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1.0 INTRODUCTION

1.1 Intent to Develop High-Quality Aggregate Quarry

Broda Properties Inc. (operating in Manitoba as "North Perimeter Aggregates Inc.") has been working to develop a high-quality aggregate-supply business on the property it owns in the Rural Municipality (RM) of Rosser. The site is approximately 589 acres on lands in Section 4, Township 12, Range 2, EPM, and Section 33, Township 11, Range 2 EPM. All land in the proposed project is held by Broda.

The proposed multi-stage development is located close to and west of the intersection of Mollard Road and Metro Route 90, immediately west of Klimpke Road, ~3 km (~2 miles) southeast of the intersection of the Perimeter Highway (Provincial Trunk Highway [PTH] 101) and PTH 7 (Figure 1-1).

Figure 1-1. Development is located 1-2 miles south of Perimeter Highway, west of intersection of Mollard Road and Metro Route 90, between Sturgeon Rd (west), Klimpke Rd. (east). Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010.

The proposed operation is not a use that was permitted under the former land-use planning and administration scheme that applied to the lands before creation of CentrePort in 2008. The property is

zoned for agriculture, the prevailing local land use (Figure 1-2). (The prevalence of the agricultural land use is evident in digital imagery routinely captured by satellites [Figure 1-3])

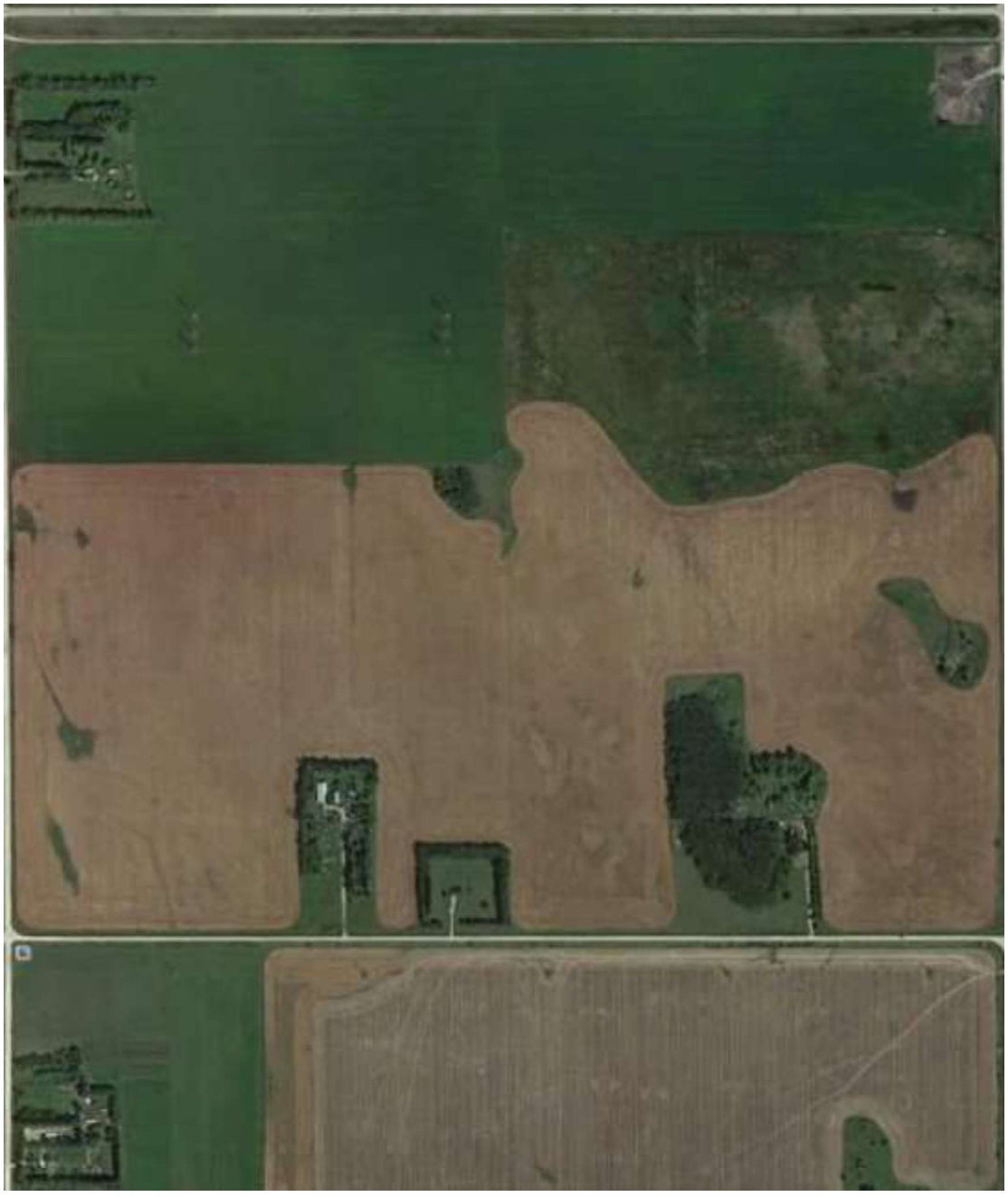


Figure 1-2. The development is planned for land now zoned and used for agriculture south of Perimeter Highway, west of Metro Route 90. Source: Google Earth, MLi3 Inc.

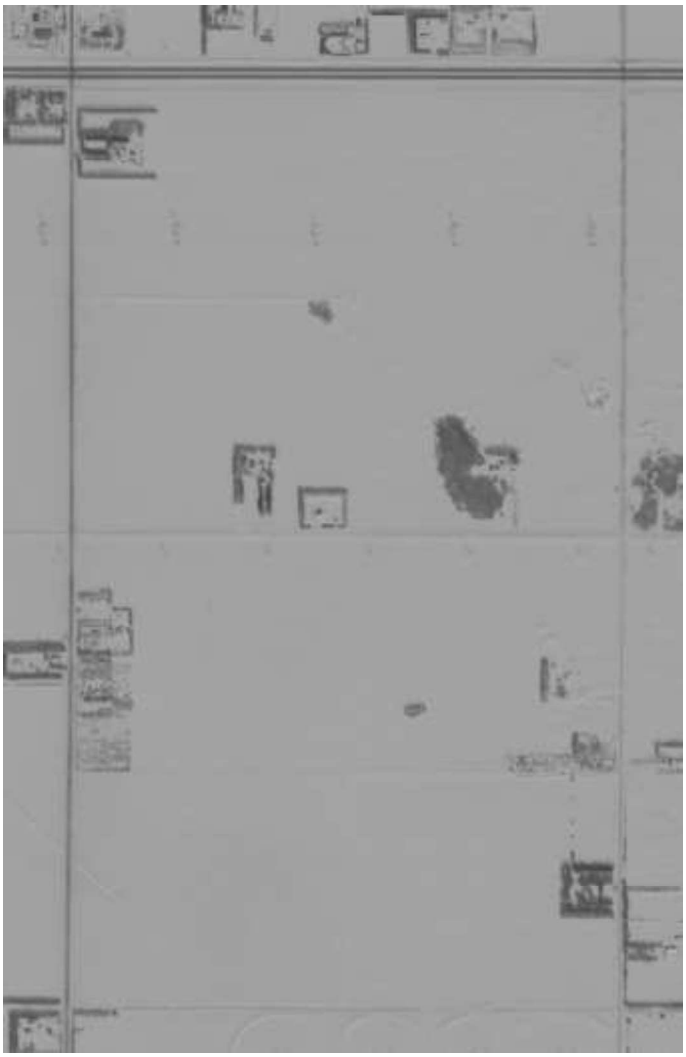


Figure 1-3. Prevalence of agriculture is reflected in unsupervised classification mapping of grey-toned "spectral signature" for cropland in recent satellite image. Darker polygons are shelterbelts, woodlots, houses, machine sheds, etc. Source: Google Earth, MLi3 Inc.

Accordingly, to support applications for Conditional Approval by the RM and South Interlake Planning Board (SIPD) of the proposed new land use, Broda worked for several years with the information and guidance from a Citizens Advisory Committee (CAC) of neighbouring landowners. This Committee collaborated briefly with Broda in 2005-2006 to help plan a project where all possible potential impacts could be identified, assessed and precluded. This was then expected to occur through a combination of careful project development and impact mitigation, ongoing environmental monitoring, and ongoing collaboration with the CAC.

The proactivity of Broda's approach, and the very high level of corporate commitments to the highest standards of possible environmental and socioeconomic care notwithstanding, several applications for the requested change in land-use zoning over many years were rejected by Rosser Council (and, accordingly, SIPD). Broda has, nonetheless, continued to believe in the intrinsic value of the project. Broda continues to believe that there was, and is, significant growing economic need and opportunity.

Broda has therefore continued to invest in building the knowledge necessary to develop the site in a sensitive fashion, consistent with the state-of-the-art in limestone quarry development and operations.

Recent (2016) changes in the planning processes applying to the lands within the CentrePort Special Planning Area (SPA) acknowledge that the quarries should be a "permitted use". This intent is consistent with the *Inland Port SPA Regulation 48/2018*, specifically its Aggregate Policy 6.1.2.3. This Policy notes that in "an area designated by the appropriate provincial authority as having 'high' or 'medium' mineral content must have the mineral extracted prior to it being developed for other uses, unless otherwise approved by the authority". The Broda property is located above the last undeveloped provincially-designated 'High Quality" limestone ore body (Figure 1-4; Baracos, A. 1983). Recovering these high-value construction materials can reduce the costs of infrastructure construction in the Winnipeg-centred region, improving all construction-project economics.

