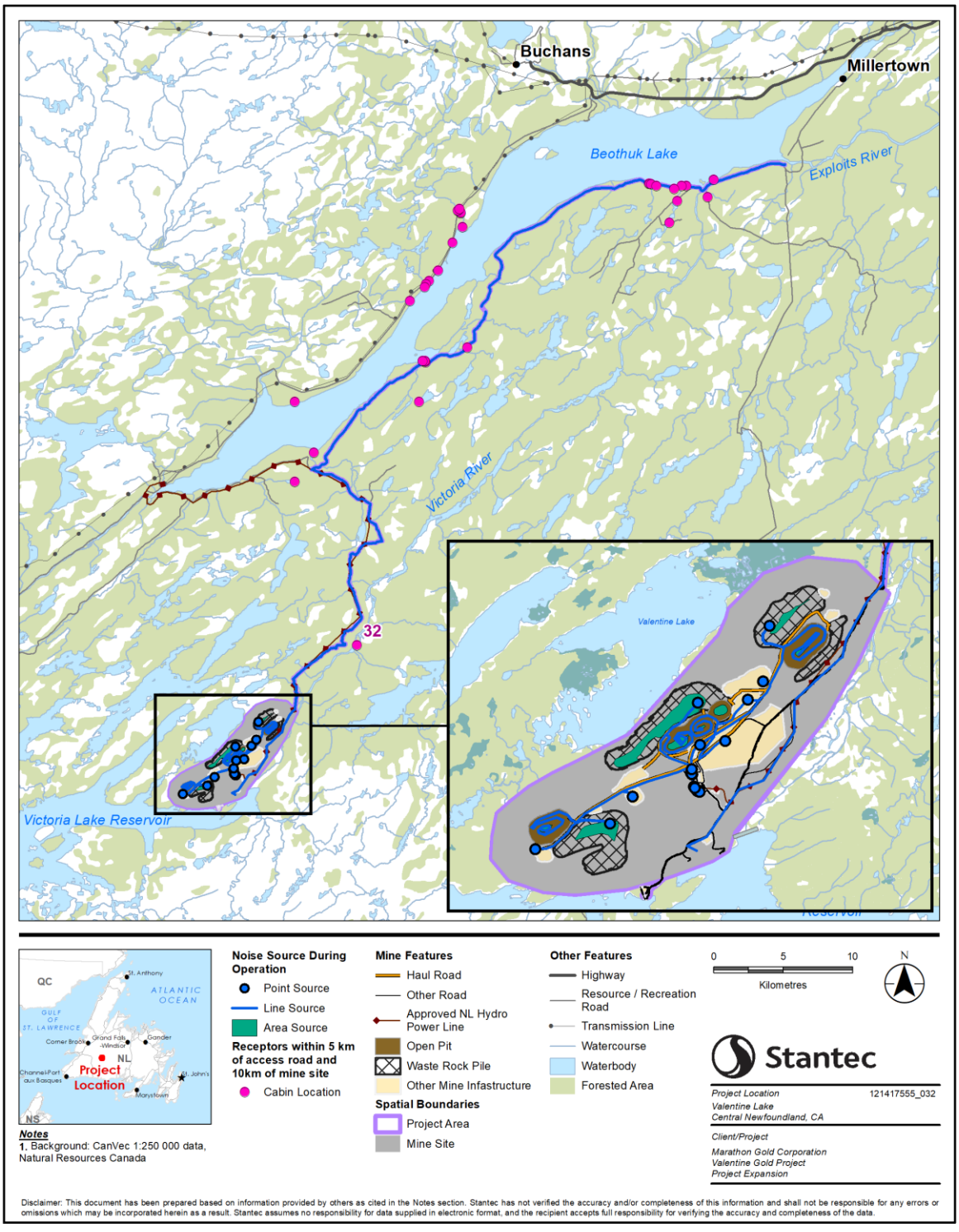

Figure 6-5 Location of Noise Sources during Operation of Approved Project Plus Project Expansion

Table 6.19 Predicted L_d, L_n and L_{dn} for Combined Project Operations at Close Receptors

Receptor[A]	Receptor Description	Project Daytime Sound Level, L_d (dBA)	Project Nighttime Sound Level, L_n (dBA)	Project Day-Night Sound Level, L_{dn} (dBA)
32	Cabin Location	27.3	26.3	32.5
33	Cabin (to be moved)	43.1	42.2	48.4
35	Accommodations Camp	48.0	47.6	53.7
36	Existing Exploration Camp	41.3	41.3	47.3

Note:
[A] See Figure 6-5 for receptor locations
"-" The L_n is not applicable during the construction phase of the Project as construction activities will not occur during nighttime hours (i.e., between 10 pm and 7 am).
See Valentine Gold EIS, Appendix 5I for an example calculation of L_{dn}

Table 6.20 Combined Project Operations – Updated Change in %HA at Close Receptors

Receptor ID	Baseline		Project Predicted L_{dn} (dBA)	Total (Baseline plus Project)		Change in %HA (Between Total and Baseline)
	L_{dn} (dBA)*	%HA		L_{dn} (dBA)	%HA	
32	46.9	1.47	32.5	47.1	1.49	0.02
33	46.9	1.47	48.4	50.7	2.41	0.94
35	46.9	1.47	53.7	54.5	3.91	2.44
36	46.9	1.47	47.3	50.1	2.23	0.75

Note:
* The lowest measured baseline L_{dn} was considered in the assessment. See the Valentine Gold EIS Report for determination of the baseline.

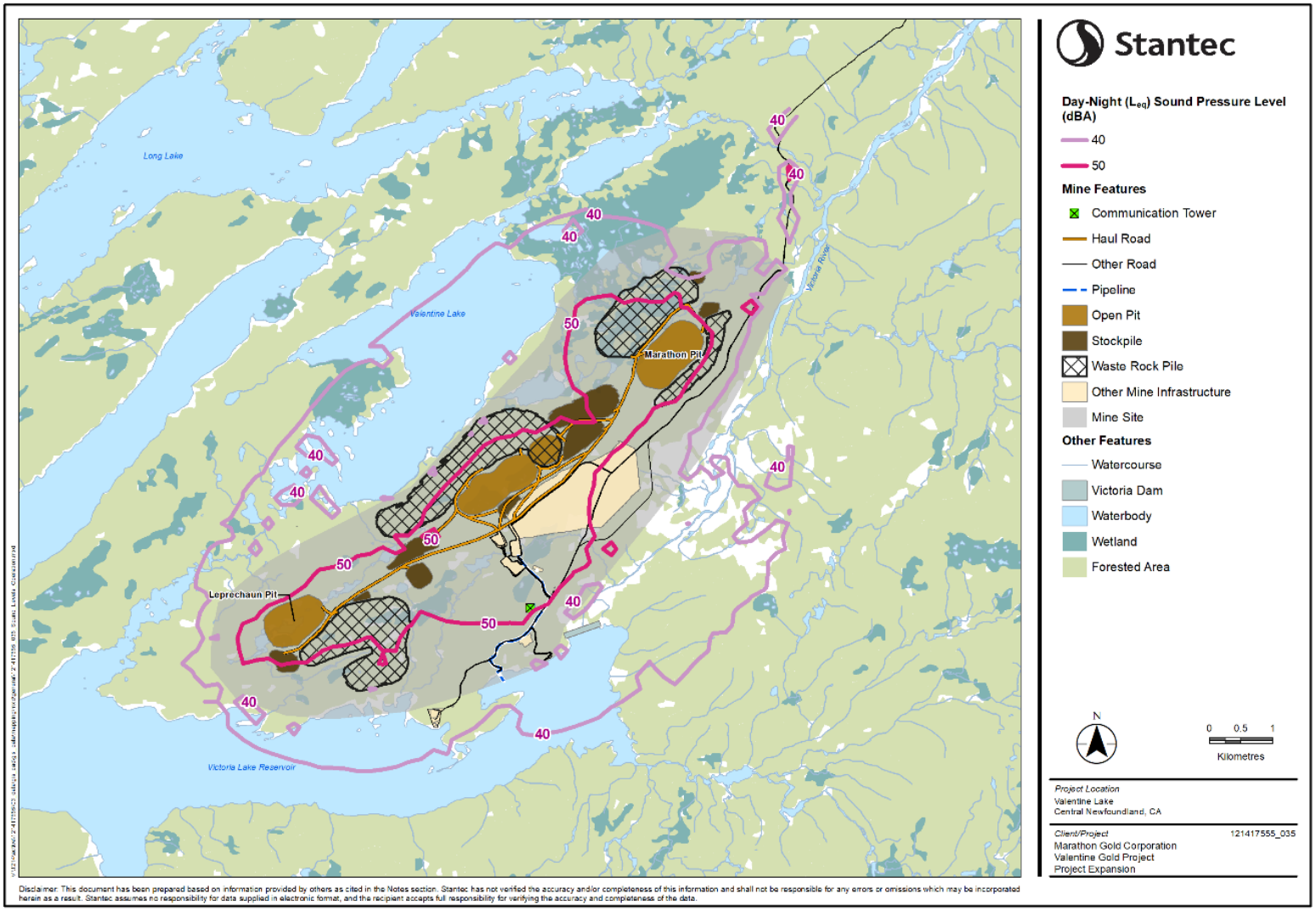

Figure 6-6 Predicted Daytime (L_d) Sound Pressure Levels from Combined Project Operations

Nighttime sound pressure levels were greater than the nighttime target of 45 dBA at the accommodations camp. Health Canada indicates that the threshold of 45 dBA relates to structures where operable windows may be in use. Mitigating the accommodations camp with sufficient ventilation systems to reduce the need to open windows would improve the sound attenuation and reduce nighttime sound levels inside the accommodations camp to levels below the Health Canada targets. This can also be supported through closed-window policies, with requirements highlighted during mandatory site orientations for all employees, contractors and visitors.

6.6.4 Change in Light Levels

Marathon does not predict additional light levels at the mine site with the addition of the Project Expansion and considers the assessment completed in the Valentine Gold EIS to be applicable to the Project Expansion.

As noted in the Valentine Gold EIS, light associated with an industrial development is critical to the safe and efficient operation of the enterprise. Excessive or poorly designed lighting can have detrimental effects on the environment whereas careful and progressive design can achieve the operational requirements while reducing adverse effects to the environment. Good lighting meets the required levels on the designated property with low capital, maintenance and energy costs. Badly designed lighting or excessive lighting can result in obtrusive lighting, contributing to light trespass, glare and sky glow (Marathon 2020).

The assessment completed in the Valentine Gold EIS for a change in ambient light focused on the potential effects that the Approved Project infrastructure and activities could have on light trespass, glare and sky glow. The effects of the Approved Project lighting on nearby receptors were assessed by comparing predicted light levels to the specified light criteria. The analysis and predictions completed in the Valentine Gold EIS was qualitative given that an exterior lighting plan for the Approved Project had not been designed. Predictions were based on the professional judgment of the study team and incorporated design mitigation measures to manage potential light effects to acceptable levels, as published in the CIE guidelines (CIE 2017).

The final design of the lighting design for the Approved Project and Project Expansion will consider recommendations presented in the Valentine Gold EIS and subsequent engagement with regulatory authorities. The final design will represent a conservative approach to the reduction of Approved Project and Project Expansion related light pollution.

6.6.5 Summary of Changes from the Approved Project

The residual effects of the Approved Project in combination with the Project Expansion are summarized below. Table 6.21 presents a comparison between residual effects for the Approved Project and the Approved Project plus Project Expansion. There are no substantive differences between residual effects for the Approved Project alone compared to the Approved Project plus the Project Expansion.

Table 6.21 Residual Effects on Atmospheric Environment for Approved Project Plus Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Air Quality	C	A	L-M	LAA/RAA	ST	C	R	U	No change
	O	A	M	LAA/RAA	MT	C	R	U	No change
	D	A	L	PA	ST	R	R	U	No change
Change in GHGs	C	A	L	N/A	ST	C	I	D	No change
	O	A	M	N/A	MT	C	I	D	No change
	D	A	N	N/A	ST	IR	I	D	No change
Change in Sound Quality	C	A	L	LAA/RAA	ST	C	R	U	No change
	O	A	M	LAA/RAA	MT	C	R	U	No change
	D	A	L	LAA/RAA	ST	R	R	U	No change
Change in Light Levels	C	A	L	LAA/RAA	ST	IR	R	U	No change
	O	A	L	LAA/RAA	MT	C	R	U	No change
	D	A	L	LAA/RAA	ST	IR	R	U	No change

KEY:
See Table 6.5 for detailed definitions

Project Phase:
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short term
MT: Medium term
LT: Long term
P: Permanent

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

N/A: Not applicable

The residual environmental effects on air quality during construction of the Project Expansion and Approved Project are adverse, as the combined construction results in a predicted increase of ambient concentrations compared to baseline conditions. The magnitude of residual effects of construction is conservatively predicted to be low to moderate (with the latter being a conservative prediction) because the annual emissions during combined construction are estimated to be less than the predicted emissions during the combined operation. The geographic extent for change in air quality is limited to the LAA / RAA, and the residual effects will be short-term (i.e., limited to the construction period) and continuous as construction activities were assumed to occur throughout the construction phase. The residual effects are predicted to be reversible as the predicted increase in ambient concentrations would return to baseline conditions after the end of construction.

The residual environmental effects on air quality during all phases of the Project Expansion and Approved Project are adverse, as the combined operation results in a predicted increase of ambient concentrations compared to baseline conditions. The magnitude of residual adverse effects on change in air quality during combined operation is predicted to be moderate. This is because the combined operation results in predicted ambient concentrations for the various substances of interest and averaging periods that are greater than 10% of baseline concentrations, and less than 50% of the AAQC (i.e., low in magnitude for NO_2, SO_2, CO, NH_3 and trace metals), greater than 50% of the AAQC (i.e., moderate in magnitude for TSP, $PM_{2.5}$ and HCN), or greater than 100% of the AAQC (i.e., high in magnitude for PM_{10}). Residual effects will be limited to the LAA / RAA. The duration for change in air quality during combined operation is medium-term, with the predicted combined operation-related increase in ambient concentrations continuing through the operation phase (14.4 years). Residual effects will be continuous, although ambient concentrations may change with meteorological conditions. The predicted increase in air contaminant concentrations would return to baseline conditions after the end of the operation phase; therefore, effects will be reversible. The ecological and socio-economic context for change in air quality during construction and operation is considered undisturbed; there has been little human development (anthropogenic sources of emissions) within the LAA / RAA prior to the Project (Table 6.21).

