

Attachment TC-05: Risk Assessment Pathways

From Table 10.2-4 in 2014 FEIS Chapter 10.0 (Human Health and Safety) (Agnico Eagle 2014)					For FEIS Addendum (Waterline)
Location	Project Activity	Effects Pathways	Environmental Design Features and Mitigation	Pathway Analysis	Applicability of Effects Pathways from 2014 FEIS to FEIS Addendum (Waterline)
Mine	Mine Site (construction)	<p>Construction activities result in air emissions, which may cause short-term changes in air concentrations, which may directly affect human health</p> <p>Fuel combustion will result in air emissions, which may contribute to territorial and national greenhouse gas emissions, which may directly affect human health</p> <p>Short-term changes in air concentrations may also result in alterations to soil concentrations, which may affect human food and water sources</p>	<p>Best management practices to control fugitive particulate emissions</p> <p>Exhaust emissions from non-road vehicles will be managed through purchasing equipment that meet Tier 3 emission standards</p> <p>Exhaust emissions from non-road vehicles will be managed through regular and routine maintenance of vehicles</p> <p>SO<sub>2</sub> emissions from non-road vehicles and stationary equipment will be reduced through the use of diesel fuel with less than 15 ppm of sulphur.</p>	Minor (bounded by operation effects)	Minor (bounded by operation effects)
Mine	Mine Site (operations)	<p>Project activities will result in air emissions, which may cause changes in air concentrations, which may directly affect human health</p> <p>Fuel combustion will result in air emissions, which may contribute to territorial and national greenhouse gas emissions, which may directly affect human health</p> <p>Changes in air concentrations may also result in alterations to soil concentrations, which may affect human food and water sources</p>	<p>Best management practices to control fugitive particulate emissions from haul roads and material handling</p> <p>Sources of particulate emissions at the processing facility are controlled through the use of baghouses</p> <p>Enclosures are used to reduce fugitive emissions at the processing facility</p> <p>Exhaust emissions from non-road vehicles will be managed through purchasing equipment that meet Tier 3 emission standards</p> <p>Exhaust emissions from non-road vehicles will be managed through regular and routine maintenance of vehicles</p> <p>SO<sub>2</sub> emissions from non-road vehicles and stationary equipment will be reduced through the use of diesel fuel with less than 15 ppm of sulphur</p>	Primary	Primary – Both project activities (mine site) and operation of the AWAR during operations phase were considered as a bounding scenario for dust generation during construction and operation of the waterline – see response to Health Canada Comment #3 (Agnico Eagle 2020)
AWAR	Phase II AWAR (construction)	<p>Construction activities result in air emissions, which may cause short-term, localized changes in air concentrations, and as a result, soil concentrations, which may directly affect human health and their food and water sources</p>	<p>Best management practices to control fugitive particulate emissions from construction activities</p>	Minor (bounded by operation effects)	Minor (bounded by operation effects)
AWAR	Phase II AWAR (operations)	<p>Project vehicles along the AWAR will result in air emissions, which may cause changes in air concentrations, which may directly affect human health</p> <p>Fuel combustion will result in air emissions, which may contribute to territorial and national greenhouse gas emissions, which may directly affect human health</p> <p>Changes in air concentrations may also result in alterations to soil concentrations, which may affect human food and water sources</p>	<p>Best management practices to control fugitive particulate emissions from vehicles travelling along the AWAR</p>	Primary	Primary – Both project activities (mine site) and operation of the AWAR during operations phase were considered as a bounding scenario for dust generation during construction and operation of the waterline – see response to Health Canada Comment #3 (Agnico Eagle 2020)
Rankin Inlet	Rankin Inlet	<p>Activities associated with material receipt, storage and transfer to the Project will result in air emissions, which may cause short-term, localized changes in air concentrations which may directly affect human health</p> <p>Fuel combustion will result in air emissions, which may contribute to territorial and national greenhouse gas emissions, which may directly affect human health</p> <p>Changes in air concentrations may also result in alterations to soil concentrations, which may affect human food and water sources</p>	<p>Best management practices to control fugitive particulate emissions</p> <p>Exhaust emissions from non-road vehicles will be managed through purchasing equipment that meet Tier 3 emission standards</p> <p>Exhaust emissions from non-road vehicles will be managed through regular and routine maintenance of vehicles</p> <p>SO<sub>2</sub> emissions from non-road vehicles and stationary equipment will be reduced through the use of diesel fuel with less than 15 ppm of sulphur.</p> <p>Best management practices to control fugitive emissions from fuel handling and storage</p>	Minor	Minor – The same design features and mitigation will be implemented for the waterline project