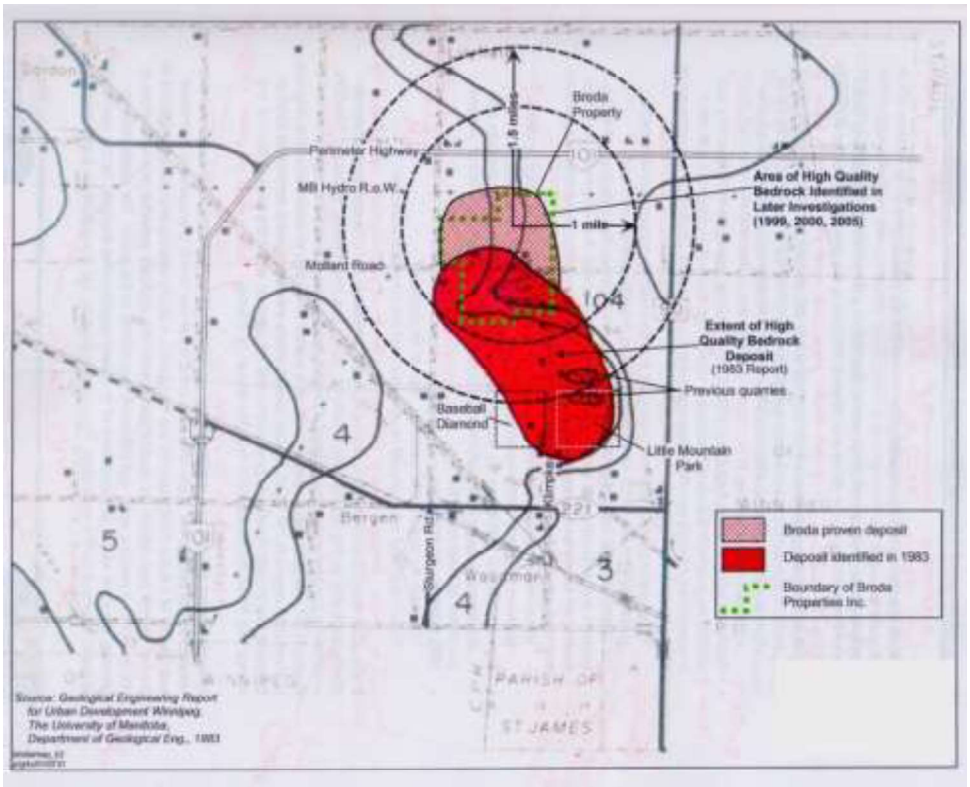


Figure 1-4. Development is located above the last undeveloped provincially-designated 'High Quality" limestone-ore body. Deposits under Broda land have variable surficial topography, and are northern continuity of a geological formation trending to southeast, previous excavated and redeveloped as community athletic amenity for public recreation. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010.

To be developed in five stages, the highest concentration of the highest-value materials, located generally north of Mallard Rd., will be quarried first (Figure 1-5). This first few stages of the project development are often termed "Stage 1" throughout this report (and in related documents prepared by MLi3 for Broda).

Little Mountain Park immediately southeast of the property (Figure 1-4) was the land use developed after aggregate materials from the southerly extension of the same geological formation were quarried and removed in previous years.

Figure 1-5. Initial development stages will address variable elevations and thicknesses of last undeveloped provincially-designated 'High Quality" limestone-ore body. Shape of complete excavation is nominal; i.e., expected but not certain. Shape will depend on field conditions. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010

1.2 Provincial Regulatory Guidance for Quarry Development

The CentrePort Act, assented to on October 9, 2008, mandates the creation of an "inland port" to encourage transportation, warehousing, trade, manufacturing, and distribution throughout Manitoba, but especially in proximity to the James Armstrong Richardson International Airport. The province initiated a process to create a "Manitoba Development Plan for CentrePort Lands", which included public, multi-stakeholder liaison, and consultations. The resulting planning scheme for the CentrePort land base proposed an enhanced future for the 20,000 acres within the Perimeter Highway considered necessary for the Project (MMM Group 2009). About 54% of the CentrePort lands fall within the RM of Rosser.

The Province has authority to ensure that quarries developed on Crown lands satisfy the stringent requirements for Environmental and Community Interests Protection under the *Mines and Minerals*

Act. The planning, operations-related monitoring, and decommissioning requirements set out under The *Quarry Minerals Regulation* (QMR; MR 65/92) amplify these protections. They do so in the form of specific prescriptions for beneficial action, and against specific unwanted action. These prescriptions apply strictly to projects proposed on Crown lands. Their protective value, however, means that they are often applied to various processes for permitting, or to approvals, for private-land development. Clause 43(1)(b)(ii) of the QMR requires minimum separation/setback distance of 400 m between any rural residence and the aggregate-mining boundary. Most rural municipalities regulating aggregate operations use this setback distance as a condition in a CUA decision to create a "buffer zone". Another example would be decisions by Manitoba Sustainable Development to include several of these QMR prescriptions as conditions if a license were to be issued under *The Environment Act*.

1.3 Guidance for Quarry Development on CentrePort Lands

The *Inland Port SPA Planning Regulation* MR 48/2016 allows a quarry as permitted land use within the Heavy Industrial Zone (Class 3; "I3"), on the CentrePort lands within the RM of Rosser. Taken together, they create another set of protections for environmental and community interests. Approval of a proposed quarry, pursuant to rezoning recommendations of the Inland Port SPA Planning Authority Board which has jurisdiction over these lands, must be made by the Minister of Municipal Relations. The Minister's decision can occur only after a public review of the proposal, including a public hearing administered by the Planning Authority Board.

1.4 R.M. of Rosser Quarry Operations By-law

In addition to these levels of environmental and community protection, including the requirements for a public hearing, and a review and issuance of approval conditions by an independent Planning Board that it co-chairs, Rosser has created a special By-law ("Quarry Operations By-Law"; Rosser By-law No. 8-15; a.k.a. the "Aggregate By-law") to create further control over such aggregate operations.

1.4.1 Assessment and Plans Required by Quarry-Operations By-law

As one type of control measure included in the Aggregate By-law, the By-law sets out requirements for several formal Assessments and Plans that must be reviewed and approved by Rosser. As prescribed in the By-law, set out in Clause 13 and Schedule A, and along with other Plans that Broda will prepare to satisfy various other requirements (e.g., MLi3 2019f), these specific Plans include the following:

- Adaptive Management Plan (submitted as the "Adaptive Management and Progressive Rehabilitation Plan"; ["AMPRP"]; MLi3 2019a)
- Progressive Rehabilitation Plan (subsumed within the AMPRP; MLi3 2019a)
- Sound Impact Assessment (submitted as the "Sound Impact Management Plan and Sound Impact Assessment"; ["SIMPSIA"]; MLi3 2019b); i.e., this plan
- Transportation Plan (MLi3 2019c)

- Visual Impact Assessment (submitted as the "Visual Impact Management Plan and Visual Impact Assessment"; ["VIMPVIA"]; MLi3 2019d)
- Water and Natural Resources Management Plan (MLi3 2019e)
- Preliminary Environmental Monitoring Plan (EMP) (MLi3 2019f; confidential; in prep.)
- Rosser Quarry Conceptual Operating Plan. WSP Engineering (WSP Canada Group Limited). 2019 (confidential; in prep.)
- Proposed Limestone Quarry in The RM of Rosser Traffic Impact Study. WSP Engineering (WSP Canada Group Limited). 2018
- Blast Impact Assessment – Proposed North Perimeter Aggregates Quarry, Rural Municipality of Rosser, Province of Manitoba. DST Consulting Engineers Inc. 2018

Broda has instructed MLi3 Inc. of Winnipeg to develop these documents (and review those prepared by others) to support its application for rezoning of its property within the RM of Rosser. The MLi3 Inc. documents have been considered, adopted and committed to by Broda (Broda *pers comm.* 2018). All the documents will be formally filed in support of Broda's request for rezoning of its property.

This document presents a voluntary corporate Sound Impact Management Plant (SIMP) as part of the Project Description being examined in the required Sound Impact Assessment (SIA) in an integrated "Sound Impact Management Plan and Sound Impact Assessment" (SIMPSIA) document. It does so because the two subjects are so closely interrelated. More importantly, it does so because impact assessments are conducted by considering the effects of proposed impact-prevention and -management measures for militating against creation of significant off-site impacts (e.g., Manoj and Prasannakumar 2002). The "Sound Impact Assessment" required by the By-law is contained herein. It follows a description of the planned project, including all relevant planned mitigation measures. The SIA evaluates the potential for significant off-site nuisance sound impacts after consideration of the expected effectiveness of the impact-prevention and –mitigation measures proposed by Broda. The SIA component of the SIMPSIA relies on published non-peer-reviewed research reports and data, published peer-reviewed reports and data, common sense, regulatory practice and precedent in Manitoba, extensive relevant professional experience, limited academic research, and personal communications with provincial regulators.