The residual environmental effects on GHG emissions during operation are adverse, as the combined Projects result in a predicted increase of GHG emissions compared to baseline conditions. The magnitude is predicted to be moderate, with the Project operation resulting in a relatively small change of GHG emissions compared to provincial and national emissions. The geographic extent for change in GHGs during operation is not applicable because the effect is global. Residual effects on change in GHGs during operation is medium term (i.e., will occur over the operation of the Project) and continuous. As with construction, the residual effect is considered irreversible as effects related to the release of GHG emissions from Project operation would not be reversible for at least 100 years. The ecological and socio-economic context for change in GHG emissions during operation is considered disturbed, as the geographic extent is global, in which there have been anthropogenic sources of GHG emissions prior to the Project (Table 6.21). The residual effects of GHG emissions predicted for Approved Project construction were not updated from the Valentine Gold EIS.

The residual environmental effects on sound quality during all phases are adverse, as the Approved Project and Project Expansion activities result in a predicted increase of sound levels compared to baseline conditions. The magnitude of residual effects is predicted to be moderate; while Approved Project and Project Expansion activities result in a change in sound levels to nearby sensitive receptors, the change is less than applicable guideline levels and expected to occur within the geographical extent of the LAA / RAA. The duration for change in sound quality during the construction and decommissioning phases are short-term, and during operation is medium-term and continuous. Residual effects on change in sound quality during operation is predicted to be reversible because the predicted increase in sound levels due to the Approved Project and Project Expansion operation would end once this phase is over. The LAA / RAA in which the changes in sound quality are assessed is considered undisturbed; there has been little human development (anthropogenic sources of emissions) within the LAA / RAA prior to the Approved Project and Project Expansion (Table 6.21).

The residual environmental effects on light levels during all phases are adverse, and are predicted to be low in magnitude, as Approved Project and Project Expansion activities will result in a relatively small change in lighting to nearby sensitive receptors. The geographic extent for change in light levels during operation is expected to be the LAA / RAA, the duration is short-term for the construction and decommissioning phases, and medium-term and continuous during the operation phase, as service and safety lighting will be used continuously overnight during operation. The residual effect on light levels will be reversible, with the increase in lighting due to the Approved Project and Project Expansion ending when decommissioning ceases. The LAA / RAA in which the changes in light levels are assessed is considered undisturbed; there has been little human development (anthropogenic sources of emissions) within the LAA / RAA prior to the Approved Project and Project Expansion (Table 6.21).

Overall, the Valentine Gold EIS for the Approved Project concluded that, with the implementation of mitigation and management measures, residual environmental effects on Atmospheric Environment were predicted to be not significant. This conclusion remains valid for the combined Projects.

6.7 ASSESSMENT OF CUMULATIVE EFFECTS

This cumulative effects assessment focuses on incremental changes in the residual effects of the Approved Project in combination with the Project Expansion, which are summarized in Section 6.6.5, as well as incremental changes in potential cumulative effects due to differences in ongoing and likely future activities since the Approved Project was released from the EA process.

6.7.1 Past and Ongoing Effects

The existing conditions of the atmospheric environment, which would include effects from past and ongoing projects and activities, are described in Section 20.2.1 of the Valentine Gold EIS and are considered applicable to the Project Expansion. The pre-construction condition of the mine site is a remote area with limited human activity, and no substantive anthropogenic sources of air emissions, greenhouse gases (GHGs), noise or light occur within 50 km, with the exception of ongoing exploration work within the Project Area. The mine site is located approximately 49 km southwest of the Town of Buchans and 60 km southwest of the Town of Millertown.

6.7.2 Potential Project-Related Contributions to Cumulative Effects

As described in Section 6.6, routine Approved Project and Project Expansion activities have the potential to change local air quality, atmospheric GHGs, sound levels, and lighting levels. The operation of heavy equipment, travel on unpaved roads, movement and handling of material, operation of site infrastructure, blasting, and use of exterior lighting during each phase of the combined Projects has the potential to interact with the existing atmospheric environment. The combined Projects, therefore, have potential to result in the following residual effects on the atmospheric environment:

- A change in air quality
- A change in atmospheric GHGs
- A change in sound quality
- A change in lighting

The effects assessment for the combined Projects includes a summary of residual environmental effects in Section 6.6 and the determination of significance in Section 6.6.5.

With the implementation of mitigation (Section 6.3), the effects of routine Project-only activities on the atmospheric environment are predicted to be not significant.

6.7.3 Other Projects and Activities and Their Effects

Table 5.6 summarizes past, present, ongoing and future projects and activities in the RAA that have potential to cause a change in the atmospheric environment. A full discussion of other projects and activities and their effects is provided in the Valentine Gold EIS (Section 20.2.3). As indicated above, the focus of this CEA is on incremental changes in potential cumulative effects due to differences in on-going and likely future activities since the Approved Project was released from the EA process.

6.7.4 Potential Cumulative Environmental Effects

The Project Expansion and Approved Project will release GHGs to the atmosphere, as will the construction and operation of other reasonably foreseeable projects. Although GHG emissions from a single project are small compared to global emissions, they cumulatively contribute to the overall global total and to climate change. The direct and indirect GHG emissions from the Approved Project plus the Project Expansion are estimated to be 126 kt CO_2e/year and are anticipated to contribute 0.02% of total annual national emissions. Project-related GHG emissions may affect Canada's ability to meet the Paris Agreement emission reduction targets, although the GHG emissions are expected to be a small fraction (0.02%) of Canada's total emissions. Similarly, the government of NL set targets to reduce GHG emissions by 35-45% below 1980 levels by 2030 and to reduce emissions by 30% below 2005 levels by 2030. The Project-related GHG emissions may affect NL's ability to meet these emissions reduction targets, although the GHG emissions are expected to be a small fraction (1.5%) of NL's total emissions. The Project emissions are ranked as low during construction and moderate during operation.

Therefore, the potential cumulative effects of the Project Expansion and Approved Project, and other reasonably foreseeable emission sources on GHG emissions are predicted to be low in magnitude (i.e.,

no measurable change). The geographic extent is anticipated to be within the cumulative effects RAA. Cumulative effects are predicted to be short-term in duration, irregular in frequency, and reversible. The ecological and socio-economic context for the Atmospheric Environment VC is considered disturbed, as the geographic extent is the cumulative effects RAA, in which there have been anthropogenic sources of GHG emissions prior to the combined Projects.

Cumulative effects on air quality, sound quality and light depend on the proximity of the combined Projects to approved and proposed future activities / projects. Changes in air quality, sound quality and light levels associated with an industrial facility tend to be greatest near the facility and decrease with increasing distance from the facility. Furthermore, the zone of influence for transport and dispersion of gaseous air emissions is generally less than 10 km, and even lower for sound and light levels. The zone of influence is defined as the distance from the facility to the point where the air contaminant concentrations, sound levels and light levels decrease to background levels (Marathon 2020). Past, present and ongoing activities / projects that are predicted to contribute to cumulative effects include mining and exploration, forestry, hunting, outfitting, trapping, and/or fishing, off-road vehicles, hydroelectric development, and existing linear features (Table 5.6). However, potential cumulative effects of these projects / activities have been accounted for in the existing conditions and residual environmental effects (Sections 6.1 and 6.6). As indicated in Figure 5-4, forestry activities since submission of the Valentine Gold EIS are focused on areas to the east of Beothuk Lake and at a distance that would prevent geographic overlap of potential effects on air quality, sound quality and light.

Activities associated with the Buchans Resources Limited Project are also located further than 10 km from the Project Area and therefore, are not expected to have an overlapping effect with the combined Projects with respect to air quality, sound quality and light. Activities associated with this project will, however, result in releases of GHGs that have the potential to interact cumulatively in the atmosphere with GHG emissions from the combined Projects.

Newcrete Investments Limited was issued Environmental Preview Report (EPR) guidelines in March 2023 for their proposed Victoria River Quarry (located <500 m from the mine site). Given the proximity, there is potential for cumulative effects on air quality, sound and light. The EPR guidelines require them to provide additional information on noise and dust effects. Given the level of analysis required for this proposed quarry, it is anticipated that Newcrete will need to consider the potential for cumulative effects of their proposed project with combined Project effects, and should it be approved, implement appropriate mitigation measures as required to limit noise and dust effects on sensitive receptors. Activities associated with this quarry will also result in releases of GHGs that have the potential to interact cumulatively in the atmosphere with GHG emissions from the combined Projects.

With mitigation measures, the cumulative effects from the Approved Project plus the Project Expansion and the reasonably foreseeable future activities in the RAA (including mitigation measures and management plans, and regulatory requirements associated with other projects and activities) are expected to be not significant (Significance Definition provided in Section 5.3.2).

6.7.5 Cumulative Effects Summary and Evaluation

The cumulative effects on the atmospheric environment of past, present, ongoing, and reasonably foreseeable projects and activities, in combination with the environmental effects of the combined Project, are summarized in Table 6.22.

Table 6.22 Summary of Potential Cumulative Effects for Atmospheric Environment

Residual Cumulative Effect[A]	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
	A	N	RAA	ST	IR	R	D
Contribution from the Project to the Residual Cumulative Effect[A]	The combined Projects will cumulatively contribute to annual provincial and federal GHG emissions, along with the Buchans Resources Limits and Victoria River Quarry, affecting their commitments to reducing GHG emissions, however, the impact is small. The operation contributes approximately 1.5% and 0.02% to the annual provincial and national emission totals, respectively. The combined Projects will cumulatively interact with the proposed Victoria River quarry, should it be approved, to result in a change in air quality, sound quality and lighting.						
Significance[B]	Although there are limitations in the available information of the effects from other present, past and future physical activities, a conservative approach was taken to estimate the cumulative effects (e.g., potential emissions from future physical activities). The predicted effects are similar to those that have occurred during other mining and quarry projects / activities, thereby increasing the confidence in the assessment. The cumulative effects on GHG emissions are predicted to be not significant with a high prediction confidence. The cumulative effects on air quality, sound quality and lighting are predicted to be not significant with a high prediction confidence.						

Notes:
[A] Descriptors are provided in Table 6.5.
[B] Significance definition is provided Section 6.5.3.

6.8 FOLLOW-UP AND MONITORING

There are no substantive changes to the proposed follow-up and monitoring measures for ambient air quality, GHG emissions, noise or lighting from those identified in the Valentine Gold EIS. Monitoring / management plans that have subsequently been developed in consultation with regulators for the Approved Project will be reviewed and revised as needed to include and address Project Expansion activities (e.g., monitoring locations).

6.9 REFERENCES

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7.0 GROUNDWATER RESOURCES

For this assessment, the Groundwater Resources Valued Component (VC) is defined as the value and function of groundwater resources in maintaining baseflow to streams for ecological habitat, and in supplying fresh water for human and industrial / commercial uses.

The Groundwater Resources VC was assessed because the construction, operation, and decommissioning, rehabilitation, and closure of the Berry Pit Expansion (Project Expansion) may affect the groundwater quality and quantity which in turn may affect surface water.

The Groundwater Resources VC is closely linked to other VCs including Surface Water Resources (Chapter 8), Fish and Fish Habitat (Chapter 9), and Other Terrestrial Components (Chapter 11). The potential environmental effects of changes to groundwater resources on these VCs are discussed in their respective chapters.

The Project Area, Local Assessment Area (LAA), and Regional Assessment Area (RAA) for the assessment of effects of the Project Expansion on groundwater resources are described in Chapter 5 and presented on Figure 7-1. They are consistent with those used in the Valentine Gold Environmental Impact Statement (EIS) (Marathon 2020) for the assessment of the Valentine Gold Project (Approved Project).

480000
485000
490000
495000
500000

5365000
5360000
5355000
5350000

N

Valentine Lake
Frozen Ear Lake
Victoria River
Victoria Lake Reservoir

0 2 4 km
1:80,000 (At original document size of 11x17)

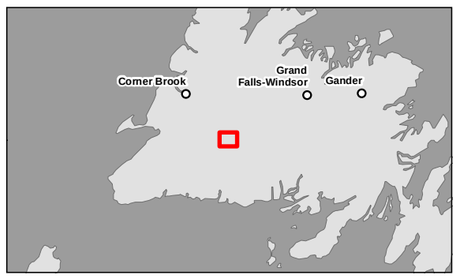
Notes
1. Coordinate System: NAD 1983 UTM Zone 21N
2. Base Data: CANVEC

Stantec

Legend

Spatial Boundaries

- Project Area
- Local/Regional Assessment Area



Project Location
Valantine Lake
Central Newfoundland, CA

121417555 REVA
Prepared by AMW on 2023-07-25
Technical Review by AD on 2023-06-12

Client/Project
MARATHON GOLD CORPORATION
VALENTINE GOLD PROJECT
PROJECT EXPANSION

Figure No.
7-1

Title
Groundwater Resources Assessment Area

W:\active_Other_PCs_Active_609_GIS\121417555\03_data\gis_cad\qgis\mxd\hydrogeology\report_figures\VEC\121417555_HGVEC_Fig7-1_AssessmentAreas.mxd Revised: 2023-07-25 By: awhite

Figure 7 1 Groundwater Resources Assessment Areas

7.1 EXISTING ENVIRONMENT

7.1.1 Summary of Existing Environment from the Approved Project

Baseline hydrogeological conditions for the Approved Project are described in the Baseline Study Appendix 3: Water Resources (BSA.3) of the Valentine Gold Project EIS (Marathon 2020) and in updates provided in responses to provincial and federal information requirements (IRs) (GEMTEC 2021a and 2021b). Information on where to access these documents online is contained in Table 1.8. The baseline hydrogeological conditions for the Approved Project are summarized below.