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Rankin Inlet	Marine Shipping	Marine shipping will result in air emissions, which may contribute to territorial and national greenhouse gas emissions These effect pathways may cause changes to air quality and soil quality (as a result of particulate deposition), resulting in subsequent changes to human food and water sources	Marine vessels will remain on-station only as long as required for off-loading delivered materials	Minor	Minor – The same design features and mitigation will be implemented for the waterline project
Mine	General construction and operation of mine and supporting infrastructure	Sensory disturbance (i.e., noise) can directly affect human health	Project design will use conventional insulation, baffles and noise suppressors on equipment Stationary equipment will be housed inside buildings Regular maintenance of equipment to limit noise Use of personal protective equipment such as ear plugs	Primary	Effect pathways not applicable
Mine	General construction and operation of mine and supporting infrastructure	Sensory disturbance (i.e., noise) can indirectly affect human health by affecting migration patterns of wildlife populations (e.g. caribou) and subsequently human food sources	Project design will use conventional insulation, baffles and noise suppressors on equipment Stationary equipment will be housed inside buildings Regular maintenance of equipment to limit noise All employees will be provided with wildlife environmental awareness training	Primary	Effect pathways not applicable
Mine	General construction and operation of mine and supporting infrastructure	Spills on the mine site or along the AWAR can cause changes to chemical concentrations in surface water, soil and vegetation, which may affect human food and water sources	Equipment will be re-fueled, serviced, and washed away from stream crossings and on impermeable pads wherever possible. There will be a wash bay in the maintenance shop Emergency response and spill contingency plans will be developed and implemented	Minor	Effect pathways not applicable
Mine	General construction and operation of mine and supporting infrastructure	Physical hazards on the mine site would not be expected to change concentrations of chemicals in environmental media and, therefore, not affect human health	Not required for the protection of human health	No linkage	Effect pathways not applicable
Mine	Mine infrastructure footprint (e.g., open pits, dikes, mine pits, waste rock, mine plant, site roads, camps) during construction, operations, closure and post-closure	Project footprint, which will physically alter watershed areas and drainage patterns, rates and quantities of diverted non-contact water to new watersheds, may change downstream flows, water levels, channel/bank stability in streams and may affect water and sediment quality, which may affect human food and water sources	Compact layout of the surface facilities within local watersheds will limit the area that is disturbed by construction and operation Access roads will be as narrow as possible, while maintaining safe construction and operation practices; minimum haul road widths will follow that defined under the Mine Health and Safety Act Best management practices for erosion and sedimentation control (e.g., silt curtains, runoff management, armouring of banks, sloping of banks), where needed To reduce the potential for erosion in channels due to higher than normal water flows and levels, natural drainage courses will be surveyed to evaluate capacity and then modified if required Where practical, natural drainage patterns will be used to reduce the use of ditches and diversion berms A Surface Water Management Plan (SD 2-6) has been developed and describes designs to reduce changes to local flows, drainage patterns, and drainage areas Monitoring during activities and use of adaptive management where necessary	Primary	Effect pathways not applicable