2.0 PURPOSE

The development and operation of an aggregate quarry will create impacts on the closely proximate sonic environment. Unprotected workers can have unsafe exposure to intense levels of sound (Bauer and Babich undated, Bauer and Babich 2006) and can display hearing losses over time. Landowners living beside quarries, especially those operations that are older and poorly capitalized, can and do complain of nuisance, even health impacts. For those parties living beside such industrial activity, the implications for their well-being can be significantly negative unless the proponent takes suitable effective steps to prevent and minimize (or even compensate for unavoidable) impacts. Accordingly,

and proactively, Broda commissioned the Sound Impact Management Plan component of this SIMPSIA as a critical and fully integrated component of the proposed project.

The SIMP component of this SIMPSIA, along with the findings of the SIA component, has been reviewed, acknowledges and adopted by Broda Properties to satisfy provincial requirements for protection of worker health and the ambient sonic environment (i.e., the specific requirements of the Manitoba Workplace Safety and Health Division (2006) and Manitoba Sustainable Development ["MSD"]). This Plan will also be relied upon and implemented by Broda to: (i) demonstrate satisfaction of relevant requirements of RM of Rosser By-law 8-15, (ii) support negotiation of a Development Agreement with the RM, and (iii) demonstrate satisfaction of various corporate commitments made in prior years to; (a) the CAC, (b) participants at public Open Houses from 2004-2010, and (c) public hearings administered by the RM of Rosser in 2009 about the proposed project, and directly and personally to (d) several landowners adjoining the Broda property, and to: (e) the Manitoba Mines Branch ("MMB").

The sound impact-assessment content of this document draws substantially from Broda's prior examinations of the subject. These occurred in prior public-review processes administered under *The Planning Act*. The penultimate formal filing of information assessing the sonic environment impact potential for the proposed project occurred in 2010 (Tetr*ES* Consultants Inc. 2010). This filing supported a Condition Use Approval application by Broda Properties to the RM of Rosser and the South Interlake Planning District. It built on similar work in 2009 to support a similar application (Tetr*ES* Consultants 2010). The most recent relevant work is the Blast Impact Assessment (DST 2018) that Broda commissioned in 2018. The SIA component draws substantially upon this recent work.

The impact-prevention and/or –mitigation components of this plan embody the 'state of the art' in proactive management of a modern, well-capitalized, and well–operated quarry during its operational phase. They are intended to help develop and maintain strong positive relations with the site's workers and neighbours, the latter through planned ongoing constructive engagement with a reactivated local Citizens Advisory Committee (CAC).

This document is filed in support of Broda's request for a change in the zoning of its lands. Its filing is to demonstrate satisfaction of the applicable requirements set out in *The Inland Port SPA Planning Regulation* MR 48/2016 that allows a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") on the CentrePort land base.

3.0 PERFORMANCE OBJECTIVES

3.1 Sound-Impact Assessment

The performance goals and objectives of this SIA are consistent with the current state-of-the-art in impact assessment and impact prevention/mitigation (e.g., Manitoba *Environment Act*'s 2015 Proposal

Report Guidelines, based on the *Licensing Procedures Regulation (Manitoba Regulation No. 163/88*). They were also selected having regard to very similar work done elsewhere in the world where impact prevention and mitigation were the purpose of the quarry planning and preliminary assessments (Manoj and Prasannakumar 2002). They are:

- Complete a credible evidence-based assessment of the potential for the proposed project, (which will require occasional blasting to loosen rock, (thereby facilitating operations of a Continuous Surface Miner, see Appendix B), to impact the ambient sonic environment sufficiently to impact the health of site workers, the comfort of neighbours, or habitat use by fauna on-site.
- Use credible public-domain data, analytical tools, and methods best able to support a credible and thorough assessment of potential impacts.
- Consider the state-of-the-art in noise prevention, suppression, dissipation, and absorption in evaluating the potential for significant post-mitigation sonic impacts.
- Evaluate sonic-impact potential using accepted professional guidance and decision precedents established by national and provincial regulatory bodies to determine potential impact significance.
- Contribute to Broda's evolution of its current conceptual Blasting Plan (allowed by the QMR and the Rosser By-law) in support of input from MMB staff, and recommendations from a Citizens Advisory Committee (CAC) that Broda will create and maintain, to respond proactively and thoroughly to any expressions of concern or suggestions for improved processing methods.
- Contribute to Broda's evolution of its current preliminary Environmental Monitoring Plan, especially for issues of consistent public and neighbour concern (e.g., noise, vibration) in conjunction with inputs from MSD staff, and through dialogue with the CAC, to respond proactively and thoroughly to any expressions of environmental concern or suggestions for improved surveillance methods, data interpretations and public and regulatory accountability.

3.2 Sound-Impact Management

The performance goals and objectives of the SIMP are consistent with the current state-of-the-art in impact prevention/mitigation (e.g., Manitoba *Environment Act*'s 2015 Proposal Report Guidelines). They were also selected in respect of very similar work where impact prevention and mitigation were the purpose of the quarry planning (Manoj and Prasannakumar 2002). They are:

- Preclude, prevent, minimize or compensate for significant residual post-mitigation off-site sound nuisance to the maximum extent possible.
- Achieve this primary objective through evolution of the current conceptual Blasting Plan allowed by the QMR and the Rosser By-law having close regard to input from MMB staff, and recommendations from a Citizens Advisory Committee (CAC) that Broda will create and maintain, to respond proactively and thoroughly to any expressions of concern or suggestions for improved quarrying methods.

- Achieve the primary objective through careful consideration of concerns (e.g., about noise, vibration) expressed or suggestions offered by MSD staff, and/or through dialogue with the CAC.

To achieve the primary objective, Broda's quarrying operations must conform to sound/noise management Best Practices on two fronts.

3.2.1 Worker-health Protection

Firstly, Broda must ensure that quarry workers are not subjected to sound levels above standards defined in the *Workplace Health and Safety Act and Regulations*. These regulations state:

> *"In a workplace where workers are likely to be exposed to sound exposure levels of more than 80 dBa (Lex) — the level of a worker's total exposure to noise averaged over the entire work day — must follow a program. The program must be tailored to the severity of sound exposure at your workplace"*. (Manitoba Guideline for Hearing Conservation and Noise Control, February 2007)

Specific requirements of this regulation include the following:

> *"Employers must determine what noise levels workers are exposed to before putting a hearing protection plan in place.*
>
> *If a noise exposure assessment indicates that workers are exposed to levels above 85 dBa (Lex), employers must use sound control measures to reduce the noise exposures to below 85 dBa (Lex). Sound control measures are engineering or administrative controls that eliminate, control or reduce noise exposure.*
>
> *Employers must provide hearing protection on request by workers exposed to sound levels over 80 dBa (Lex). The use of hearing protectors that meet the requirements of CAN/CSA Standard Z94.2-02, Hearing Protection Devices – Performance, Selection, Care, and Use is required when sound exposure levels are at 85 dBa (Lex) or higher".*

3.2.2 Neighbour Nuisance Prevention

Secondly, quarry neighbours should not be subjected to nuisance noise as defined by *Manitoba's Quarry Mineral Regulations*. The Regulations state that:

> *"No operator of a quarry shall permit a quarry to be established or operated that emits sound, (other than sound caused by blasting), in excess of the following limits when measured at any adjacent seasonal or permanent residence:*
>
> *(a) 45 dBa sound pressure level, during the hours between 10:00 p.m. and 7:00 a.m.; and*
> *(b) 55 dBa sound pressure level during the hours between 7:00 a.m. and 10:00 p.m."*

As committed to in this document, both these pertinent regulations will be met or exceeded by the design of the intended facility and by Broda's operational plans. The commitment to nuisance-noise prevention was an early corporate commitment to meet some of the initial concerns raised in the earlier planning of the project by the CAC.

In addition to collaboration with regulatory and other government departments, Broda will maintain a collaborative approach with its neighbours to support its SIMP. Broda intends to reactivate and maintain collaborative dialogue with a Citizens Advisory Committee that Broda created in 2005. Broda supported several meetings with the CAC through 2006 to explore its needs for information and input to project planning until Committee members declined to participate after the project was rejected by Rosser Council in 2009. New participants in the Committee will be sought to augment the core of members willing to maintain their participation from the earlier years. Attendance at the CAC meetings will remain under an "open-door" policy. The former mechanisms for public accountability will be strengthened with new digital techniques. These will provide for public input to and surveillance of quarry operations, and new techniques (e.g., interactive website) for public and regulatory accountability.

4.0 WORK DONE TO DATE

4.1 Conceptual Operating Plan

Broda has prepared a conceptual-level multi-stage plan for developing and operating the quarry (WSP Engineering [confidential; in prep.]; Appendix A). The scope of the current draft plan covers 5 stages of development. Key components of the plan have been influenced by the potential for minimizing nuisance effects of operations on the very few homes or businesses within three kilometres of the approximate centroid of the first 3 stages of the proposed quarry (Figure 4-1). A conceptual five-stage development process has been rendered (WSP 2018), with the first three stages located north of Mollard Road.

Figure 4-1. Distribution of the few occupied dwellings and businesses near first 3 development stages of the proposed quarry. Sources: Google Earth, Tetr*ES* Consultants Inc., MLi3 Inc.

The interim Operating Plan must be further refined through dialogue with MIT, MMB and the CAC. It would be refined again if Broda decides to develop the property south of Mollard Rd. (i.e., the last two stages) in 15-20 years.

The confidential Conceptual Operating Plan sets out the current intended layout and expected quarry operations. For purposes of this SIMPSIA, the content of the Conceptual Operating Plan (WSP 2019 in prep.) is considered to be the "Project Description" being evaluated in the SIA component.

- An evolving, subsurface, progressive-trench type of quarry created by a Continuous Surface Miner.