Bedrock underlying the Leprechaun and Marathon open pit areas and waste rock piles consists of the Valentine Lake Intrusive Complex, described as an elongate zoned intrusive body of Precambrian quartz porphyry monzonite, trondhjemite, gabbro, and diorite. A well-defined northeast trending thrust fault defines the southeast margin of the complex. The Valentine Lake Intrusive Complex is the major host of gold mineralization of the Approved Project.

Bedrock underlying the Tailings Management Facility (TMF), process plant and accommodations camp consists of mixed sedimentary units and lesser gabbroic and mafic volcanic rocks of the Victoria Lake Group, comprised of Cambrian to mid-Ordovician rocks. The group consists of dark grey to black shale and siltstone containing thin, felsic, tuffaceous beds. The black shale layers transform into a mélange with felsic volcanic blocks near major faults.

The Project Area is underlain by an overburden layer of till comprising loose to compact, grey-brown silty sand with gravel, and occasional cobbles/boulders or clay. An unconfined aquifer occurs within the saturated overburden and shallow bedrock, with semi-confined groundwater flow conditions present at depth within the bedrock. The hydraulic conductivity and movement of groundwater through the overburden material is controlled by primary porosity (i.e., in the pore space between grains of unconsolidated material), while groundwater flow within the underlying bedrock is expected to mainly occur within secondary porosity, such as fractures, joints, and will vary depending on the frequency and interconnection of these discontinuities.

The Project Area is situated along a groundwater divide and an area of groundwater recharge that corresponds with the surface water divide crest of the topographic ridge. The direction of groundwater flow is assumed to follow topography and surface water flow, which, depending on the specific location on the Site, would be to the northwest towards Valentine Lake or to the southeast towards the Victoria River and Victoria Lake drainage systems. These bordering drainage features to the northwest and southeast of the Project Area are expected to be areas of regional groundwater flow discharge.

Overall, groundwater levels in the Project Area are shallow, ranging from 2.7 metres below ground surface (mbgs) to -0.57 mbgs (artesian). Shallow groundwater flow follows topography and the direction of surface runoff at horizontal hydraulic gradients ranging from 1 % (0.01 m/m) in the northern portion of the process plant site to 7 % (0.07 m/m) in the area of the Marathon overburden stockpile and low-grade ore (LGO) stockpile. Estimated vertical hydraulic gradients determined using paired well systems in the TMF, process plant site, and Marathon and Leprechaun waste rock pile areas indicate slight vertical

gradients ranging from less than 1 % (< 0.01 m/m) in the Marathon waste rock pile and TMF areas to 3 % (0.03 m/m) in the process plant site and Leprechaun waste rock pile areas; both downwards and upwards components of flow are identified.

Observed day-to-day variability in groundwater levels and the apparent coincidence of these variations with rainfall events support the concept that the process plant site overburden and shallow bedrock aquifer is an unconfined system.

Estimates of hydraulic conductivity for the overburden (till) range from 3.31×10^{-7} m/s in the TMF to 4.58×10^{-4} m/s in the process plant site, with an overall geometric mean of 6.44×10^{-6} m/s for the Project Area. The hydraulic conductivity of shallow bedrock (down to the tested depth of about 30 m) range from 1.68×10^{-7} m/s in the TMF to 9.91×10^{-5} m/s in the Marathon pit area, with an overall geometric mean of 4.02×10^{-6} m/s for the Project Area.

Groundwater quality is classified as either calcium-bicarbonate or sodium bicarbonate water, with a principally meteoric signature and no significant inorganic water quality environmental issues.

7.1.2 Existing Environment Update

Since submission of the Valentine Gold EIS and associated IRs, several additional hydrogeological field investigations have been completed in the areas of both the Approved Project and the Project Expansion, as described below.

7.1.2.1 Approved Project

Two seven-day pumping tests were conducted in September and October, 2021 to determine the bulk hydraulic conductivity for Marathon and Leprechaun deposits (GEMTEC 2022a). In addition, in-situ packer testing, slug testing, groundwater level measurements, and water quality sampling were conducted at 19 locations (GEMTEC 2022b).

Groundwater elevations, groundwater quality, and hydraulic conductivity of the overburden and shallow bedrock were all consistent with the baseline hydrogeological conditions described in Section 7.1.1. Estimates of bulk hydraulic conductivity of the Marathon and Leprechaun deposits from pumping tests were approximately one order of magnitude higher than discrete hydraulic conductivity estimates obtained through packer testing. Despite the increases hydraulic conductivity estimates, the updated model results predicted a total groundwater flow increase of only 7% to the Marathon and Leprechaun pits. The pumping test results suggest that the upper bedrock including the Valentine Lake Intrusive Complex acts as a confined aquifer, and it is assumed that there are localized confined conditions at depth over the Project Area (GEMTEC 2022a). The pumping test also showed no indication that faults play a significant role in groundwater response to pumping in the bedrock at depths up to 300 mbgs.

7.1.2.2 Project Expansion

The 2022 Feasibility Study Update Geotechnical and Hydrogeological Investigations Valentine Gold Project (GEMTEC 2022c) included in-situ packer testing, slug testing, groundwater level measurements, and water quality sampling at seven locations within the footprint of the Berry waste rock pile. The observed hydrogeological conditions were consistent with those described in Section 7.1.1.

Subsurface materials within the footprint of the Berry waste rock pile generally consist of a surficial layer of organic material (rootmat, topsoil, and/or varying thicknesses of peat), overlying till, then overlying bedrock. The geometric mean of hydraulic conductivity estimates within the footprint of the Berry waste rock pile was 8.6×10^{-7} m/s for the overburden (till) and 3.7×10^{-7} m/s for the shallow bedrock. Groundwater levels within the footprint of the Berry waste rock pile are shallow ranging from approximately 7.8 mbgs to -0.1 mbgs (artesian). Shallow groundwater flow is to the northwest towards Valentine Lake at a relatively steep horizontal hydraulic gradient of 17 % (0.17 m/m). Vertical gradients in the nested monitoring wells were measured to range from 8 % (0.08 m/m) to 26 % (0.26 m/m) downward.

7.2 PROJECT EXPANSION INTERACTIONS AND PATHWAYS

Table 7.1 lists the potential Project Expansion effects on groundwater resources and provides a summary of the Project Expansion effect pathways and measurable parameters and units of measurement to assess potential effects. These are consistent with those used for the Approved Project in the Valentine Gold EIS (Marathon 2020). Potential environmental effects and measurable parameters were selected based on review of recent environmental assessments for mining projects in Newfoundland and Labrador (NL) and other parts of Canada, comments provided during engagement for the Approved Project, and professional judgment.

Table 7.1 Potential Effects, Effect Pathways and Measurable Parameters for Groundwater Resources

Potential Environmental Effect	Effect Pathway	Measurable Parameters and Units of Measurement
Change in groundwater quantity	• Direct loss or alteration of habitat arising from reduced baseflow to surface water features • Reduced groundwater availability for existing well users	• Reduction in baseflow (%) in surface water features supporting ecological habitat • Well yield (L/min) for existing well users in the Project Area
Change in groundwater quality	• Direct loss or alteration of habitat arising from chemistry of groundwater discharging to surface water features • Degradation of groundwater quality in potable water supplies	• Concentration of chemical parameters (various) in groundwater compared to applicable guidelines

Table 7.2 identifies the physical activities that might interact with groundwater resources and result in the identified environmental effect. These interactions are indicated by checkmark and are discussed further in Section 7.5.2, in the context of effects pathways and residual effects. Following the table, justification is provided for where no interaction (and therefore no resulting effect) is predicted.

Table 7.2 Project Expansion-Environment Interactions with Groundwater Resources

Physical Activities	Environmental Effects to Be Assessed	
	Change in Groundwater Quantity	**Change in Groundwater Quality**
CONSTRUCTION		
Mine Site Preparation and Earthworks: Clearing and cutting of vegetation and removal of organic materials, development of roads, and excavation and preparation of stockpile areas within the Expansion footprint. For the open pit, earthworks include stripping, stockpiling of organic and overburden materials, and development of in-pit quarries to supply site development rock for infrastructure such as structural fill and road gravels. Also includes temporary surface water and groundwater management, and the presence of people and equipment on site.	✓	✓
Construction / Installation of Infrastructure and Equipment: Construction of infrastructure as required for the Project Expansion. Also includes: • Installation of water control structures (including earthworks) • Presence of people and equipment on-site	✓	–
Emissions, Discharges and Wastes[A]: Noise, air emissions / GHGs, light, water discharge, and hazardous and non-hazardous wastes.	–	–
OPERATION		
Open Pit Mining: Blasting, excavation and haulage of rock from the open pits using conventional mining equipment.	✓	✓
Topsoil, Overburden and Rock Managem**ent:** Four types of piles: • Topsoil • Overburden • Waste rock • Low-grade ore Rock excavated from the open pit that will not be processed for gold will be used as engineered fill for site development, maintenance and rehabilitation, assuming it is non-acid generating, deposited in mined out basins of Berry pit, or will be deposited in a waste rock pile.	✓	✓
Tailings Management : Following treating tailings via cyanide destruction, tailings will be thickened and pumped to an engineered tailings impoundment in years 1 to 9, then pumped to the exhausted Berry open pit in year 10 to the end of operation. Marathon plans to upgrade the water treatment process by replacing the proposed polishing pond with a smaller SAGR unit that provides improved treatment of nitrogen species.	✓	✓

Table 7.2 Project Expansion-Environment Interactions with Groundwater Resources

Physical Activities	Environmental Effects to Be Assessed	
	Change in Groundwater Quantity	**Change in Groundwater Quality**
Water Management (Collection, treatment and release): Site contact water and process effluent will be managed on site and treated prior to discharge to the environment. Where possible, non-contact water will be diverted away from mine features and infrastructure, and site contact and process water will be recycled to the extent possible for use on site.	✓	✓
Utilities, Infrastructure and Other Facilities: Most utilities, infrastructure and facilities remain unchanged, and are as described in the Valentine Gold EIS (Marathon 2020) and assessed as part of the Approved Project. Relocation of the explosives facility, maintenance of Berry Complex haul and site access roads, and site snow clearing will be required for the Project Expansion. Note that while the location of the explosives facility has changed, the design and activities associated with the facility have not.	✓	–
Emissions, Discharges and Wastes[A]: Noise, air emissions / GHGs, light, water discharge, and hazardous and non-hazardous wastes.	–	–
Employment and Expenditure Operation of the combined Approved Project and Project Expansion is estimated to require a peak workforce of approximately 524 fulltime equivalents (FTEs) (44 FTEs above the Valentine Gold EIS estimate) and an average of 366 FTEs.	–	–
DECOMMISSIONING, REHABILITATION AND CLOSURE		
Decommissioning of Mine Features and Infrastructure	✓	✓
Progressive Rehabilitation: Erosion stabilization and re-vegetation of completed overburden and/or waste rock piles; infilling or flooding of exhausted mining areas; and completing revegetation studies and trials.	✓	✓
Closure Rehabilitation: Active rehabilitation based on successes of progressive rehabilitation activities. Includes: grading and revegetating cleared areas, where practicable; breaching and regrading ponds to reestablish drainage patterns; erosion stabilization and revegetation of completed overburden and/or waste rock piles; and infilling or flooding of open pit.	✓	✓
Post-Closure: Long-term monitoring	✓	✓
Emissions, Discharges and Wastes[A]	–	–

Notes:

✓ = Potential interaction

– = No interaction

[A] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project Expansion activities. Rather than acknowledging this by placing a checkmark against each of these activities, “Wastes and Emissions” is an additional component under each Project Expansion phase.

The following Project Expansion activities and components are not expected to result in an effect on the quantity or quality of groundwater resources:

- Emissions, Discharges, and Wastes as the receivers will be air and surface water
- Decommissioning, Rehabilitation and Closure-related transportation along the access road
- Employment and Expenditure as these are unrelated to groundwater resources

7.3 MITIGATION AND MANAGEMENT MEASURES

A series of environmental management plans have been developed by Marathon to mitigate the effects of Approved Project development on the environment. Mitigation and management measures previously committed to in relation to the Approved Project can be found in Appendix 2E. These measures will be applied to the Project Expansion as applicable. No new mitigation and management measures are anticipated to be required related to Project Expansion activities.

7.4 SUMMARY OF APPROVED PROJECT RESIDUAL EFFECTS

7.4.1 Groundwater Quantity

The Valentine Gold EIS (Marathon 2020) predicted that during construction, local changes in infiltration rates and changes in evapotranspiration rates and runoff would have a limited effect on groundwater resources due to their limited extent of development (footprint). Construction earthworks could encounter groundwater and require water management; however, with implementation of the construction mitigation measures, these effects were expected to be low in magnitude. The temporary pumping for construction dewatering would be short term and on an as-needed basis; therefore, changes to groundwater quantity and flow due to temporary construction dewatering were characterized as low in magnitude, given that excavations for typical foundations were expected to be between 1 and 3 m below ground surface.

During operation, the primary Approved Project effect on groundwater quantity and/or flow would be the lowering of water levels through continued dewatering of the open pits and the raising (or mounding) of the water table through operation of the waste rock piles and TMF. Results of the groundwater flow modelling indicated that as dewatering progressed with development of the open pits, the average annual groundwater inflow rate to the open pits would increase, with a maximum rate of 1,350 m^3/d at the Leprechaun pit, and 1,846 m^3/d at the Marathon pit at the end of the operation. Dewatering of the open pits was predicted to lower the water table by up to 1 m over an area extending up to 1.6 km from the Leprechaun pit and up to 1.3 km from the Marathon pit. Mounding of the water table within the area of the TMF was predicted to extend up to 475 m north of the limits of the TMF and would be contained within the limits of the Leprechaun and Marathon waste rock piles. Drawdown due to the operation of the seepage collection ditches around the perimeter of the TMF and waste rock piles were predicted to lower the water table up to 1 m in the immediate vicinity of the collection ditches only.