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Location	Project Activity	Effects Pathways	Environmental Design Features and Mitigation	Pathway Analysis	Applicability of Effects Pathways from 2014 FEIS to FEIS Addendum (Waterline)
AWAR (main access road), haul roads, and Rankin Inlet Infrastructure	Road footprint during construction, operations, and closure	Project footprint, which will physically alter drainage patterns, may change downstream flows, water levels, and channel/bank stability in streams, and affect water and sediment quality, which may affect human food and water sources	<p>Access roads will be as narrow as possible, while maintaining safe construction and operation practices; minimum haul road widths will follow that defined under the Mine Health and Safety Act</p> <p>Best management practices for erosion and sedimentation control (e.g., silt curtains, runoff management, armouring of banks), where needed</p> <p>Where practical, natural drainage patterns will be used to reduce the use of ditches and diversion berms</p> <p>A Surface Water Management Plan (SD 2-6) has been developed and describes designs to reduce changes to local flows, drainage patterns, and drainage areas</p>	Minor	Effect pathways not applicable
Mine, AWAR, Rankin Inlet	Mine and supporting infrastructure during construction, operations, and closure	Sediment releases from infrastructure and road construction, including watercourse crossings, can affect quality of nearby surface waters and sediments, which may affect human food and water sources	<p>Best management practices for erosion and sedimentation control (e.g., silt curtains, runoff management, armouring of banks), where needed</p> <p>Where applicable, construction runoff will be captured and managed to minimize suspended solids</p> <p>Proposed roads will be as narrow as possible, while maintaining safe construction practices</p>	Minor	Effect pathways not applicable
Mine, AWAR, Rankin Inlet	Mine and supporting infrastructure during construction and operations	Fugitive dust sources and deposition of dust (including from blasting during mining) can change water and sediment quality, which may affect human food and water sources	<p>Best management practices to control fugitive particulate emissions from haul roads and material handling</p> <p>Use of water or dust suppressants to manage dust; use of chemical suppressants will be in accordance with the Environmental Guidance for Dust Suppression published by the Government of Nunavut Department of the Environment</p> <p>Enforcing speed limits to suppress dust production</p> <p>Design roads as narrow as possible while maintaining safe construction and operation practices</p> <p>Crossings will be perpendicular to watercourse</p> <p>The running surface of the road will be maintained thereby reducing the generation of dust</p> <p>Sheds, enclosures, and covers will be used in major ore handling areas and most crushing areas</p> <p>For uncovered crushing areas, water or dust suppression will be used</p> <p>Dust control systems will be used to limit dust emissions, for example, processing equipment with high efficiency bag houses will be used</p> <p>Most personnel arriving at or leaving the site will be transported by bus, thereby reducing the amount of traffic (and dust)</p> <p>Operating procedures will be developed that reduce dust generation; for example, tailings deposition will be designed to limit dust generation</p>	Primary	Primary – Both project activities (mine site) and operation of the AWAR during operations phase were considered as a bounding scenario for dust generation during construction and operation of the waterline – see response to Health Canada Comment #3 (Agnico Eagle 2020)

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Mine	Mine and supporting infrastructure during construction and operations	Air emission of sulphur dioxide, nitrogen oxides and particulates may change water and sediment quality, which may affect human food and water sources	Construction equipment and trucks will be equipped with industry-standard emission control systems Compliance with regulatory emission requirements will be met. Processing equipment will use dust collectors to limit emissions of particulate matter Exhaust emissions from non-road vehicles will be managed through regular and routine maintenance of vehicles SO <sub>2</sub> emissions from non-road vehicles and stationary equipment will be reduced through the use of diesel fuel with less than 15 ppm of sulphur Operating procedures will be developed that reduce dust generation Generator efficiencies and equipment will be tuned for optimum fuel-energy efficiency	Primary	Effect pathways not applicable
AWAR and Rankin Inlet	During construction and operations, air emissions from vehicles	Air emission of sulphur dioxide, nitrogen oxides and particulates may change water and sediment quality, which may affect human food and water sources	Construction equipment and transport trucks will be equipped with industry-standard emission control systems Compliance with regulatory emission requirements will be met	No Linkage	No Linkage
Mine	Mining activities and water management during construction, operations, and closure	Release of mine wastewater (including sewage) may cause changes to surface water quality and sediment quality (i.e., nutrient and metal concentrations), which may affect human food and water sources	Treated sewage will be piped to the tailings storage facility Mine wastewater will be treated and tested before released to Meliadine Lake; if water quality does not meet discharge limits, it will be circulated and re-treated Water quality will meet CCME aquatic life objectives or site-specific water quality objectives at the edge of the mixing zone in Meliadine Lake Underground water will be collected, contained, monitored, re-used in the underground, or collected, contained, monitored, or treated, if required, to meet discharge limits for release to Meliadine Lake A site Water Management Plan has been developed and describes containment of contact water through the use of diversions, attenuation ponds, and treatment facilities during construction, operations, and closure Other applicable design features and mitigation, as identified in the Project Mine Closure and Reclamation Plan (SD 2-17)	Primary	Effect pathways not applicable
Mine and Rankin Inlet	Construction and operation of camps	The construction and operation of camps may cause erosion and release of substances to surface water and could affect water and sediment quality, which may affect human food and water sources	Best management practices for erosion and sedimentation control; and storage and use of chemicals will be implemented Ditches will be constructed to route any runoff water to the attenuation pond Sewage will be directed to the tailings storage facility and will not be released to surface water	No Linkage	Effect pathways not applicable
Mine	Mine and supporting infrastructure during construction and operations	Process and potable water use resulting in reduced water levels can affect water quality in Meliadine Lake, which may affect human food and water sources	Manage pumping rates so total annual discharge from Meliadine Lake does not drop below the 10-year dry condition No water withdrawal during the 10-year dry condition Water withdrawal rate(s) will be controlled to avoid effects on the source water lake(s) Capture and reuse site water to reduce fresh water requirements	Minor	Effect pathways not applicable