- Selective strategic and substantial lengths of site-perimeter berming and landscaping to create sound-absorbing/altering/reflecting screens of earthen windrows vegetated with native species adapted to the agricultural landscape of the region (Figures 4-2, 1-3).
- An office facility, associated with a scale and Scale House, which may be developed from an existing well-maintained structure on the property (Photo 12).
- A larger structure obscured by sound-absorbing and visual screening plantings of native trees and shrubs for large-vehicle maintenance and repairs.
- A small similarly screened workshop for small-equipment repairs.
- Stockpiles (mostly at grade) of stored aggregate products screened with sound-absorbing earthen materials.
- Protection of existing sound-absorbing/deflecting woodlots and shelterbelts.
- A machinery-parking area, located some distance north of Mollard Road in a current open area (Photo 1), that will be screened by a discontinuous strategically-placed sound-absorbing/deflecting earthen berm planted with native trees and shrubs.

Photo 1. Local rural shelterbelts typically use outer ranks of relatively faster-growing native deciduous trees (e.g., trembling aspen) protecting inner rows of slower-growing coniferous trees (e.g., Englemann, white or black spruce); see Photo 2. Shelterbelts are typically associated with remnant woodlots of river-bottom forest (oak, ash, aspen, black poplar), as shown here on Broda's property. Sources: Google Earth, MLi3 Inc.

The first three stages of the operation are planned to be set back from and north of Mollard Road (Figure 4-2). This should greatly minimize noise propagation from the site and its operations. Potential acoustic impacts should be prevented, minimized or mitigated by an effective combination of:

- The low population density (only three homes are occupied within about ~850 m of the quarry).

- Existence of remnant river-bottom forest woodlots and mature residential shelterbelts having significant capacity, especially in spring, summer and fall, to absorb, alter and deflect/reflect sounds emanating from the quarry (Figure 4-2).

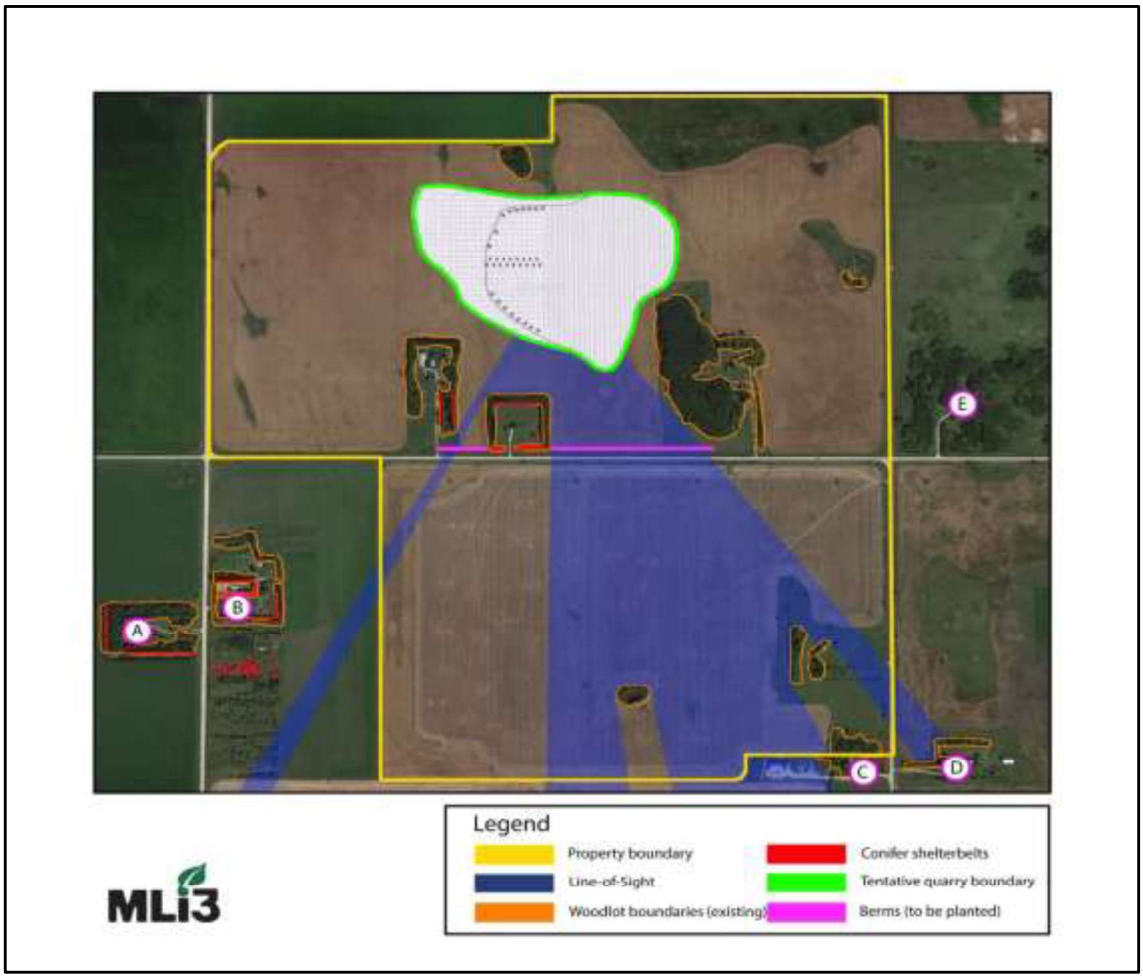


Figure 4-2. Shelterbelts and remnant forest woodlots provide visual and sonic nuisance screening of vectors from Broda's initial operations to southwest, south and southeast. Planted berms will mitigate impacts. Sources: Google Earth, MLi3 Inc.

- Broda's commitment to develop an integrated sound-absorbing/altering/reflecting system of strategically-placed vegetated berms across the few remaining direct pathways for sound propagation from the quarry.
- Planned placement of most large equipment (and some stockpiles below grade).

- The substantial regional background noise in the soundscape emanating consistently from the Perimeter Highway and occasionally from local and regional agricultural, industrial and commercial activities.

The site will be surrounded by strategically placed sections of vegetated perimeter earthen berms. This should reduce and, in some cases and locations, completely prevent, off-site lateral propagation of sound from operating equipment. Soil and sandy material stockpiles will be screened by additional strategically placed (and higher) berms, to maximize localized absorption of nuisance sound. Distances between quarry and aggregate-producing activities and the associated storage stockpiles will be minimized in the final site layout. This will help reduce on-site transportation noise by shortening the distance between material generation and material stockpiling. Berms will be planted with native fast-growing tree species like hybrid poplars (female cultivars, to prevent release of nuisance seed ['cotton']) and water-transpiring trees and shrubs.

Broda intends to plant fast-growing species on the strategic-screening berms such that summer sound-propagating pathways of most site buildings should be minimal after establishment of the plantings. Slower-growing coniferous tree species are also to be planted, in density and in proximity to the faster growing deciduous trees and shrubs (Manitoba Forestry n.d.; University of Minnesota n.d.) to protect the conifers, thereby promoting their increased survival and growth. Techniques will be identical to those used for planting rural home and farm shelterbelts (PFRA 2015), especially those immediately nearby (Photos 1, 2). The planned species composition and densities are to enhance sound-absorbing and -screening capacity and complexity. This will be very important where berms are planned to block the few sound-propagating pathways towards several adjoining landowners from the centroid of the Stage 1 quarry (Figure 4-2). The potentially significant pathways (i.e., < 1 km) are to the south and north, not the east or west. These will be the highest priority for immediate placement of vegetated berms (Figure 4-2).

Photo 2. Typical shelterbelt of deciduous trees (e.g., aspen) protecting conifers (e.g., spruce), near intersection of Mollard Road and Brookside Blvd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

On average, up to ~80% of the time (DST 2018), Broda intends to use "Continuous Surface Miner" technology to loosen and fragment rock as efficiently as possible. Up to ~20% of the time, on average, (DST 2018), Broda will use judicious blasting techniques (and timing) to loosen rock that is too hard to be broken up by the Surface Miner. This combination will be superior to the best current practices in

the Manitoba quarrying industry. Broda plans to quarry the limestone using a progressive-trenching excavation (Figure 4-3).