As indicated in the Valentine Gold EIS, there are no known groundwater well users located within the LAA / RAA. Therefore, no water supply wells or groundwater withdrawals that supply potable water were present within the extent of drawdown of the open pits and no adverse environmental effects to

groundwater quantity and/or flow were predicted from the Approved Project on existing water supply wells. A discussion of the effects of lowering the water table on wetlands was provided in the Vegetation, Wetlands, Terrain and Soils VC (Section 7.6) in the Valentine Gold EIS. The direction of groundwater discharge to each surface water feature from baseline conditions to end of operation remained consistent with water features receiving groundwater and the effect of changes in groundwater discharge on surface water levels and flow were generally offset by flows from seepage collection ditches. The lowering of water levels through continued dewatering of the open pits, and the continued development of the waste rock piles and stockpiles and operation of the TMF was predicted to result in a change in groundwater level of less than 5 m in the Project Area and 1 m in the LAA / RAA; therefore, the magnitude of the effect was considered low to moderate.

During decommissioning, rehabilitation and closure, water levels would begin to rise within the open pits until an overflow elevation was reached. The water level would rise to a maximum water elevation of approximately 377 m above mean sea level (amsl) at Leprechaun pit, and approximately 330 m amsl at Marathon pit, and would represent the local water table elevation at closure. At the end of closure, the water table was predicted to return to near baseline conditions except in the northwest corner of the Leprechaun pit which would be permanently lowered at this location. Drawdown due to the presence of the seepage collection ditches around the perimeter of the TMF, waste rock piles and ore stockpiles was predicted in the direct vicinity of the collection ditches. However, the predicted effects of the removal of the ditches on baseflow rates resulted in flow rates in nearby water features that were similar to baseline conditions. Several smaller tributaries were expected to receive higher baseflow starting in operation due to the presence of the TMF, and these effects would continue throughout closure. Overall, the magnitude of effects on groundwater quantity during this phase would be low in the LAA / RAA, as the change in groundwater level was predicted to be less than 1 m.

7.4.2 Groundwater Quality

The Valentine Gold EIS predicted that during construction, changes to groundwater quality could result from infiltrating water in exposed areas of overburden removal. The short duration of the construction period was not anticipated to result in metal leaching / acid rock drainage issues (ARD); therefore, groundwater quality effects were not anticipated during construction.

During operation, the Approved Project activities and components that could interact with groundwater quality and result in adverse environmental effects included open pit mining, management of topsoil, overburden and waste rock, TMF operation, and water management. Baseflow loadings would directly affect the surface water quality, and the effects are further characterized in Section 7.4 of the Valentine Gold EIS. The magnitude of changes to groundwater quality during operation would be low in the LAA / RAA, as the change in groundwater quality would not adversely affect any existing or reasonably foreseeable groundwater users.

During decommissioning, rehabilitation and closure, the waste rock piles and TMF would be progressively rehabilitated throughout the Project Area, reducing the seepage from these areas. During this phase, the ore stockpiles would also be depleted and rehabilitated, and should not act as source areas post-closure. As there were no groundwater receivers located along the predicted groundwater flow paths, the effects

of the seepage from the Approved Project infrastructure from groundwater were predicted to discharge to surface water receivers. These effects are characterized in Section 7.4 of the Valentine Gold EIS. Overall, the magnitude of changes to groundwater quality effects during decommissioning, rehabilitation and closure were predicted to be low in the LAA / RAA, as the change in groundwater quality would not adversely affect existing or reasonably foreseeable groundwater users.

In summary, the Valentine Gold EIS for the Approved Project concluded that with mitigation and management measures, residual environmental effects on the groundwater resources were predicted to be not significant because the Approved Project was not predicted to result in:

- Decrease in the yield from an existing and otherwise adequate groundwater supply well to the point where it is inadequate for its intended use.
- Change in groundwater quality, such that the quality of groundwater from an otherwise adequate water supply well that meets applicable guidelines deteriorates to the point where it becomes non-potable or cannot meet the Guidelines for Canadian Drinking Water Quality (Health Canada 2022) for a consecutive period exceeding 30 days.
- Physical or chemical alteration to an aquifer to the extent that interaction with local surface water results in streamflow or surface water chemistry changes that adversely affect aquatic life or a down-stream surface water supply.

7.5 ASSESSMENT OF RESIDUAL EFFECTS OF PROJECT EXPANSION

7.5.1 Assessment Criteria Methods

This section describes the criteria and methods used to assess environmental effects on groundwater resources from the Project Expansion. Residual environmental effects (Section 7.5.2) are assessed and characterized using criteria defined in Section 7.5.1.1, including direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological or socio-economic context. The methods of determining residual effects are the same as for the Approved Project. The assessment also evaluates the significance of residual effects using threshold criteria or standards beyond which a residual environmental effect is considered significant. The definition of a significant effect for the Groundwater Resources VC is provided in Section 7.5.1.2.

7.5.1.1 Residual Effects Characterization

Table 7.3 presents definitions for the characterization of residual environmental effects on groundwater resources. The criteria describe the potential residual effects that remain after mitigation measures have been implemented. Quantitative measures were developed, where possible, to characterize residual effects. Qualitative considerations were used where quantitative measurement was not possible.

Table 7.3 Characterization of Residual Effects on Groundwater Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Neutral –** no net change in measurable parameters for groundwater resources relative to baseline **Positive –** a residual effect that moves measurable parameters in a direction beneficial to groundwater resources relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to groundwater resources relative to baseline
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible –** no measurable change to groundwater resources relative to baseline **Low –** a measurable change is detectable but within the normal variability that would be expected relative to baseline **Moderate –** measurable change occurs that is considered elevated above baseline or depressed below baseline but within acceptable limits **High –** measurable change occurs that is considered elevated above acceptable limits or regulatory objectives
Geographic Extent	The geographic area in which a residual effect occurs	**Project Area –** residual effects are restricted to the Project Area **LAA/RAA–** residual effects extend into the LAA/RAA
Frequency	Identifies how often the residual effect occurs and how often during the Project Expansion or in a specific phase	**Single event –** occurs only once **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period required until the measurable parameter or the VC returns to its existing (baseline) condition, or the residual effect can no longer be measured or otherwise perceived	**Short term –** residual effect restricted to construction or decommissioning, rehabilitation and closure phases **Medium term –** residual effect extends through Project Expansion operations but is expected to subside when operations cease **Long term –** residual effect extends beyond the life of the Project Expansion **Permanent –** recovery to baseline conditions unlikely
Reversibility	Describes whether a measurable parameter or the VC can return to its existing condition after the Project Expansion activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and rehabilitation **Irreversible –** the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

7.5.1.2 Significance Definition

Thresholds have been established to define significant adverse residual environmental effects on quantity and quality of groundwater. Thresholds consider the federal and provincial regulations, policies and guidelines identified in Section 5.1.4, the residual effects characterization criteria presented in Section 7.5.1.1, and measurable parameters listed in Section 7.2.

- Decrease in the yield from an existing and otherwise adequate groundwater supply well to the point where it is inadequate for its intended use.
- Change in groundwater quality, such that the quality of groundwater from an otherwise adequate water supply well that meets applicable guidelines deteriorates to the point where it becomes non-potable or cannot meet the GCDWQ (Health Canada 2022) for a consecutive period exceeding 30 days.
- Physical or chemical alteration to an aquifer to the extent that discharge to surface water is at concentrations which exceed the Metal and Diamond Mining Effluent Regulations (MDMER) limits.
- Interaction with local surface water results in streamflow or surface water chemistry changes that adversely affect aquatic life or a down-stream surface water supply.

7.5.2 Assessment of Residual Effects

For each potential effect identified in Section 7.2, specific Project Expansion activities that may interact with groundwater resources are identified and described. The following sections first describe the pathways by which a potential Project Expansion effect could result from Project Expansion activities in the absence of mitigation during each Project Expansion phase (i.e., construction, operation, and decommissioning, rehabilitation and closure). Mitigation and management measures (Section 7.3) are applied to avoid or reduce these potential pathways and resulting environmental effects. Residual effects are those remaining following implementation of mitigation, which are then characterized using the criteria defined in Section 7.5.1.1. A determination of the significance of the predicted residual effects is provided in Section 7.5.3.

7.5.2.1 Analytical Assessment Techniques

The effects analysis for groundwater quantity and flow, and groundwater quality, is carried out using a number of analytical methods and tools, and includes laboratory analytical data, three-dimensional numerical groundwater flow modelling, water quality modelling, and mass balance loading calculations. The techniques are described in detail in “Hydrogeology Modelling, Valentine Gold Project” (the “existing model”; Stantec 2020) and the “Valentine Gold Project – Berry Complex Expansion: Hydrogeological Model Update” (the “updated model”; Appendix 7A).

The updated model provides quantitative predictions about changes in groundwater levels and flow during the construction, operation, and decommissioning, rehabilitation and closure phases of the Project Expansion and the resulting changes in groundwater discharge for the following:

- Operation:
  - Dewatering rates from staged development of the Berry pit, and associated changes to groundwater levels and baseflow to surrounding water bodies
  - Groundwater seepage from the Berry waste rock pile, the Berry / Marathon LGO stockpile (expanded from the Marathon LGO stockpile for the Approved Project), and the TMF
- Decommissioning, Rehabilitation and Closure:
  - Groundwater inflow rates to the Berry open pit at progressive stages during filling with water to form pit lakes
  - Groundwater seepage from the closed and rehabilitated Berry waste rock pile and TMF
  - Groundwater in contact with the tailings used as backfill in the Berry open pit

A water balance and water quality model was built using GoldSim™, coupling water quantity and mass transfer of contaminants/parameters of potential concern (POPCs) from different Project Expansion components. The results of the model were used to predict the water quality from seepage to groundwater associated with the Berry waste rock pile and the Berry / Marathon LGO stockpile during construction, operation, and decommissioning, rehabilitation and closure (Stantec 2023b; Appendix 7A).

- For the seepage associated with the Berry waste rock pile and the Berry / Marathon LGO stockpile, the concentrations of POPCs from sources were multiplied by the predicted groundwater discharge to each surface water feature that originated at each source (i.e., the Berry waste rock pile or the Berry / Marathon LGO stockpile without consideration for attenuation along the groundwater flowpath) to estimate the mass loading to each surface water feature from each source.
- The mass loading approach used for the Berry waste rock pile and the Berry / Marathon LGO stockpile was considered overly conservative for assessing effects on surface water quality due to groundwater infiltrating from beneath the TMF based on predicted water quality in the TMF, and the relatively small receiving water volume in Victoria River downstream of the Victoria Dam. Therefore, a contaminant transport approach using the USGS contaminant fate and transport code MT3D was applied. The contaminant transport model provides an attenuation factor that can be applied to source concentrations from the TMF to estimate a concentration in groundwater discharging to surface water features. This approach was also used to assess the effects on surface water quality due to groundwater in contact with the tailings deposited in the Berry pit after year 9 of operations below the water table.

7.5.2.2 Assumptions and the Conservative Approach

The following assumptions, which provide as conservative an approach as practicable, were applied to the groundwater flow model and used in the assessment of effects:

- The water quality infiltrating to groundwater from the Berry waste rock pile and the Berry / Marathon LGO stockpile was assumed to be representative of the water quality at the predicted discharge location to the receiving environment. This approach provides a conservative estimate of groundwater quality discharging to surface water and does not consider physical or chemical attenuation processes along the groundwater flow path.
- Loading predictions to downstream receptors do not consider groundwater travel times and are based on discharge rates at the end of operation and decommissioning, rehabilitation and closure once the open pit is filled to its final water elevation. As a result, the loadings represent a conservative estimate under steady-state conditions during operation.
- The Berry waste rock pile and Berry / Marathon LGO stockpiles are assumed to be saturated as the stockpiles are placed through operation, where the volume of water infiltrating from precipitation will result in an equal amount of seepage out the base of the piles. This assumption is conservative as it results in an instantaneous loading of POPCs to groundwater as opposed to the more realistic gradual loading over the operating period.

Note that while the tailings impoundment area is not anticipated to change in design, location or capacity as a result of Project Expansion activities, the TMF has been considered in the assessment of Project Expansion effects for groundwater as particles from tailings stored in the Berry pit will travel north and south and will be indistinguishable from particles from the TMF itself.

7.5.2.3 Change in Groundwater Quantity

Groundwater quantity effects can include potential lowering of local water levels, with consequent reduction in water levels in water supply wells drilled for the Approved Project, reduction in domestic well yield in proximity to Project Expansion activities, and reduction in local streamflow. Project Expansion activities which could affect groundwater quality are listed in Table 7.2 and described in detail in Chapter 2 of this document. The Project Expansion activities which are anticipated to result in potential effects on groundwater quantity are discussed further below.