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Mine and Rankin Inlet	Mine and supporting infrastructure during construction and operations	Spills and leaks during equipment operation can affect water and sediment quality of nearby surface waters, which may affect human food and water sources	<p>Hazardous materials and fuel will be stored according to regulatory requirements to protect the environment and workers (i.e., Materials and Waste Management Plan)</p> <p>Storage tanks (e.g., fuel, engine oil, hydraulic oil, and waste oil and coolant) will be double walled, or located in lined and bermed containment areas</p> <p>Hazardous wastes will be stored on site in appropriate containers to prevent exposure until they are shipped off site to an approved facility</p> <p>Individuals working on site and handling hazardous materials will be trained in the Transportation of Dangerous Goods</p> <p>Soils from petroleum spill areas will be deposited and spread in a lined biopile for remediation</p> <p>A Spill Response Plan has been developed</p> <p>Emergency spill kits will be available wherever toxic materials or fuel are stored and transferred</p>	No Linkage	Effect pathways not applicable
Mine	Site Water Management: seepage and runoff during operations and closure	Runoff and leaching from the waste rock storage facilities and mine footprint may change surface water and sediment quality (i.e., metal concentrations), which may affect human food and water sources	<p>A site Water Management Plan has been developed and describes the containment and management of contact water on-site</p> <p>Runoff and seepage from the Project site will be diverted to sumps and attenuation ponds (and treated if required) prior to release into Meliadine Lake</p> <p>Water quality in attenuation ponds will be monitored and managed such that the discharge entering Meliadine Lake meets discharge limits</p> <p>Potential acid generating (PAG) rock and metal leaching waste rock will be segregated at source and placed into designated areas within waste rock locations</p>	Minor	Effect pathways not applicable
Mine	Site Water Management: seepage and runoff during operations and closure	Vertical and lateral seepage from the tailings storage facility may enter nearby waterbodies and change water and sediment quality (i.e., metal concentrations), which may affect human food and water sources	<p>A site Water Management Plan has been developed and describes the containment and management of contact water on-site</p> <p>Seepage will be captured at sumps and diverted to the tailings storage facility</p> <p>All ponds collecting seepage will be designed to prevent release into the surrounding aquatic environment</p> <p>Tailings facility discharge water will be monitored for water quality, and treated as required, prior to discharge</p>	Minor	Effect pathways not applicable
Mine	Site Water Management: seepage and runoff during operations and closure.	Seepage of pore water through, or underneath, incompletely frozen dikes to adjacent watersheds may change water and sediment quality in local watersheds, which may affect human food and water sources	<p>A site Water Management Plan has been developed and describes containment and management of contact water on-site</p> <p>The dikes will be designed and constructed to control seepage</p> <p>Performance of the dikes will be monitored and appropriate remediation applied if required</p>	Minor	Effect pathways not applicable