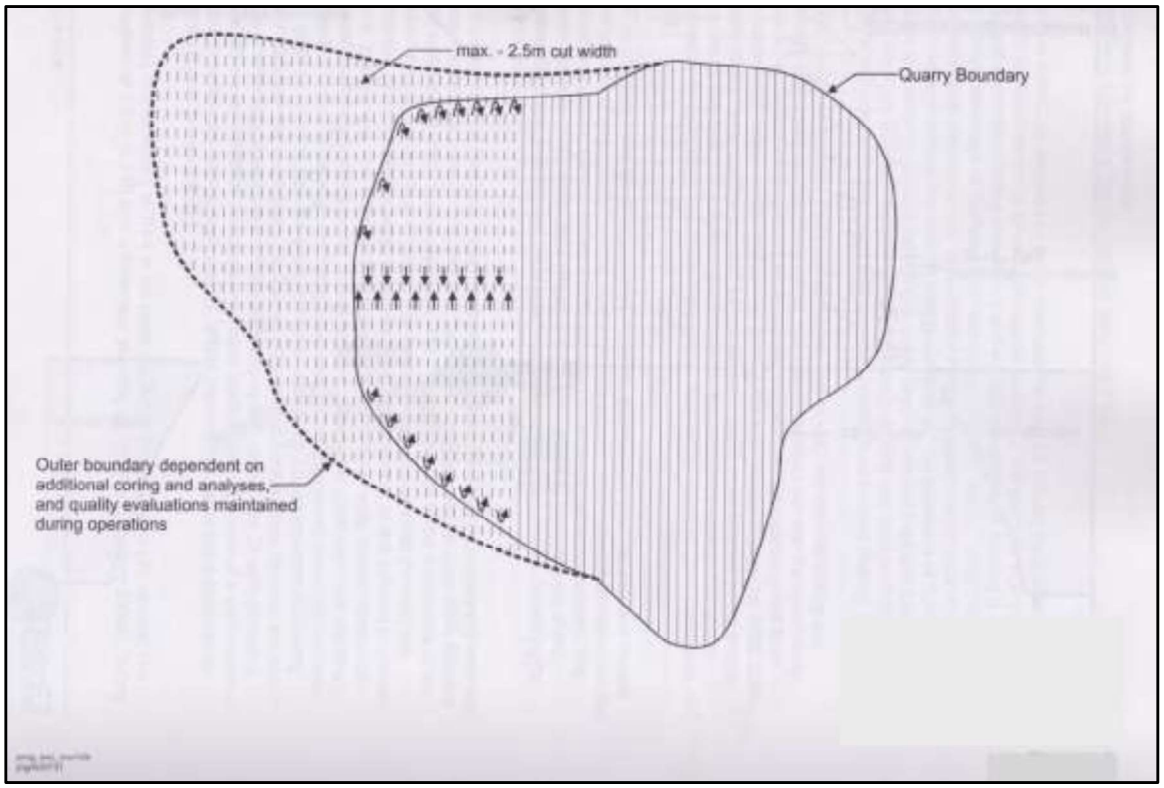


Figure 4-3. Initial quarry-development stages will address variable elevations and thicknesses of limestone-ore body using progressive-trenching excavation method. Final shape of complete excavation is nominal and will depend on field conditions. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010.

This technique will excavate loose rock down to its nominal design depth of ~5-8 m (Figure 4-4) so it can be crushed and conveyed for stockpiling. Final depth of excavation will depend on future varying combinations of excavation conditions, groundwater elevations and markets for the various types of construction materials that can be created from the crushing operation.

As previously noted, most heavy operating equipment will be placed or will operate at the base of the excavation (Figure 4-4). This places the equipment well below the sound-propagating pathways of neighbouring homes, greatly reducing sound propagation off the site and the potential for noise nuisance at the few adjacent homes.

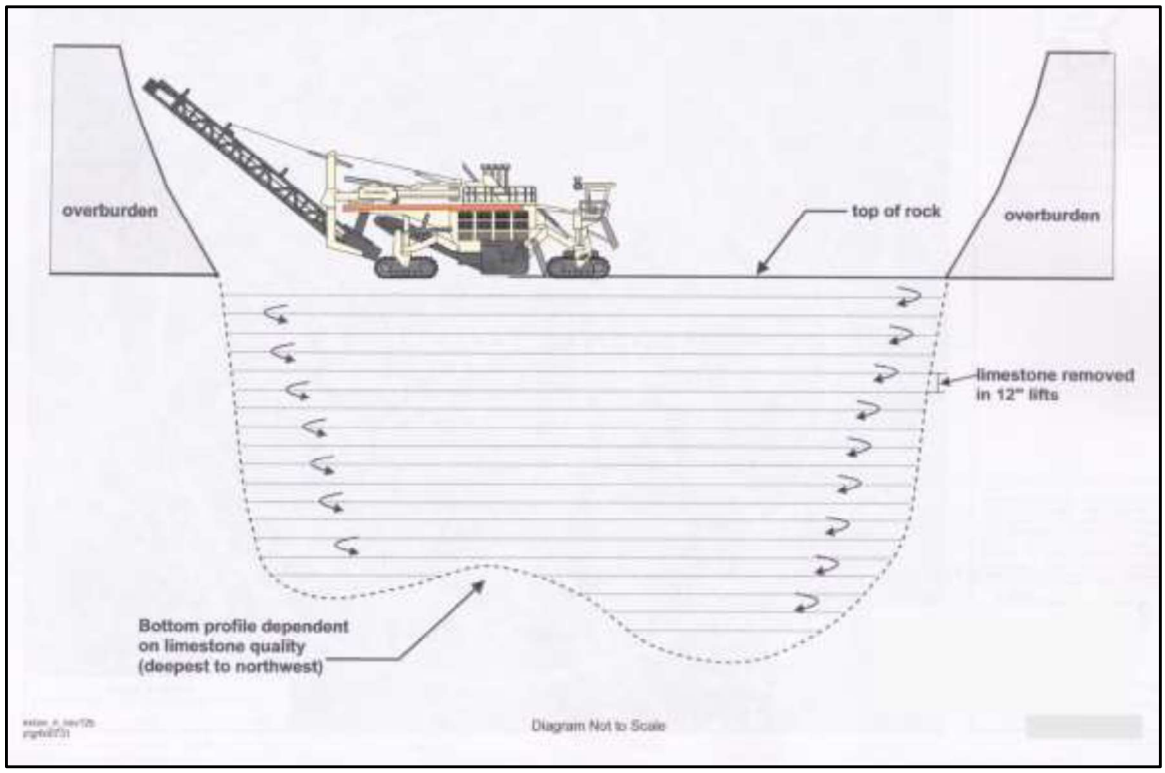


Figure 4-4. Excavators and conveyors delivering aggregate to surface will be well below sound-propagating pathways of adjoining properties. Final depth is nominal and uncertain; will depend on field conditions. Direct sound dissemination will be vertical, not lateral. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010

As noted, the limestone would be quarried from an evolving, slowly moving and reconfiguring moving-trench excavation (Figure 4-3), traveling sequentially back-and-forth across the property over the years (DST 2018). Broda intends that non-commercial overburden will be used to sequentially backfill areas behind the moving face. Thus, ongoing daily excavation operations will also, *de facto*, serve as execution of key elements of Broda's Adaptive Management and Progressive Rehabilitation Plan (AMPRP; MLi3 2019a), fulfilling the corporate commitments set out in the AMPRP.

The quarry is intended to operate from April to November. Broda advises that the production goal is 5,000 to 6,000 tonnes/day of limestone, to be achieved during a Monday to Friday work week, 7 a.m. until 6 p.m., and on Saturdays 9 a.m. until noon. Broda estimates 15 to 20 seasonal workers will be hired during the operation phase, for a period up to a nominal 20+ years. When the "Stage 4 and 5" lands (south of Mollard Rd.) are developed, the staff size could increase.

Stockpiled finished limestone products are intended to be purchased and hauled by trucks to client. The proximity of the Broda quarry to Winnipeg and the Capital Region means that haul costs to construction sites should be substantially reduced over trucking from Stony Mountain and Stonewall.

This would also mean fewer GHG emissions from haulage. Broda expects 150 – 200 trucks/day at peak production, and 50 – 75 trucks/day when aggregate demand is lower.

During collaborative consultations with Manitoba Infrastructure and Transportation in February 2010, MIT advised that it would not likely allow direct access to the Perimeter Highway (No. 101) by quarry vehicles. This was despite Broda's request for such access to reduce the sound impact of haulage past the sole resident close to the site on Mollard Road. Consistent with this dialogue, and the preference received from MIT, Broda's planned access to the site is therefore still westerly from Brookside Boulevard. This would occur along a short (~1-mile) section of Mollard Road to and from Brookside Boulevard (Photo 2); MLi3 2019c). Meetings planned with MIT to resume collaborative planning will explore whether the former preference is still MIT's preference today, especially given recent upgrades to the local intersections (e.g., Photos 3, 4).

Photo 3. Recently upgraded intersection of Mollard Road and Brookside Blvd, looking north from Mollard. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Broda has advised that it intends to enforce proper site access and egress. It will also ensure no chronic local road-dust nuisance is created by truck traffic. It plans to pave and maintain the portion of Mollard Road between its site and Brookside Blvd. (Photo 4), and to integrate that upgraded road section with the recently upgraded intersection with Brookside Blvd. (Photos 3, 4; MLi3 2019c), pending final review of results from the confidential WSP Traffic Impact Study (WSP Engineering 2018).

Photo 4. West-facing view of Mollard Road taken from east side of upgraded intersection with Brookside Blvd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Broda also intends to maintain this upgraded access route (e.g., moving these costs from the RM's annual road-maintenance budget, a very significant benefit to the RM). In response to complaints, which it will monitor, document and disclose (sections 7 and 8 herein), Broda has committed to check and take immediate corrective action (Tetr*ES* Consultants 2010). The quarry is planned to satisfy regulatory requirements and be subject to public regulatory reviews. Quarry operations will be the subject of a benefits-sharing Agreement

"Development Agreement" including impact-mitigation measures that Broda intends to negotiate with the RM of Rosser.

4.2 Review and Reconsideration of Issues Affecting Project Planning, Layout and Operations

Broda has reviewed the records for meetings with the CAC from 2005 -2006 for issues it expressed, to thereby guide data-gathering and impact-prevention activities completed to date, including the confidential Conceptual Operating Plan (WSP 2019 in prep.). In developing this Plan, Broda has reconsidered all past guidance received through collaborative dialogue with government departments and officials (esp. Manitoba Conservation, Manitoba Mines Branch, MIT).