Construction

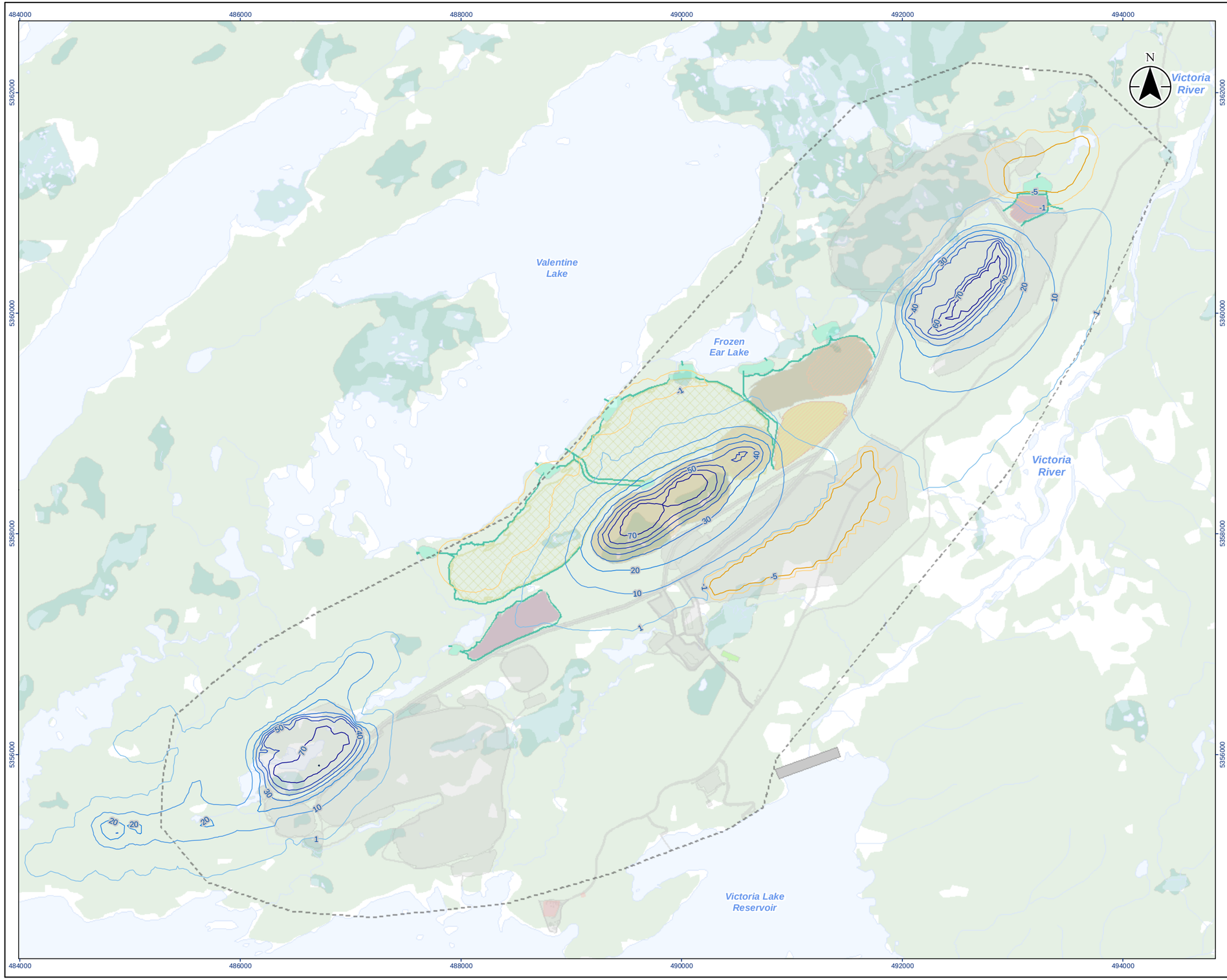
Groundwater flow patterns may be altered by dewatering for the initial pit development and construction of Project Expansion infrastructure. The resulting change in groundwater flow patterns and recharge rates may affect groundwater discharge to surface water features and wetlands.

With the implementation of the mitigation measures presented in the Valentine Gold EIS (e.g., limiting construction footprint, use of standard management practices including drainage control and excavation) changes to groundwater quantity and flow due to temporary construction dewatering are characterized as adverse, continuous, short-term (i.e., limited to the construction phase and on an as-needed basis), reversible, and confined to the Project Area. The magnitude is expected to be low, given that excavations for typical foundations are expected to be on the order of 1 mbgs with deeper foundations in some instances. Timing (i.e., natural seasonal variations in precipitation) may affect dewatering rates, particularly during the spring when higher groundwater levels are expected; however, these variations would not be a Project Expansion-related effect. The ecological context within which effects to groundwater quantity would occur in the LAA / RAA is considered undisturbed as defined in Table 7.3.

Operation

During operation, the primary Project Expansion effect on groundwater quantity and/or flow during operation is the lowering of groundwater levels through dewatering of the Berry pit.

Results from the update model indicate that as dewatering progresses with development of the Berry pit, the average annual groundwater inflow rate to the Berry pit will increase, to a maximum rate of 1,770 m^3/d at the end of the operation phase. The change in water table elevation due to dewatering (e.g., drawdown) of the open pits for the Approved Project and the Project Expansion at the end of mining in comparison to existing conditions is shown on Figure 7-2. Dewatering of the Berry pit is predicted to lower the water table by up to 1 m over an area extending up to approximately 3 km long by 1.3 km wide. Increased infiltration results in some mounding within the footprint of the Berry waste rock pile. Due to this increased infiltration, a reversal in the horizontal gradient between the Berry pit and Valentine Lake is not predicted to occur during the operation phase.



Stantec

Legend

Predicted Water Table Mounding Contour (above baseline) (m)

- -1
- -5

Predicted Water Table Drawdown Contour (below baseline) (m)

- 1
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80

- Mine Site

Proposed Project Expansion

- Ditch / Drainage Channel
- Sedimentation Pond
- Topsoil Stockpile
- Overburden Stockpile
- Open Pit
- SAGR Unit
- Waste Rock Pile
- Explosives Facility
- Site Feature Approved - Overlap

Approved Project

- Approved Project Components

0 1 2 km

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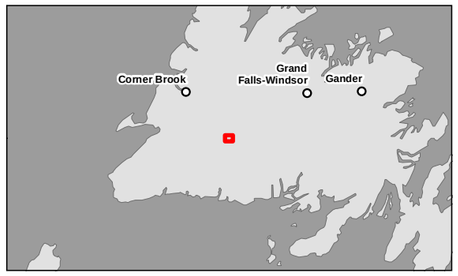
Notes

1. Coordinate System: NAD 1983 UTM Zone 21N
2. Base Data: CANVEC



Project Location
Valantine Lake
Central Newfoundland, CA

121417555 REVA
Prepared by AMW on 2023-07-25
Technical Review by AD on 2023-06-12

Client/Project
MARATHON GOLD CORPORATION
VALENTINE GOLD PROJECT
PROJECT EXPANSION

Figure No.
7-2

Title
Water Table Drawdown at End of Approved Project and Project Expansion Operation

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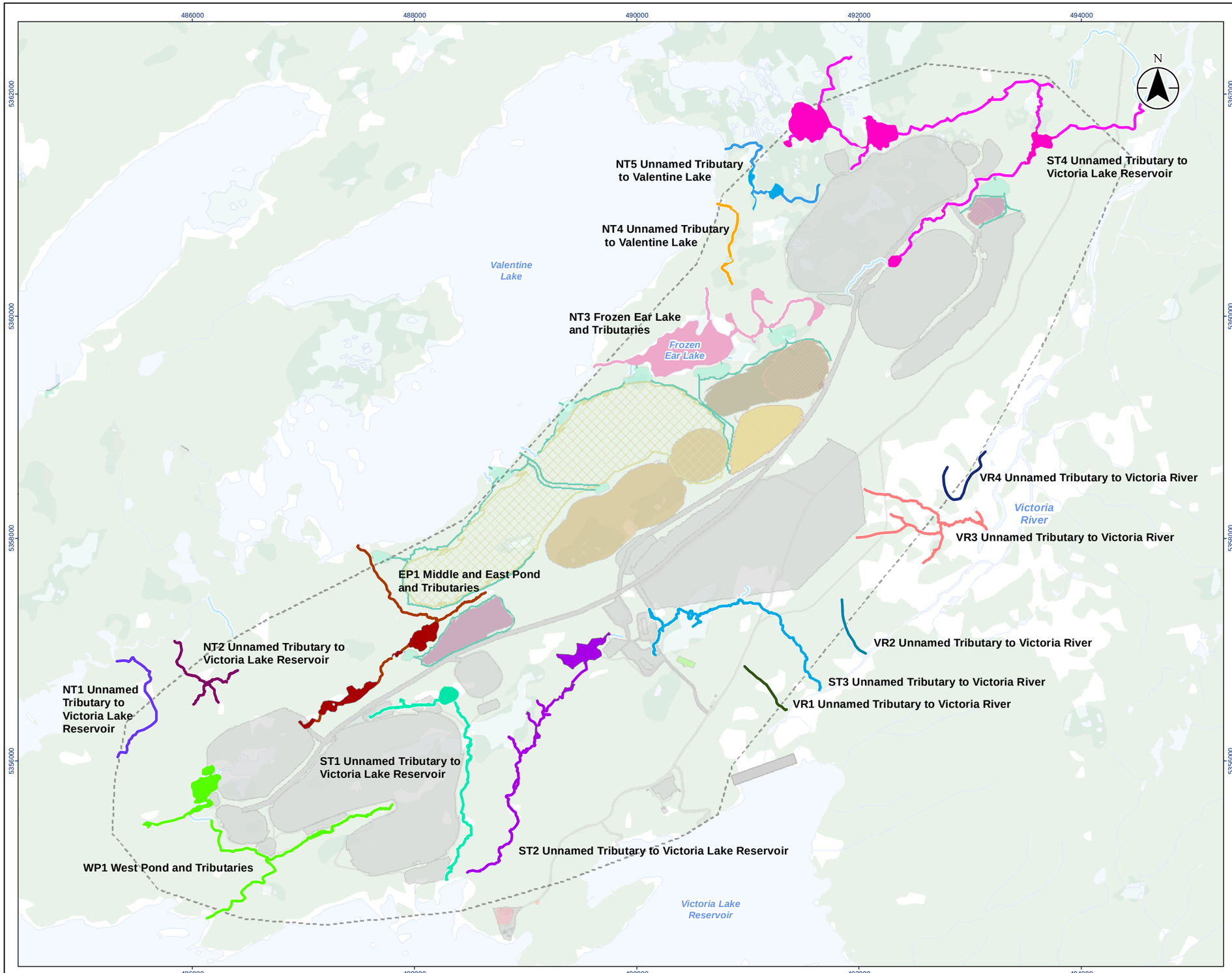
Based on a review of the NL Water Well Database (NLDMAE 2020), there are no known groundwater well users located within the Project Area or LAA / RAA. Therefore, no water supply wells or groundwater withdrawals that supply potable water are present within the extent of drawdown of the open pits (Figure 7-2). As a result, no adverse environmental effects to groundwater quantity and/or flow are predicted from the Project Expansion on existing water supply wells.

The effects of the Berry pit at its full extent and the operation of the Berry waste rock pile, the Berry / Marathon LGO stockpile, and the TMF on the groundwater discharge to surface water features are assessed by comparing the predicted operation and baseline discharge rates presented in Table 7.4. The surface water features included in Table 7.4 are those within the 1 m drawdown and mounding contours associated with the Berry pit and the TMF as presented on Figure 7-2. The locations of each of the surface water features included in Table 7.4 are presented on Figure 7-3.

Table 7.4 Estimated Groundwater Discharge to Surface Water Features During Operation

Surface Water Feature	Net Flow from Groundwater to Surface Water Feature (m^3/d)		
	Baseline	**Operation**	**% Reduction**
Frozen Ear Lake and Tributaries NT3	1,828	1,783	2 %
Middle and East Pond and Tributaries EP1	521	372	29 %
Unnamed Tributary to Victoria River ST3	489	422	14 %
Unnamed Tributary to Victoria River VR3	306	312	-2 %
Valentine Lake (direct)	13,191	13,412	-2 %



Stantec

Legend

- Mine Site

Proposed Project Expansion

- Ditch / Drainage Channel
- Sedimentation Pond
- Topsoil Stockpile
- Overburden Stockpile
- Open Pit
- SAGR Unit
- Waste Rock Pile
- Explosives Facility
- Site Feature Approved - Overlap

Approved Project

- Approved Project Components

0 1 2 km

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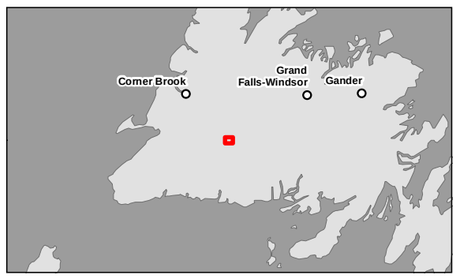
Notes