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Mine	Site Water Management: Dewatering of Project Footprint Lakes to Downstream Receiving Lakes (e.g., to Lake A7, A1, B6, B34, Meliadine Lake) during construction and operations.	Dewatering of lakes may change flows, water levels, channel/bank stability, and water quality (e.g., suspended sediments, nutrients, metals) in receiving and downstream waterbodies, which may affect human food and water sources	During dewatering activities, TSS will be monitored, and if necessary, treated before release downstream Pumped water from the dewatered lakes will be directed through properly designed structures to the lake environment, and not to lake outlets, to prevent erosion in the receiving waterbodies and to attenuate flows Shoreline areas susceptible to extensive erosion will be armoured to reduce erosion and associated re-suspension of fine sediment Where practical, natural drainage patterns will be used to reduce the use of ditches or diversion berms	Primary	Effect pathways not applicable
Mine	Pit development and operations	Release of pit water inflows to local watersheds may affect water and sediment quality in local watersheds, which may affect human food and water sources	Groundwater inflow to the pits or other dewatered areas will not be directly released to local watersheds All pit water will be pumped to the TSF, re-used in process. Excess TSF water will be treated, if necessary, prior to release	No Linkage	Effect pathways not applicable
Mine	Pit development and operations	Removal of bedrock and ore material may change or alter existing faults and change contaminant transport processes in subsurface and surface water quality, which may affect human food and water sources	Groundwater model results suggest a travel time of 500 to 1000 years for water to move, via groundwater pathways, from the tailings storage facility to Meliadine Lake. A talik will have formed beneath the tailings storage facility before water can flow along this pathway	No Linkage	Effect pathways not applicable
Mine	Pit Development	Removal of saline groundwater inflows during pit development to local watersheds may affect water and sediment quality in local watersheds, which may affect human food and water sources	Water inflow to the dewatered areas will not be directly released to local watersheds; water will be treated and then diverted to a water management pond prior to release into Meliadine Lake	Minor	Effect pathways not applicable
Mine, AWAR, and Rankin Inlet	Construction and operation of roads	Cross-drainage structures for the mine site roads, AWAR, and Rankin Inlet bypass road may alter stream hydraulics and geomorphology, and alter water and sediment quality, which may affect human food and water sources	Cross-drainage structures will be designed and constructed such that structures will not create a hydraulic barrier to fish passage and will convey peak flows corresponding to 1:25 year 24-hour rainfall event	Minor	Minor – The same design features and mitigation will be implemented for the waterline project
Mine, AWAR, and Rankin Inlet	Construction and operation of roads	Freezing and plugging of culverts in the winter may result in over-topping and erosion of road surface releasing silt into watercourses during freshet and affect water and sediment quality, which may affect human food and water sources	Use of staggered culvert configuration to promote drainage during spring thaw and freshet Regular inspection of the road to identify any areas where ponding of water along the road represents a risk, and installing additional culverts or French drains to alleviate the risk	No Linkage	No Linkage
Mine, AWAR, and Rankin Inlet	Construction and operation of roads	Release of potential acid generating materials from road building materials at the watercourse crossings can alter water and sediment quality, which may affect human food and water sources	Use of non-acid generating material at all watercourse crossings. Testing will continue on new sources identified for road building Rock quarry activity will be at least 30 m from the high water mark of any waterbody	Minor	Minor – The same design features and mitigation will be implemented for the waterline project