4.3 Establishing 'Baseline' for Impact Assessment

Relevant work completed to support design and execution of this SIA included:

- Establishing "Baseline" conditions on and around the site that would affect the approach, benchmark information and methods for the assessment. This 'benchmarking' was established over the past decade, consistent with Best Practice for Impact Assessment (e.g., Shepard 2005):

  > *"Every impact assessment is (or, at least, should be) conducted with reference to a standard: the current environment of the area in which the components in the broad categories of physical-chemical, biological, cultural, and socioeconomic factors".*

- Mapping distribution of occupied homes in relation to the site using satellite imagery, aerial photographs, topographic maps and site surveillance. Distances from the centroid of the expected Stage 1 quarry and adjoining occupied homes were established (Figure 4-1).
- Determining areal distribution and relative density of native vegetation that could obscure, alter/mask or absorb sound disseminated from the site. The character of this vegetation, its apparent health and its seasonal growth behaviour was also tentatively established.
- Distribution, density, apparent age and health, and spatial patterns of planted rural home and farm shelterbelts especially those immediately nearby (e.g., Figure 4-2; Photos 1,2, 5-11) were also determined. The species composition so important for understanding the seasonality of sound screening and absorption, especially along sound-dissemination pathways towards several adjoining homes, was also determined.

Photo 5. Typical remnant spruce shelterbelt and remnant native aspen wood. Near intersection of Mollard Rd. and Sturgeon Rd. Photo taken Oct 28. 2017. Source: MLi3 Inc.

Photo 6. Typical remnant spruce shelterbelt and remnant native aspen wood on site, located near intersection of Mollard Road and Klimpke Road, at eastern edge of Broda property. Photo taken Oct 28, 2017. Source: MLi3.

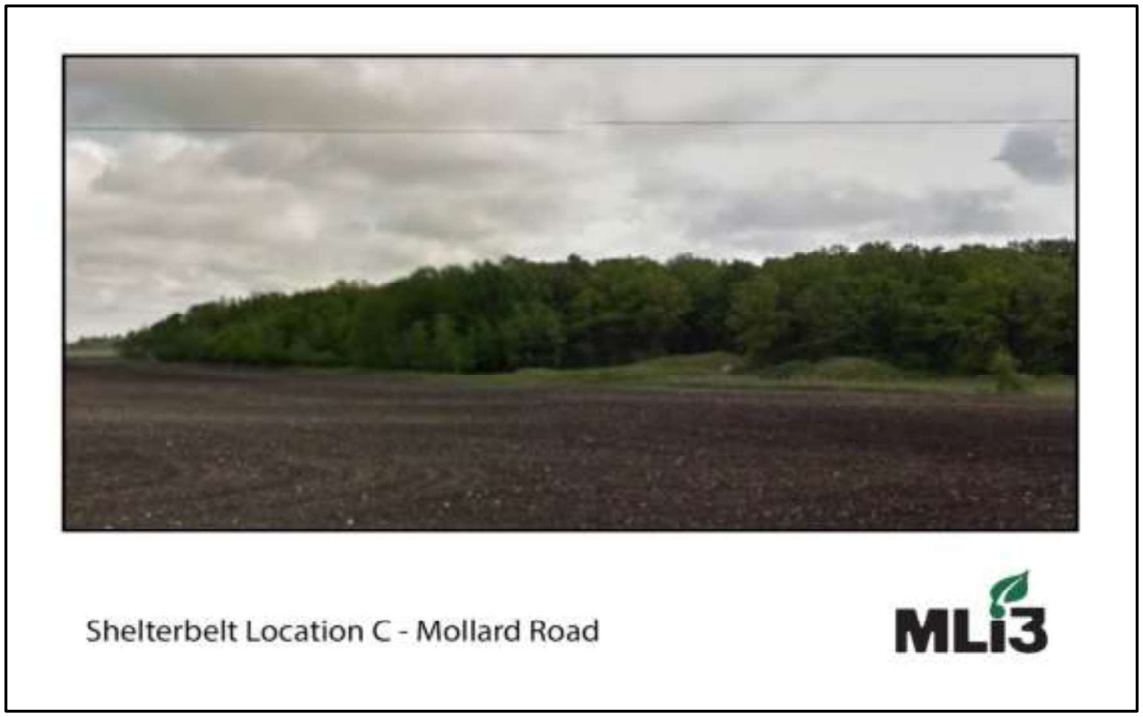


Photo 7. Typical remnant native aspen wood located near intersection of Mollard Road and Klimpke Road, at eastern edge of Broda property, north of Mollard Rd. Source: Google Earth 3D.

Photo 8. Typical two-species (deciduous, coniferous), single-ranked shelterbelt located on Klimpke Rd., at eastern edge of property, north of Mollard Rd. Source: Google Earth 3D.

Photo 9. Remnant river-bottom aspen woodlot with ill-maintained but very tall spruce shelterbelt, with dense adjacent corridor of tall woody shrubs. Together, this vegetation creates two substantial seasonal sound-absorbing/deflecting corridors. One is located north (centre of picture) and the other is west (right in picture) of and very close to quarry, close to Mollard Road near west edge of Broda property. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Photo 10. Typical remnant river-bottom aspen woodlot creating sound-absorbing/deflecting corridor west (left in picture) and north (centre of picture) of dwelling close to Mollard Road close to east edge of quarry, near eastern edge of Broda property. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Photo 11. Lithic materials assessed qualitatively and quantitatively in recent assessment of geological resource. Located on Broda land north of Mollard Rd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Photo 12. Existing rural residential dwelling locate on Broda land north of Mollard Rd. eligible for re-design and re-purposing (e.g., Office and adjoining Scale House). Photo taken Oct 28, 2017. Source: MLi3

- Examining the current state of botanical and topographic sound screening opportunities along sound-propagating pathways towards adjoining homes and business properties north and south of the proposed quarry location in relation to: (i) existing earth and botanical sound-propagation barriers created along surface profiles between homes and properties close to the property and the nominal quarry centroid (e.g., Figures 4-1, 4-2, 4-5 and 4-6a, 4-6b, 4-6c, 4-6d, 4-6e); (ii) the types, spatial distribution, height, planting density and apparent condition of existing native species in remnant river-bottom forest woodlots on site, and of remnant shelterbelt species around the existing buildings on and around the property (Figure 4-2; Photos 5-11).

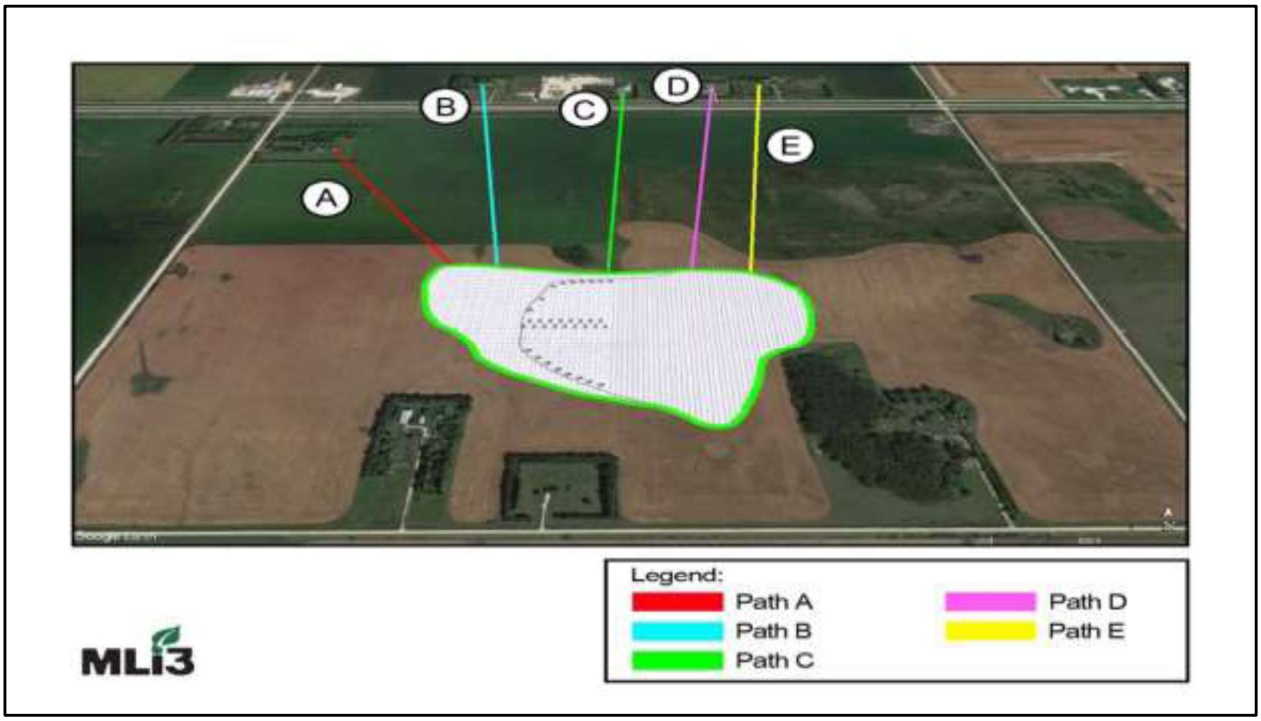
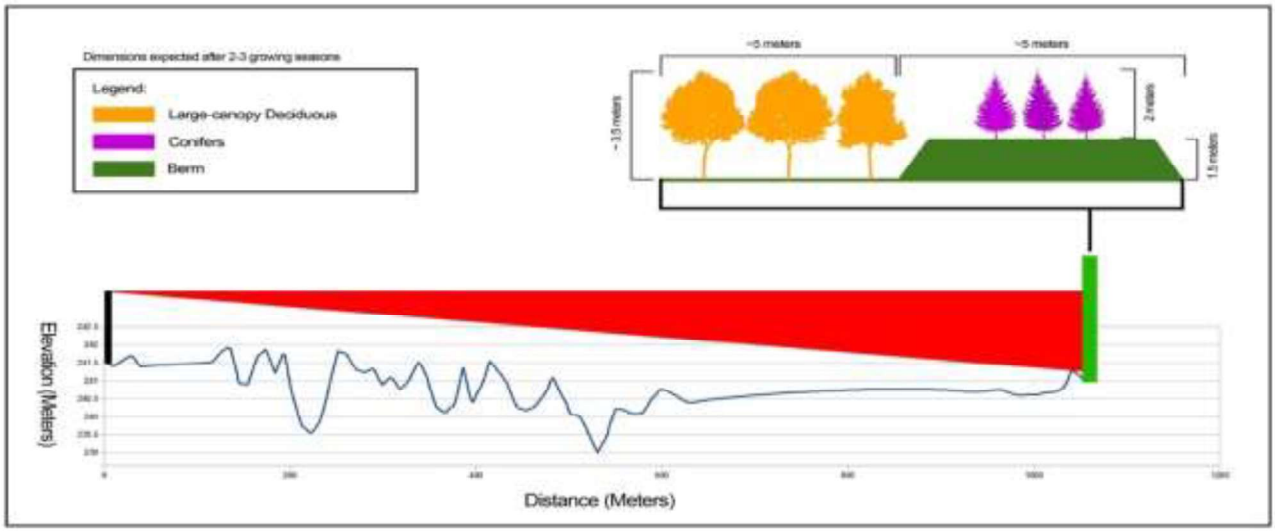