1. Coordinate System: NAD 1983 UTM Zone 21N
2. Base Data: CANVEC



Project Location
Valantine Lake
Central Newfoundland, CA

121417555 REVA
Prepared by AMW on 2023-07-25
Technical Review by AD on 2023-06-12

Client/Project
MARATHON GOLD CORPORATION
VALENTINE GOLD PROJECT
PROJECT EXPANSION

Figure No.
7-3

Title
Assessed Surface Water Features

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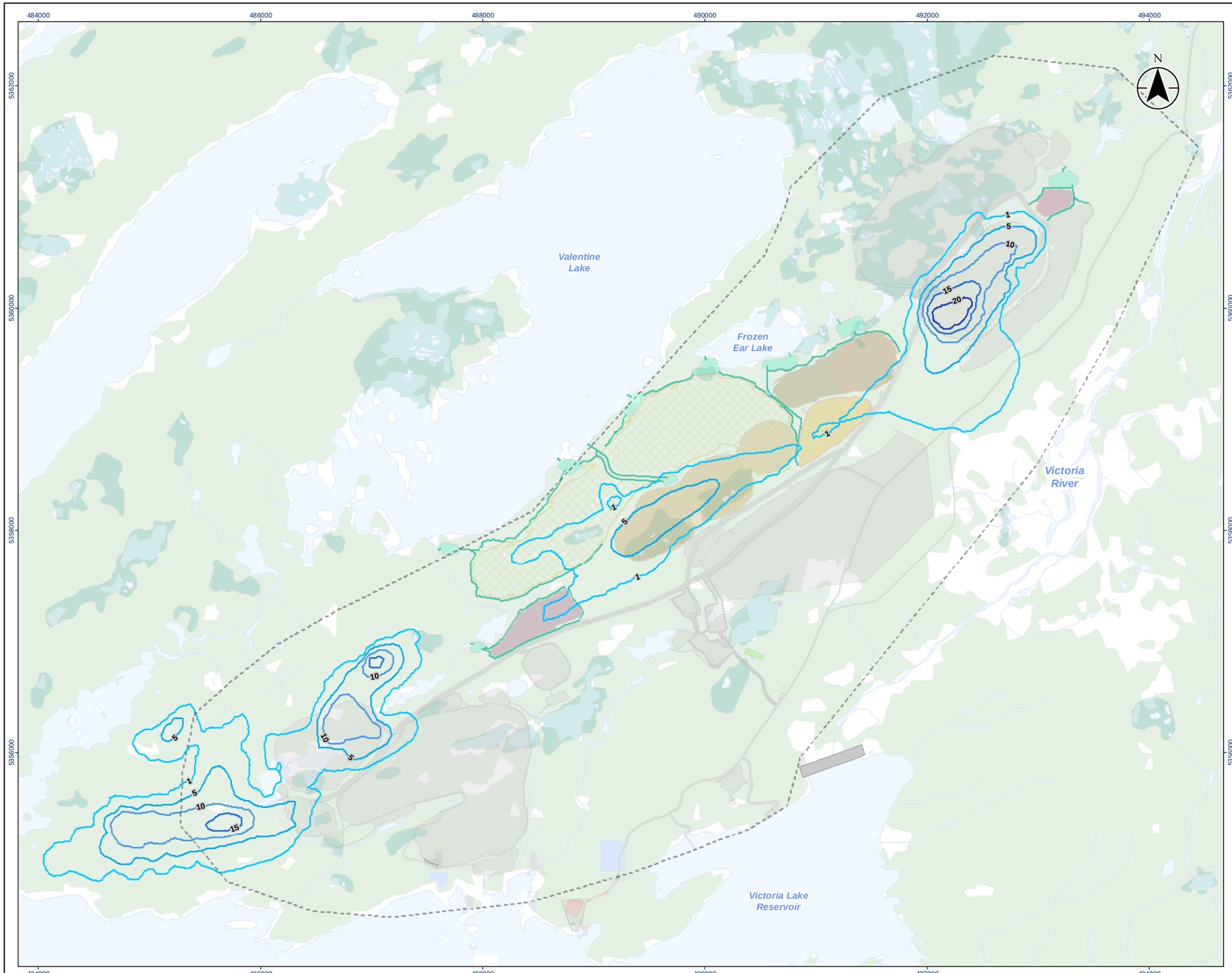
The direction of groundwater discharge to each surface water feature from baseline conditions to end of operation remains consistent with water features receiving groundwater. The rate of groundwater discharge is generally decreased for water features closest to the open pits, particularly for Middle and East Ponds and tributaries (EP1), which are also predicted to be affected by dewatering of the Leprechaun pit. The rate of groundwater discharge to surface water features is predicted to increase slightly in the unnamed tributary to the Victoria River (VR3) during operation due to the increased rate of infiltration through the TMF compared to baseline conditions. The effects of changes in predicted surface water flows are evaluated in Chapter 8 (Surface Water Resources).

The lowering of water levels through continued dewatering of the Berry pit and development of the Berry waste rock pile and TMF through the operational phase of the Project Expansion and Approved Project will result in a change in groundwater quantity and flow in the LAA. Within the LAA, this change is characterized as adverse, long-term, continuous and irreversible, as the water levels are not expected to return to baseline levels during decommissioning, rehabilitation and closure. At the boundary of the LAA, there is no anticipated residual effect on groundwater resources. The change will be confined to the Project Area in the vicinity of the Berry pit. As the largest predicted effects on groundwater elevations are centered around the open pit, and within the expected range, the magnitude is considered moderate. While the magnitude will be reduced during decommissioning, rehabilitation and closure as the open pit fills to form pit lakes, some local drawdown will remain in the vicinity of the open pits as discussed below. Natural seasonal variations in precipitation may affect dewatering rates, particularly during spring when higher groundwater levels are expected; however, these variations would not be considered a Project Expansion-related effect. The ecological context within which effects to groundwater quantity would occur in the LAA / RAA is considered undisturbed as defined in Table 7.3.

Decommissioning, Rehabilitation and Closure

Following completion of the operation phase, dewatering of the Berry pit will cease and water levels will begin to rise within the open pit until an overflow elevation is reached. The water level will rise to the minimum pit edge elevations of approximately 418 m amsl, 418 m amsl, and 400 m amsl for the southern, central, and northern basins of the Berry pit, respectively and will represent the local water table elevation at closure. The simulated drawdown (relative to baseline conditions) after the Berry pit has filled to its expected overflow levels (i.e., the minimum pit edge elevations) is presented on Figure 7-4. At the end of closure, the water table is predicted to return to near baseline conditions except for within the footprint of the Berry pit where drawdowns below baseline of up to 5 mbgs are predicted to persist.



Stantec

Legend

Predicted Water Table Drawdown Contour (below baseline) (m)

- 1
- 5
- 10
- 15
- 20

- Mine Site

Proposed Project Expansion

- Ditch / Drainage Channel
- Sedimentation Pond
- Topsoil Stockpile
- Overburden Stockpile
- Open Pit
- SAGR Unit
- Waste Rock Pile
- Explosives Facility
- Site Feature Approved - Overlap

Approved Project

- Approved Project Components

0 1 2 km

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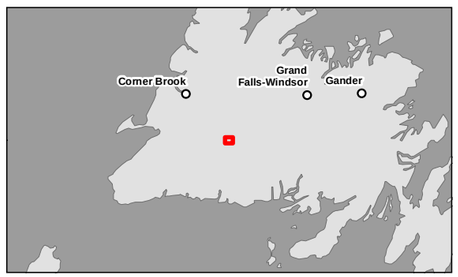
Notes
1. Coordinate System: NAD 1983 UTM Zone 21N
2. Base Data: CANVEC



Project Location
Valantine Lake
Central Newfoundland, CA

121417555 REVA
Prepared by AMW on 2023-07-25
Technical Review by AD on 2023-06-12

Client/Project
MARATHON GOLD CORPORATION
VALENTINE GOLD PROJECT
PROJECT EXPANSION

Figure No.
7-4

Title
Water Table Drawdown Following Closure

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Table 7.5 presents the comparison of baseline groundwater discharge rates to those following decommissioning, rehabilitation and closure (i.e., after the Berry pit lakes are full).

Table 7.5 Estimated Groundwater Discharge to Surface Water Features Post-Closure (i.e., Pit-Full) Conditions

Surface Water Feature	Net Flow from Groundwater to Surface Water Feature (m^3/d)		
	Baseline	Post-Closure	Percent Reduction
Frozen Ear Lake and Tributaries NT3	1,828	1886	-3 %
Middle and East Pond and Tributaries EP1	521	483	7 %
Unnamed Tributary to Victoria River ST3	489	478	2 %
Unnamed Tributary to Victoria River VR3	306	331	-8 %
Valentine Lake (direct)	13,191	13,226	-0.3 %

Groundwater flow to the receptors is predicted to return to within 10 % of baseline rates in the surface water features potentially affected by the Project Expansion. The effects of changes of groundwater discharge on surface water levels and flow are evaluated in the Chapter 8 (Surface Water Resources).

The changes in groundwater levels during closure are characterized as adverse, long-term, continuous, irreversible, and confined to the Project Area. The magnitude will be low as the change in groundwater level is predicted to be less than 1 m except within the footprint of the Berry pit where a change in groundwater levels of approximately 5 m is expected. Natural seasonal variations may affect water levels, particularly during spring when higher groundwater levels are expected, however, this is not considered a Project Expansion-related effect. The ecological context within which effects to groundwater quantity would occur in the LAA / RAA is considered undisturbed as defined in Table 7.3.

7.5.2.4 Change in Groundwater Quality

Groundwater quality effects can include changes in groundwater chemistry near site infrastructure and may adversely affect groundwater quality in wells should they be located in proximity to Project Expansion activities, and contaminated discharge to local surface water.

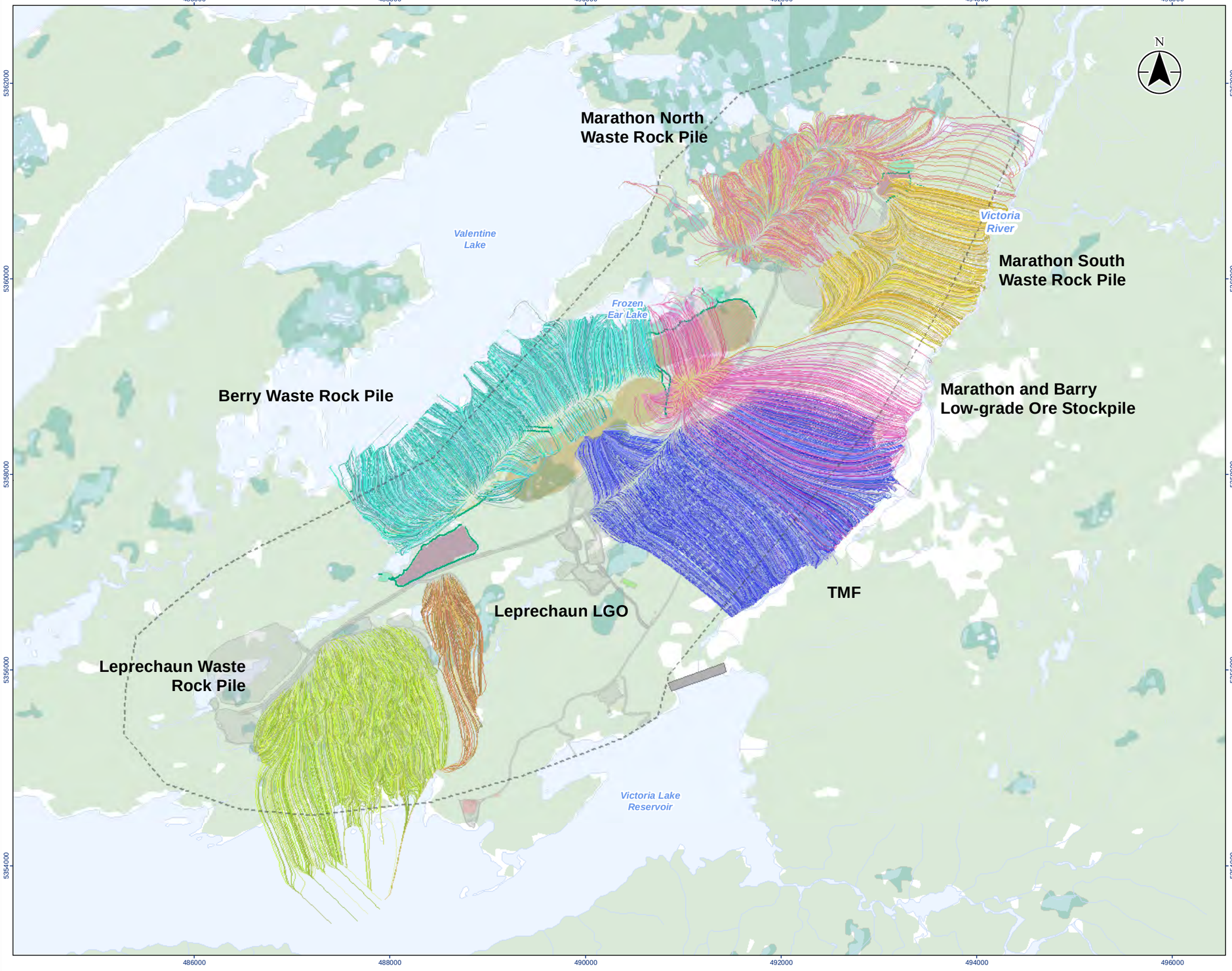
Construction

As indicated in Table 7.2, Project Expansion activities during construction that could affect groundwater quality are mine site preparation and earthworks. Groundwater quality effects can include changes in groundwater chemistry from infiltrating water in exposed areas of overburden removal.

Operation

The main potential effect to groundwater quality during operation of the Project Expansion is the potential release of impacted seepage from the Berry waste rock pile, Berry / Marathon LGO stockpile, and the TMF. Seepage will migrate through overburden and shallow bedrock toward discharge points at the closest streams, lakes or wetlands. The Project Expansion is not anticipated to interact with the nearest reported residential groundwater supplies in the vicinity of Buchans and Millertown due to the distance between the Project Expansion and these well users. In addition, the intervening lakes and watershed divides would act as hydraulic barriers. In the absence of identified well users, surface water would be the primary receptor of impacted seepages from the TMF or waste rock piles.

Seepage from the base of Berry waste rock pile and Berry / Marathon LGO stockpile during operation is predicted to move to the receiving environment following the particle traces presented on Figure 7-5. The main ultimate surface water receiver of seepage from the Berry waste rock pile is Valentine Lake. The main receiver of seepage from the TMF is the Victoria River. Modelled seepage from the Berry / Marathon LGO stockpile will travel both north to Frozen Ear Lake (and ultimately to Valentine Lake) and south towards the Victoria River.



Stantec

Legend

- Mine Site

Proposed Project Expansion

- Ditch / Drainage Channel
- Sedimentation Pond
- Topsoil Stockpile
- Overburden Stockpile
- Open Pit
- SAGR Unit
- Waste Rock Pile
- Explosives Facility
- Site Feature Approved - Overlap

Approved Project

- Approved Project Components

0 1 2 km

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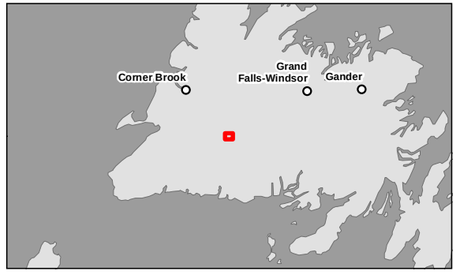
Notes

1. Coordinate System: NAD 1983 UTM Zone 21N
2. Base Data: CANVEC



Project Location
Valantine Lake
Central Newfoundland, CA

121417555 REVA
Prepared by AMW on 2023-07-25
Technical Review by AD on 2023-06-12

Client/Project
MARATHON GOLD CORPORATION
VALENTINE GOLD PROJECT
PROJECT EXPANSION

Figure No.
7-5

Title
Particle Traces Illustrating Flow Paths from Waste Rock Piles, LGO Stockpiles, and TMF at End of Approved Project and Project Expansion Operation

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Table 7.6 provides a summary of mean concentrations of POPCs predicted for groundwater seepage originating from the Berry waste rock pile and the Berry / Marathon LGO stockpile at the end of operation (Stantec 2023b, Appendix 7A). Consistent with predictions in the Valentine Gold EIS for the Approved Project, all predicted concentrations are below the MDMER limits, where applicable.