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Mine, AWAR, and Rankin Inlet	Construction and operation of roads	Surface water drainage through quarries and transport of blasting residuals and metals directly into watercourses can affect surface water and sediment quality, which may affect human food and water sources	<p>Where possible, stockpiling of rock and fill from quarries and borrow sites will be placed such that surface water is not diverted through the piles with runoff to surface waterbodies; drainage from quarries will not flow directly into any waterbodies or watercourses</p> <p>When there is seepage from a quarry that could enter a waterbody, a water quality sample will be collected and analyzed</p> <p>Quarries will be excavated and sloped for positive drainage</p> <p>Quarries will be inspected on a regular basis to monitor water ponding, particularly at spring melt</p> <p>Excavations will be at least 30 m away from any watercourses</p> <p>Best management practices for erosion and sediment control</p>	Minor	Minor – The same design features and mitigation will be implemented for the waterline project
Mine	Ongoing exploration	Ongoing exploration, and uptake and release of water, can affect surface water and sediment quality, which may affect human food and water sources	<p>Best management practices for erosion and sedimentation control (e.g., silt curtains, runoff management, armouring of banks, timing and location of releases), where needed</p> <p>Best management practices for storage and treatment, if necessary, of any release water</p> <p>Testing, as required by operational licence, before release of water</p> <p>Best management practices for withdrawal rates, withdrawal volumes, and timing of withdrawals</p> <p>Reuse of water, where applicable, to reduce water usage</p>	Minor	Effect pathways not applicable
Mine, AWAR, and Rankin Inlet	Decommissioning (e.g., roads, buildings, infrastructure, underground workings) during closure	Removal of project infrastructure (e.g., roads, dikes, etc.) may change flows and cause of release sediment and contaminants and can affect water and sediment quality, which may affect human food and water sources	<p>A preliminary Closure and Reclamation Plan has been developed and describes measures for permanent closure</p> <p>Best management practices for erosion and sedimentation control such as installation of rip-rap, if applicable, to prevent erosion after removal of the culverts</p> <p>Instream work will be limited to the minimum extent possible. Instream work will follow DFO operational guidance and timing windows</p> <p>All bridges and culverts will be removed and original drainage patterns restored. Stream crossings will be rehabilitated</p> <p>Dikes will be removed to a minimum depth of 1 m below average lake water level or back to original; removal of dikes will be timed to minimize release of sediments</p> <p>In the underground workings, seal all drill holes and openings connected to the surface</p> <p>Remove unused explosives and other chemicals from the mine site</p> <p>Roads will be scarified, allowing native plants to re-establish, and slopes will be stabilized against erosion</p>	Minor	Effect pathways not applicable

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Mine	Decommissioning of tailings and waste rock storage facilities during closure	Activities required for covering and reclaiming the tailings and waste rock storage facilities may cause release of contaminants and can affect water and sediment quality, which may affect human food and water sources	<p>A preliminary Closure and Reclamation Plan has been developed and describes measures for permanent closure</p> <p>The waste rock storage facilities have been designed for long-term stability</p> <p>A cover of non-potentially acid generating and non-metal leaching rockfill cover will be placed on the surface of the tailings to a thickness that will allow the tailings to remain frozen</p> <p>The pond in the tailings area will be drained and filled with waste rock to promote surface drainage to Tiriganiaq Pit</p> <p>The surface of the tailings and waste rock storage facilities will be graded to blend into the existing topography and to shed water from the surface</p>	Minor	Effect pathways not applicable
Mine	Remediation of attenuation pond AP-01 during closure	Reconnection of attenuation pond (or Lake H17) to Meliadine lake can affect water and sediment quality, which may affect human food and water sources	<p>A preliminary Closure and Reclamation Plan has been developed and describes measures for permanent closure</p> <p>Sediments will be analyzed, and if concentrations are higher than baseline or guidelines, sediments will be managed according to best practices</p>	Minor	Effect pathways not applicable
Mine	Pits (closure and post-closure)	Water quality in flooded pits may be higher than objectives and reconnection of drainages may affect downstream water and sediment quality, which may affect human food and water sources	<p>A preliminary Closure and Reclamation Plan has been developed and describes measures for permanent closure</p> <p>The pits are designed to have stable slopes during mining and post-closure</p> <p>The pits will be progressively reclaimed as excavation is completed</p> <p>The pits will be flooded, with water from Meliadine Lake, over a 10 year period following completion of pit operations</p> <p>Water quality in the pits will be monitoring continuously during the flooding process</p> <p>All diversion dikes will be kept intact as a barrier between open pits and surrounding lakes until the pit water meets acceptable concentrations for release to the environment; water will be treated if it is unacceptable for discharge</p>	Primary	Effect pathways not applicable

**References:**

Agnico Eagle. 2014. Final Environmental Impact Statement (FEIS) - Meliadine Gold Project, Nunavut from: [ftp://ftp.nirb.ca/02-REVIEWS/ACTIVE%20REVIEWS/11MN034-Agnico Eagle%20MELIADINE/2-REVIEW/09-FINAL%20EIS/FEIS](ftp://ftp.nirb.ca/02-REVIEWS/ACTIVE%20REVIEWS/11MN034-Agnico%20Eagle%20MELIADINE/2-REVIEW/09-FINAL%20EIS/FEIS).

Agnico Eagle. 2020. Waterline FEIS Addendum – Meliadine Mine Information Request Responses. Submitted to Nunavut Impact Review Board. October 13, 2020.