Figure 4-5. Illustrative distribution of surface-elevation profiles/sound-dissemination pathways (in this case, from northerly properties) to the nominal nearest edge of early quarry stages north of Mollard Rd. Sources: Google Earth 3D, MLi3 Inc.



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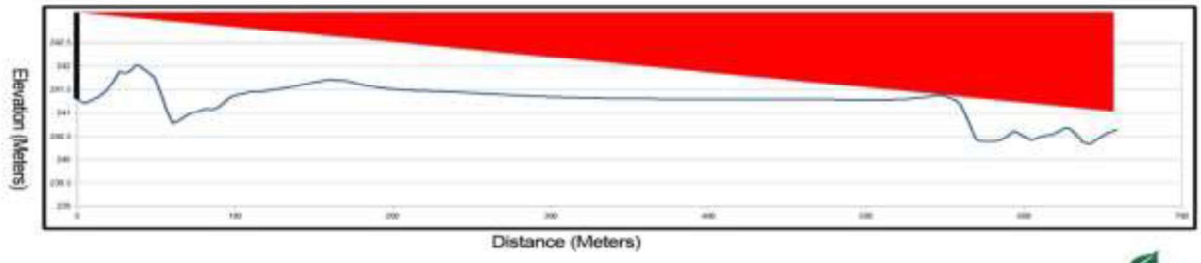

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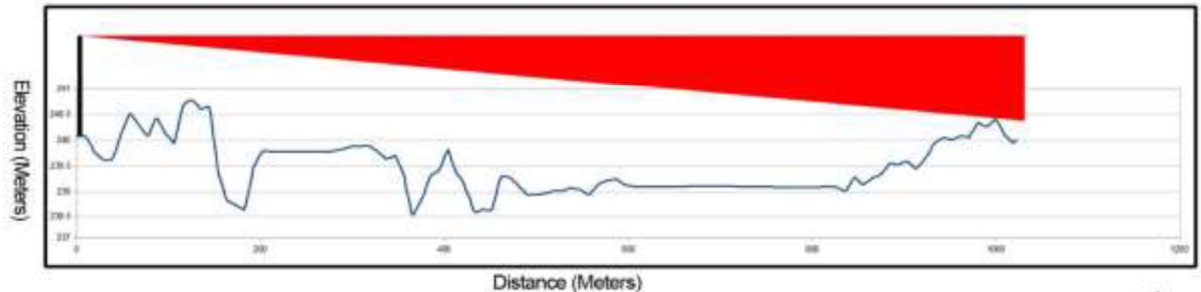

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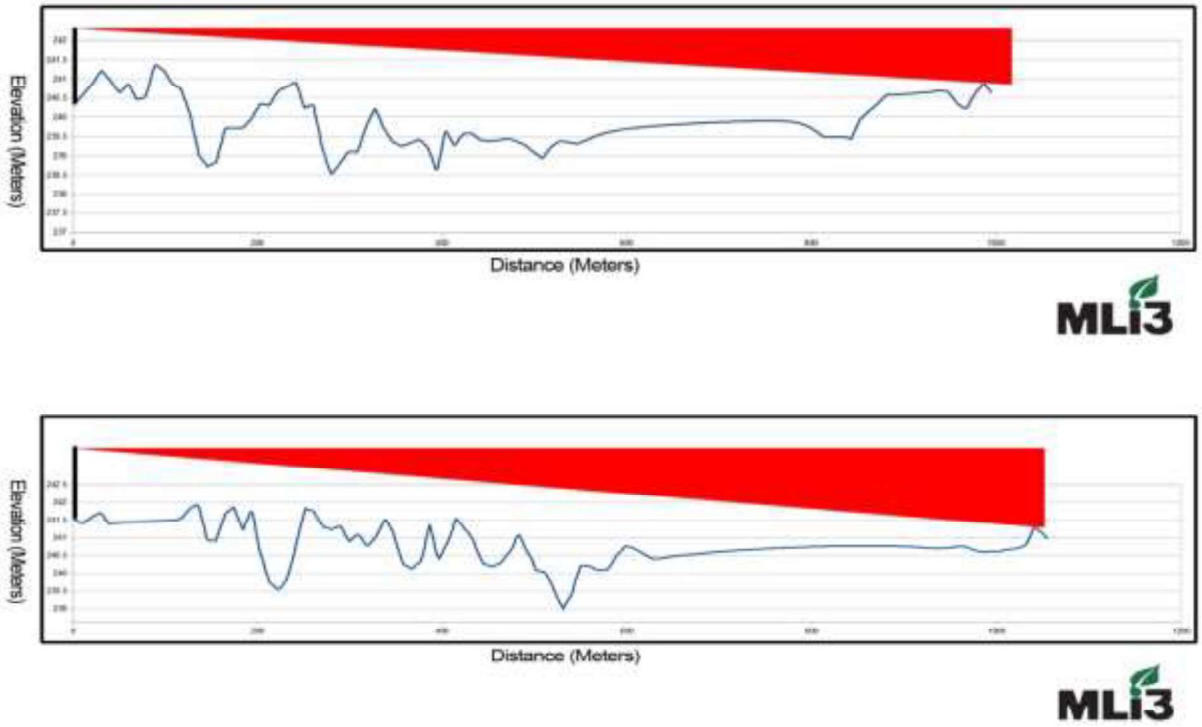

Figure 4-6a, 4-6b, 4-6c, 4-6d and 4-6e. Illustrative surface profiles from northerly properties to nearest (nominal) edge of early quarry stages north of Mollard Rd., establishing pre-development sound-propagating pathways from 5 homes and businesses north of quarry. All pathways towards locations north of Perimeter Highway require planted berms to preclude or reduce noise propagation north of quarry, as illustrated for pathway "B". Sources: Google Earth 3D, MLi3 Inc.

- Examining the northerly surface-elevation profiles plotted to establish relative elevation differences between vantage points at homes or businesses north of the Perimeter Highway and the nominal quarry edge, prior to development, to define pre-development sound-impact potential requiring construction of new strategically-placed vegetated berms to block northern sound-propagating pathways with potential for lateral noise dissemination. All five homes were found to have this potential and to require this mitigation. This analysis was also important within the SIA for determining whether buffer-zone prescriptions in the MMB QMR would be met if the quarry were excavated at the centroid of the nominal Stage 1 quarry location.
- Completing new site groundwater-level surveys to better understand seasonal, annual and decadal groundwater dynamics. This has helped planning of site layout, operations and infrastructure placement (including sound-screening earthen berms and rows of native trees and shrubs), and options thereto, in case adaptation of site planning is needed, especially if in response to unexpected site conditions or events (e.g., sustained rise in regional groundwater).

- Examining sound-screening measures employed by other licensed and regulated quarries across Manitoba and Ontario (especially by Lafarge) for insights helpful to site-layout planning, vegetation-selection and planting, and operations planning for prevention of sound impacts.
- Completing a comprehensive assessment of the site's aggregate resource in 2015 (satisfying such requirements for sites designated as being of 'High Quality'). The masses and types of non-marketable material that can be used as clean fill for initial site berming, and to support other elements of site landscaping (e.g., Photo 11) are now much better known (Stantec Consulting 2015).

4.4 Establishing Interpretive Context for Evaluating Sound-Exposure Effects

Effort was invested in preparing key data for the SIA to describe the thresholds for exposure-caused adverse effects ("impacts" on health, "nuisance" effects on personal lifestyle and daily living experience). Public-domain data sources were examined, especially data-interpretation summary reports published by the leaders in the workplace-health protection sector and scientific research and monitoring results published in the professional peer-reviewed literature.