Table 7.6 Predicted Concentrations POPC in Seepage to Groundwater from Berry / Marathon LGO Stockpile, Berry Waste Rock Pile, and TMF during Operation

Parameter	Units	MDMER Limit[A]	Berry / Marathon LGO Stockpile	Berry Waste Rock Pile	TMF
Aluminum	µg/L	-	600	600	0.044
Antimony	µg/L	-	15	28	0.00078
Arsenic	µg/L	100	9.3	58	0.0023
Barium	µg/L	-	41	120	0.0045
Boron	µg/L	-	180	370	0.018
Cadmium	µg/L	-	0.12	0.42	0.000011
Calcium	µg/L	-	110,000	190,000	13
Chromium	µg/L	-	2.5	7.3	0.00044
Copper	µg/L	100	31	72	0.088
Iron	µg/L	-	270	310	0.067
Lead	µg/L	80	0.66	2.2	0.000094
Magnesium	µg/L	-	11,000	19,000	1.6
Manganese	µg/L	-	500	1300	0.067
Mercury	µg/L	-	0.11	0.41	0.000035
Molybdenum	µg/L	-	77	130	0.0089
Nickel	µg/L	250	5.5	8.1	0.00085
Phosphorus	µg/L	-	50	50	0.019
Potassium	µg/L	-	17,000	52,000	2.7
Selenium	µg/L	-	3.9	5	0.00029
Silver	µg/L	-	0.55	1.6	0.00016
Sodium	µg/L	-	79,000	150,000	49
Thallium	µg/L	-	0.18	0.24	0.000021
Uranium	µg/L	-	23	110	0.00042
Zinc	µg/L	400	22	63	0.0023
Chloride	µg/L	-	3,000	3,000	4.3
Nitrate + Nitrite	µg/L	-	110,000	70,000	0.06
Nitrite	µg/L	-	2,400	1,600	0.019
Nitrate	µg/L	-	100,000	68,000	0.06
Ammonia	µg/L	-	13,000	8,700	3.9

Table 7.6 Predicted Concentrations POPC in Seepage to Groundwater from Berry / Marathon LGO Stockpile, Berry Waste Rock Pile, and TMF during Operation

Parameter	Units	MDMER Limit[A]	Berry / Marathon LGO Stockpile	Berry Waste Rock Pile	TMF
Unionized Ammonia	µg/L	500	495	330	0.15
$Cyanide_{Total}$	µg/L	500	10	10	0.97
$Cyanide_{WAD}$	µg/L	-	1	1	0.17
Sulphate	µg/L	-	140,000	140,000	98
Fluoride	µg/L	-	830	1,600	0.17

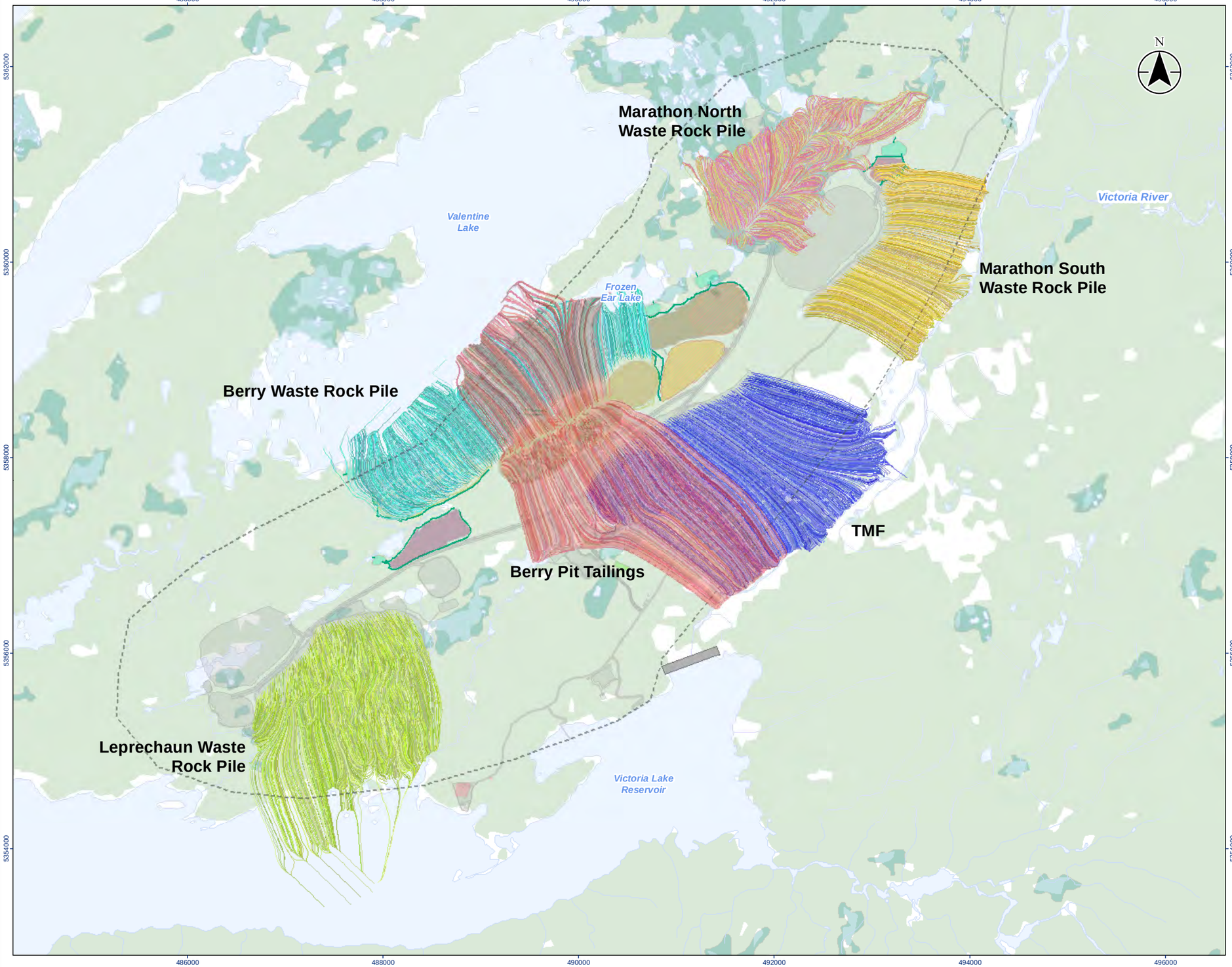
Notes:
[A] = MDMER, Schedule 4, Maximum Authorized Monthly Mean Concentration
- = Not applicable

As these loadings from groundwater discharge will directly affect surface water quality, the effects are further characterized in Chapter 8 (Surface Water Resources). No groundwater discharges to local receiving waters are predicted to exceed the MDMER limits.

The changes in groundwater quality during operation are characterized as adverse, long-term, continuous, irreversible, and confined to the LAA/RAA. The magnitude will be low in the LAA/RAA, as the change in groundwater quality will not adversely affect any existing or reasonably foreseeable future groundwater users. The ecological context within which effects to groundwater quality would occur in the LAA/RAA is considered undisturbed as defined in Table 7.3. This characterization of residual effects is consistent with residual effects for the Approved Project in the Valentine Gold EIS.

Decommissioning, Rehabilitation and Closure

Following decommissioning, rehabilitation and closure, the main potential effects of the Project Expansion on groundwater quality are seepage from the Berry waste rock pile and contact between groundwater and the tailings deposited in the Berry pit. Groundwater from these sources is predicted to move to the receiving environment following particle traces presented on Figure 7-6.



Stantec

Legend

- Mine Site

Proposed Project Expansion

- Ditch / Drainage Channel
- Sedimentation Pond
- Topsoil Stockpile
- Overburden Stockpile
- Open Pit
- SAGR Unit
- Waste Rock Pile
- Explosives Facility
- Site Feature Approved - Overlap

Approved Project

- Approved Project Components

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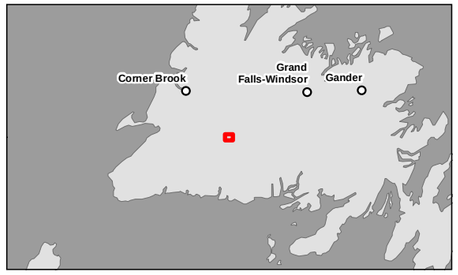
Notes

1. Coordinate System: NAD 1983 UTM Zone 21N
2. Base Data: CANVEC



Project Location
Valantine Lake
Central Newfoundland, CA

121417555 REVB
Prepared by AMW on 2023-07-25
Technical Review by AD on 2023-06-12

Client/Project
MARATHON GOLD CORPORATION
VALENTINE GOLD PROJECT
PROJECT EXPANSION

Figure No.
7-6

Title
Particle Traces Illustrating Flow Paths from Waste Rock Piles, TMF, and Backfilled Berry Pit, following Closure of Approved Project and Project Expansion Operation

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Table 7.7 provides a summary of mean concentrations for groundwater seepage originating from the Berry waste rock pile, the TMF, and the backfilled Berry pit post-closure (Stantec 2023b). Seepage from the Berry waste rock pile and TMF will be reduced as it is progressively rehabilitated throughout the Project Expansion. The Berry / Marathon LGO stockpile will be also depleted and rehabilitated and is not likely to act as a source area post-closure. The MDMER limits are exceeded in the seepage from the TMF for unionized ammonia and the backfilled Berry pit for cyanide (total). Predicted concentrations of POPCs in groundwater at the point of discharge to surface water are lower than at the point of seepage to groundwater, as presented in Table 7.7.

Table 7.7 Predicted Concentrations POPC in Seepage to Groundwater from Berry Waste Rock Pile, TMF, and Backfilled Berry Pit Post-Closure

Parameter	Units	MDMER Limit[A]	Berry Waste Rock Pile	TMF	Backfilled Berry Pit
Aluminum	µg/L	-	600	190	560
Antimony	µg/L	-	16	2.7	2.8
Arsenic	µg/L	100	5.2	3.1	8.6
Barium	µg/L	-	35	16	20
Boron	µg/L	-	38	34	51
Cadmium	µg/L	-	0.091	0.04	0.07
Calcium	µg/L	-	100,000	190,000	99,000
Chromium	µg/L	-	4.3	2	2.4
Copper	µg/L	100	34	62	31
Iron	µg/L	-	300	370	340
Lead	µg/L	80	0.93	0.26	0.33
Magnesium	µg/L	-	11,000	34,000	15,000
Manganese	µg/L	-	510	620	440
Mercury	µg/L	-	0.23	0.037	0.052
Molybdenum	µg/L	-	15	11	18
Nickel	µg/L	250	1.9	1.9	2.1
Phosphorus	µg/L	-	50	50	50
Potassium	µg/L	-	6,500	4,500	6,400
Selenium	µg/L	-	0.83	0.97	1.2
Silver	µg/L	-	0.86	0.18	0.22
Sodium	µg/L	-	4,500	51000	72,000
Thallium	µg/L	-	0.14	0.054	0.1
Uranium	µg/L	-	7.1	0.71	2.7
Zinc	µg/L	400	35	8.3	7.2
Chloride	µg/L	-	3,100	4,900	8,100
Nitrate + Nitrite (as N)	µg/L	-	58	72	860

Table 7.7 Predicted Concentrations POPC in Seepage to Groundwater from Berry Waste Rock Pile, TMF, and Backfilled Berry Pit Post-Closure

Parameter	Units	MDMER Limit[A]	Berry Waste Rock Pile	TMF	Backfilled Berry Pit
Nitrite (as N)	µg/L	-	7.8	16	50
Nitrate (as N)	µg/L	-	57	71	840
Ammonia	µg/L	-	61	15,000	13,000
Unionized Ammonia	µg/L	500	2.3	560	480
$Cyanide_{Total}$	µg/L	500	10	400	3,800
$Cyanide_{WAD}$	µg/L	-	1	100	390
Sulphate	µg/L	-	54,000	390,000	270,000
Fluoride	µg/L	-	1,200	560	530

Notes:
[A] = MDMER, Schedule 4, Maximum Authorized Monthly Mean Concentration
- = Not applicable

Based on MT3D modeling (Stantec 2023a), the predicted attenuation ratio of seepage from the base of the TMF discharging to the Victoria River post-closure is 0.05. This indicates that if a solute is released from the TMF at a concentration of 1 mg/L, it will be attenuated to a concentration of 0.05 mg/L (or 50 µg/L when it is discharged to Victoria River. The predicted concentrations of POPCs in groundwater discharge to the Victoria River that originate at the TMF post closure are presented in Table 7.8. Concentrations are predicted to be below the MDMER limits, where applicable. These findings are consistent with the Valentine Gold EIS.

Based on MT3D modeling (Stantec 2023a), the predicted attenuation ratio for groundwater in contact with the tailings and waste rock backfill in the Berry pit discharging to Valentine Lake and the Victoria River post-closure are 0.006 and 0.07, respectively. This indicates that if a solute is released from the from the Berry pit at a concentration of 1 mg/L, it will be attenuated to concentrations of 0.006 mg/L and 0.07 mg/L (or 6 µg/Land 70 µg/L) when it is discharged to Valentine Lake or the Victoria River, respectively. The predicted concentrations of POPCs in groundwater discharge to the Valentine Lake and the Victoria River that originate at the central and southern basins of the Berry pit are presented in Table 7.8. Concentrations are predicted to be below the MDMER limits, where applicable.

Table 7.8 Predicted Concentrations POPC in Groundwater Discharge to the Victoria River and Valentine Lake Originating at the TMF and the Backfilled Berry Pit Post Closure

Parameter	Units	MDMER Limit[A]	Discharge to Victoria River Originating at:		Discharge to Valentine Lake Originating at:
			TMF	Backfilled Berry Pit	Backfilled Berry Pit
Aluminum	µg/L	-	0.0022	39	3.4
Antimony	µg/L	-	0.000039	0.2	0.017
Arsenic	µg/L	100	0.00011	0.6	0.052
Barium	µg/L	-	0.00023	1.4	0.12
Boron	µg/L	-	0.00092	3.6	0.3
Cadmium	µg/L	-	0.00000055	0.0049	0.00042
Calcium	µg/L	-	0.67	6,900	590
Chromium	µg/L	-	0.000022	0.17	0.015
Copper	µg/L	100	0.0044	2.2	0.19
Iron	µg/L	-	0.0033	24	2
Lead	µg/L	80	0.0000047	0.023	0.002
Magnesium	µg/L	-	0.079	1100	90
Manganese	µg/L	-	0.0033	31	2.6
Mercury	µg/L	-	0.0000018	0.0037	0.00031
Molybdenum	µg/L	-	0.00045	1.3	0.11
Nickel	µg/L	250	0.000042	0.15	0.013
Phosphorus	µg/L	-	0.00094	3.5	0.3
Potassium	µg/L	-	0.13	450	39
Selenium	µg/L	-	0.000014	0.082	0.007
Silver	µg/L	-	0.0000078	0.015	0.0013
Sodium	µg/L	-	2.4	5,100	430
Thallium	µg/L	-	0.000001	0.0072	0.00062
Uranium	µg/L	-	0.000021	0.19	0.016
Zinc	µg/L	400	0.00012	0.5	0.043
Chloride	µg/L	-	0.21	570	49
Nitrate + Nitrite	µg/L	-	0.003	60	5.2
Nitrite	µg/L	-	0.00093	3.5	0.3
Nitrate	µg/L	-	0.003	59	5.1
Ammonia	µg/L	-	0.19	890	76
Unionized Ammonia	µg/L	500	0.0074	34	2.9
$Cyanide_{Total}$	µg/L	500	0.048	270	23
$Cyanide_{WAD}$	µg/L	-	0.0083	27	2.3
Sulphate	µg/L	-	4.9	19,000	1,600

Table 7.8 Predicted Concentrations POPC in Groundwater Discharge to the Victoria River and Valentine Lake Originating at the TMF and the Backfilled Berry Pit Post Closure

Parameter	Units	MDMER Limit[A]	Discharge to Victoria River Originating at:		Discharge to Valentine Lake Originating at:
			TMF	Backfilled Berry Pit	Backfilled Berry Pit
Fluoride	µg/L	-	0.0083	37	3.2

Notes:
[A] = MDMER, Schedule 4, Maximum Authorized Monthly Mean Concentration
- = Not applicable

The changes in groundwater quality during decommissioning, rehabilitation and closure are characterized as adverse, long-term, continuous, irreversible, and confined to the LAA / RAA. The magnitude will be low in the LAA / RAA, as the change in groundwater quality will not adversely affect any existing or reasonably foreseeable groundwater users. The ecological context within which effects to groundwater quality would occur in the LAA / RAA is considered undisturbed as defined in Table 7.3. This characterization of residual effects is consistent with that predicted for the Approved Project in the Valentine Gold EIS.

As these loadings form groundwater discharge will directly affect the surface water quality, the effects are further characterized in Chapter 8 (Surface Water Resources).

7.5.2.5 Summary of Project Expansion Residual Environmental Effects

Residual environmental effects that are likely to occur because of the Project Expansion are summarized in Table 7.9. The significance of residual adverse effects is considered in Section 7.5.3.

Table 7.9 Project Expansion Residual Effects on Groundwater Resources

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Groundwater Quantity	C	A	L	PA	ST	C	R	U
	O	A	M	PA	LT	C	I	U
	D	A	L	PA	LT	C	I	U
Change in Groundwater Quality	C	N	-	-	-	-	-	-
	O	A	L	LAA/RAA	LT	C	I	U
	D	A	L	LAA/RAA	LT	C	I	U

KEY
(see Table 7.3 for detailed definitions**)**

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short term
MT: Medium term
LT: Long term
P: Permanent

-: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

7.5.3 Determination of Significance

The main adverse residual environmental effect on groundwater quantity and flow identified in this assessment is the lowering of the water table because of dewatering the Berry pit. This effect will be most notable during the operation phase, and to a lesser extent during decommissioning, rehabilitation and closure as the open pit fills and groundwater levels recover. The threshold for significance as defined in Section 7.5.1.2 is a decrease in the yield from an existing and otherwise adequate groundwater supply well to the point where it is inadequate for its intended use. As there are no groundwater users within the Project Area or the LAA / RAA, adverse residual environmental effects of the Project Expansion on a change in groundwater quantity and/or flow from routine activities carried out during all phases of the Project Expansion are considered to be not significant.

The main adverse residual environmental effect on groundwater quality identified in this assessment is the increase in concentrations of POPCs in groundwater due to seepage from the Berry waste rock pile, the Berry / Marathon LGO stockpile, and the TMF. Groundwater quality may also be affected by the tailings used as backfill in the Berry pit. The threshold for significance as defined in Section 7.5.1.2 is change in groundwater quality, such that the quality of groundwater from an otherwise adequate water supply well that meets applicable guidelines deteriorates to the point where it becomes non-potable or cannot meet the GCDWQ (Health Canada 2022) for a consecutive period exceeding 30 days. As there are no groundwater users within the Project Area or the LAA / RAA, adverse residual environmental effects of the Project Expansion on a change in groundwater quality from routine activities carried out during all phases of the Project Expansion are considered to be not significant.

An adverse residual environmental effect can also occur if physical or chemical alteration to an aquifer to the extent that interaction with local surface water results in streamflow or surface water chemistry changes that adversely affect aquatic life or a down-stream surface water supply. Effects to surface water features as a result of the effects of Project Expansion activities on groundwater are assessed in Chapter 8 (Surface Water Resources).

7.6 COMBINED RESIDUAL EFFECTS OF THE PROJECT EXPANSION AND APPROVED PROJECT

The groundwater flow model update completed in support of the Project Expansion (Stantec 2023a, Appendix 7A), included simulation of the open pits, waste rock piles, LGO stockpiles, ditches, and TMF associated with both the Approved Project and the Project Expansion. The water table drawdown results presented on Figure 7-2 and 7-4 as well as the particle traces presented on Figures 7-5 and 7-6 illustrate the predicted combined effects on groundwater from the Approved Project and the Project Expansion.

Figure 7-2 and Figure 7-4 demonstrate that the 1 m drawdown and mounding contours associated with the Project Expansion at the end of operation and following decommissioning, rehabilitation and closure do not interact with the 1 m drawdown and mounding contours associated with the Approved Project. This indicates that there are no combined effects on groundwater quantity and flow from the construction, operation, and decommissioning of the Project Expansion in addition to the Approved Project.

Figures 7-5 and 7-6 demonstrate that the particle traces originating from the Project Expansion components (namely the Berry pit, the Berry waste rock pile, the Berry / Marathon LGO stockpile, and the TMF) do not overlap with the particle traces originating from the Approved Project components (namely the Marathon north and south waste rock piles, the Leprechaun waste rock pile, and the Leprechaun LGO stockpile). This indicates that there are no combined effects on groundwater quality from the construction, operation, and decommissioning of the Project Expansion in addition to the Approved Project.

Table 7.10 provides a comparison of residual effects between the Approved Project and the Approved Project plus the Project Expansion. The combined effects on surface water quantity and quality associated with groundwater seepage from both the Approved Project and Project Expansion components are assessed in Chapter 8 (Surface Water Resources).

Table 7.10 Residual Effects on Groundwater Resources for Approved Project Plus Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Change Groundwater Quality	C	A	L	PA	ST	C	R	U	No change
	O	A	M	LAA/RAA	LT	C	I	U	No change
	D	A	L	LAA/RAA	LT	C	I	U	No change
Change in Groundwater Quality	C	N	-	-	-	-	-	-	No change
	O	A	L	LAA/RAA	LT	C	I	U	No change
	D	A	L	LAA/RAA	LT	C	I	U	No change

KEY
See Table 7.3 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short term
MT: Medium term
LT: Long term
P: Permanent
N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

-: Not applicable

7.7 ASSESSMENT OF CUMULATIVE EFFECTS

This focus of this cumulative effects assessment (CEA) is on incremental changes in the residual effects of the Approved Project in combination with the Project Expansion, which are summarized in Section 7.6, as well as incremental changes in potential cumulative effects due to differences in on-going and likely future activities since the Approved Project was released from the EA process. New activities known or likely to be occurring in the RAA have been updated since the Approved Project was assessed and are described in Chapter 5 (Table 5.6).

7.7.1 Past and Ongoing Effects

The Project Area lies within the Western Mountains and Central Uplands climate zone of NL, generally characterized by cloudy conditions, strong winds and heavy snowfall in winter (Heritage NL 2019). The shallow groundwater system in the area is predicted to be largely controlled by surface runoff and local recharge, while at moderate depths the flow system may be influenced by recharge at higher elevations (Tóth 2009).

Groundwater quality may be influenced by natural processes such as weathering of rocks, evapotranspiration, depositions due to wind, leaching from soil, runoff due to hydrological factors, and biological processes in the aquatic environment, leading to changes in the pH and alkalinity, phosphorus loading, increase in fluoride content, and high concentrations of sulphates. Natural processes affecting groundwater quantity include climate-related events, such as flooding or extended drought. Human activities affecting groundwater include effects due to hydroelectric development, mining, industrial / urban development, agriculture, fertilizers, pesticides, inefficient irrigation practices, forestry activities, aquaculture, pollution, and recreational activities, leading to elevated concentrations of heavy metals, mercury, coliforms, nutrient loads, change in groundwater storage, and destruction of forests (Ferencz et al. 2019; Chilton 1996). Climate change is also considered as one of the main driving forces of change in water availability (Mirchi et al. 2013).

Past, present and ongoing projects/activities in the vicinity of the Project Area may contribute to anthropogenic pressures on groundwater resources. However, the effects of previous activities and natural environmental influences are reflected in the existing conditions for the Groundwater Resources VC, as described in (Section 7.1), and the assessment of residual effects (Section 7.5 and 7.6). The assessment includes consideration of the current condition (e.g., quantity or quality) of potentially affected groundwater resources, as well as the potential resiliency or sensitivity to further environmental change resulting from the combined Projects in combination with other ongoing projects and activities that may affect the same VC.

7.7.2 Potential Combined Project-Related Contributions to Cumulative Effects

As described in Section 7.5 and 7.6, routine Approved Project and Project Expansion activities and components have the potential to affect groundwater resources via large-scale pumping and dewatering during operation of the open pits, and localized changes to groundwater quality in the vicinity of processing facilities, TMF and waste rock piles. The Project, therefore, has potential to result in the following residual effects on groundwater resources:

- A change in groundwater quantity
- A change in groundwater quality

With the implementation of mitigation (Section 7.3), the effects of routine activities of the combined Projects on groundwater resources are predicted to be not significant.

7.7.3 Other Projects and Activities and Their Effects

Table 5.6 summarizes past, present, ongoing and future projects and activities in the RAA that have potential to cause a change in groundwater quantity and/or quantity, thereby affecting groundwater resources. A full discussion of other projects and activities and their effects is provided in the Valentine Gold EIS. As indicated above, the focus of this CEA is on incremental changes in potential cumulative effects due to differences in on-going and likely future activities since the Approved Project was released from the EA process.

7.7.4 Potential Cumulative Environmental Effects

Based on the assessment in Section 20.3.3 of the Valentine Gold EIS, there were no pathways from past, present, or ongoing projects / activities that would act cumulatively with the Approved Project in the LAA / RAA resulting in a change in groundwater quantity or groundwater quality. Therefore, there were no potential cumulative effects of the Approved Project and other reasonably foreseeable projects and activities identified in the Valentine Gold EIS.

With respect to the Buchans Resources Limited Project, groundwater effects from this project are separated from the LAA based on the nature of the groundwater divides between the projects, therefore no cumulative groundwater effects are anticipated. For the proposed Victoria River Quarry, which is located less than 500 m from the mine site, significant groundwater quantity effects from this proposed quarry are not anticipated as the aggregate extraction will occur above the water table. In addition, the proposed quarry is located outside of the predicted area of groundwater drawdown for the Approved Project and Project Expansion. Thus, no cumulative groundwater effects are anticipated.

In summary, there are no potential cumulative effects on groundwater resources predicted for the combined Projects and other reasonably foreseeable projects and activities.

7.8 FOLLOW-UP AND MONITORING

The Valentine Gold EIS included recommendations for a groundwater follow-up and monitoring plan to verify and confirm the anticipated effects of the Approved Project and to meet regulatory requirements related to specific permits and conditions of approval. A detailed monitoring plan is to be implemented during development of the Approved Project and is expected to include regular monitoring of groundwater levels and water quality in monitoring wells (or drive points) installed:

- around the open pits
- in the vicinity of (but not limited to) Valentine Lake, Victoria Lake Reservoir and Victoria River
- upgradient, cross gradient, and downgradient of the TMF and waste rock piles around the open pits

Key elements of the Project Expansion, such as the Berry pit, the Berry waste rock pile, and the Berry / Marathon LGO stockpile will be added to the follow-up and monitoring plan to verify and confirm the anticipated effects of the Project Expansion and to meet regulatory requirements related to specific permits and conditions of approval.

7.9 REFERENCES

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