Exposure to excess, unwanted and uncontrolled sound levels is an increasing problem of modernity, especially urbanity. Recent innovations in all aspects of digital technology have inadvertently enhanced sound production and dissemination: "…*the electronic nature of our age, which encourages many noisy gadgets; [and] the rising number of vehicles on the roads; and busier airports*…" is often reported as being among the major causes of noise pollution and reported health and nuisance effects (Chepesiuk 2005). One of the most ubiquitous and influential sectors creating this problem is the Transportation sector: "*The Environmental Protection Agency (EPA) has long identified transportation—passenger vehicles, trains, buses, motorcycles, medium and heavy trucks, and aircraft—as one of the most pervasive outdoor noise sources*…" (Chepesiuk 2005). The phrase "*secondhand noise*" is increasingly used by some activists and regulators to describe sound levels affecting people "…*who did not produce it*"… Anti-noise activists say its effect on people is similar to that of secondhand smoke: "*Like secondhand smoke, it's put into the environment without people's consent and then has effects on them that they don't have any control over*" (Chepesiuk 2005). "*Secondhand noise*" is described by some as "…*a civil rights issue*" (Blomberg pers. comm. n.d.) "

Understanding sound, "noise" and sound "intensity" is challenging. The scale by which sound intensity, no matter the specific frequency is measured and studied, no matter the frequency in which it is emanated, is logarithmic, meaning that increases in intensity levels are by order of magnitude (10, 100, 1000, etc.) rather than arithmetic (i.e., 1, 2, 3, 4, etc.). A doubling of sound (i.e., from a measurement of decibels (dB) in the 'A' scale (dBa) is, in fact an increase by one order of magnitude. Zero dBa is generally regarded as the threshold at which at which a person begins to hear sound. Nonetheless, human research has established thresholds of experience that are generally consistent across the human genome: "A soft whisper [experienced] at 3 feet equals 30 dBa, a busy freeway at 50 feet is around 80 dBa, and a chain saw can reach 110 dBa or more at operating distance. Brief exposure to sound levels exceeding 120 dBa without hearing protection…may even cause physical

pain". The US National Institute for Occupational Safety and Health (NIOSH) has defined 'hazardous noise' as sound that "…exceeds the time-weighted average of 85 dBa, meaning the average noise exposure measured over a typical eight-hour work day" (Stephenson, pers. com. n.d.). in respect of this 'industrial-strength level of injurious exposure, it has been reported that "… about 17% [of the European population] is exposed to levels above 65 dBa…", according to the European Environment Agency (Chepesiuk 2005).

Today's digitally-driven technologies have intensified noise pollution and its related impacts: "*Our modern industrialized society has spawned ubiquitous entertainment and sports industries with their boom boxes,… surround-sound movie theatres, loud TV commercials, and even louder commercials at sports stadiums crammed full of thousands of noisy fans. In drag racing, a growing international sport, a German team of audio engineers set an earsplitting record of 177 dB–sound pressure level in 2002. Popular "boom cars" equipped with powerful stereo systems that are usually played with the volume and bass turned up abnormally high and the car windows rolled down can hit 140–150 dBa. Listening to music at a level of 150 dBa would be like standing next to a Boeing 747 airplane with its engines at full throttle, according to statistics provided by Noise Free America, an anti-noise advocacy group*" (Chepesiuk 2005).

Because sound is inherently subjective, people differ in their affinity and sensitivity for sound frequencies and intensities: "*Some experts define noise simply as "unwanted sound," but what can be unwanted for one person can be pleasant or even essential sound to another—consider boom boxes, car stereos, drag races, and lawn mowers in this context* (Chepesiuk 2005).

Exposures to excessive sound can be injurious and adverse to enjoyment of life. More recent studies have suggested that noise levels of 50 dB(A) at night may also increase the risk of myocardial infarction by chronically elevating cortisol production (Lercher, Hörtnagl and Kofler 1993; Maschke 2003; Franssen et. al. 2004). Fairly typical roadway noise levels are sufficient to constrict arterial blood flow and lead to elevated blood pressure (EPA 1978). Even sound levels as low as 40 dB(A) (about as loud as a refrigerator or library (Chiltern District Council) can generate noise complaints (Gelfand 2001) and the lower threshold for noise causing sleep disturbance is 45 dB(A) or lower (Walker and Fahy 1998).

In the workplace, noise pollution is generally a problem once the noise level is greater than 55 dB(A). Selected studies show that approximately 35% to 40% of office workers find noise levels from 55 to 60 dB(A) extremely irritating (Stellman 1998) however, if the noise source is continuous, the threshold level for tolerability among office workers is lower than 55 dB(A). (Passchier-Vermeer and Passchier 2000). According to the New York Center for Agricultural Medicine and Health in Cooperstown*,"... a staggering 75% of farmworkers have some kind of hearing problem, largely the result of long-term exposure to loud equipment*" (Chepesiuk 2005).

Annoyance effects of noise are minimally affected by demographics, but fear of the noise source and sensitivity to noise both strongly affect the 'annoyance' of a noise (Miedema and Vos 1999).

The powerful impact of technology on modern life can be placed in a helpful historical context. "*In the past three decades, we have built noisier and noisier devices that are not subject to any regulations,"* Blomberg says. "*Think about it. The car alarm is a seventies invention, as is the leaf blower. The stereo sound systems we have in our cars are much louder than the sound system the Beatles used for their concerts in the sixties. All they had back then were three-hundred-amp speakers*" (Chepesiuk 2005).

4.5 Evaluating the Potential for Sonic Impact

The subject of sound levels and potential for nuisance noise was addressed in the 2010 Environmental Impact Assessment (EIA) report that was submitted in support of the respective CUA public-review processes administered by Rosser Council and the SIPD. The document assessed the potential for harmful or nuisance noise. It took account of Broda's then-current corporate commitments to processes, technologies and methods that could reduce noise levels from quarrying (excluding truck-related) operations.

At the time that the 2010 document was prepared, Broda had committed, in response to several public references to demonstrated impacts from blasting at other quarries in the Interlake, to extract the aggregate using a 'Continuous Surface Miner' machine instead of relying exclusively upon blasting to loosen and break up the base ore body (i.e., "No Blasting"). This was an unprecedented commitment within the entire national industry. There were no regulatory requirements to use this new technology nor much operating experience with it in Canada. Hence, the information in the 2010 EIA report did not deeply address noise from blasting other than as a context for evaluating the expected noise propagation from a hypothetical operating Surface Miner machine (Tetr*ES* Consultants 2010). Since then, MLi3 understands that few other quarry developers or operators have seen the need to adopt this very high-cost machinery. No regulatory requirement for its use has yet been created by the province, nor any jurisdiction in Canada.

Based on advice received from blasting professionals (DST 2018), Broda now intends to use the Surface Miner for ~80% of its rock-loosening and rock-extraction operations, on average, but now acknowledges that it may have to rely on blasting for up to ~20% of these actions (DST 2018), as its nearby (and already permitted) competitors are allowed. Broda's current plan is for only occasional reliance on blasting (on average, only approximately one millisecond, perhaps several dozen times per year).

Since the Tetr*ES* 2010 impact assessment, Broda has commissioned a "Blast Impact Assessment", conducted by blasting specialists with extensive experience and expertise in the Canadian mining industry (DST 2018). The content of the DST report has added to and strengthened the impact-assessment information relied upon in 2010. Both assessments had regard to the extent of predicted compliance with the Quarry Minerals Regulation.

The Quarry Minerals Regulation allows blasting under only very stringent prescription. The Regulation (Part V, s.44) sets out permitted times that blasting may occur, and permissible noise levels at adjacent residences during quarry blasting. The regulation states:

- *"No operator of a quarry shall permit any blasting at the quarry*

(a) between 4:00 p.m. of any day and 9:00 a.m. of the following day; or

b) at any time on a Saturday, Sunday or statutory holiday; unless otherwise approved by the director under the Act.

- *No operator of a quarry shall permit any blasting at the quarry that emits sound exceeding the following limits when measured on adjacent property:*

  (a) within 15 metres of a building maintained as a residence, 130 decibels linear peak sound pressure level;

  (b) within 15 metres of a building maintained for use other than as a residence, 150 decibels linear peak sound pressure level; and

  (c) where any person other than an employee of the operator is exposed to the sound, 140 decibels linear peak sound pressure level.

- *No operator of a quarry shall permit any blasting at the quarry that emits soil-borne vibrations exceeding the following limits when measured on adjacent property inside a building below grade or less than one metre above grade,*

  (a) for any building maintained as a residence, 12 millimetres per second peak particle velocity; and

  (b) for any building maintained for use other than as a residence, 50 millimetres per second peak particle velocity".

The following are expressions of Broda's corporate commitment reported in key prior documents (e.g., Tetr*ES* Consultants 2010). MLi3 takes at face value Broda's affirmation to stand behind these prior commitments. MLi3 thus considers these corporate commitments to be reliable and directly pertinent to this assessment of potential for significant, post-mitigation impacts on either worker health or neighbour sonic environments from the project, as now configured to use blasting:

- *"The entire operation will be set back from the road, surrounded by a berm. Using overburden stripped from the site, after the topsoil has been salvaged and stockpiled for site berming and rehabilitation, berms will be created along the edges of the property, or the active quarry site, using the overburden and topsoil. To provide for visual screening and to reduce the localized effects of equipment noise and dust, berms will be revegetated with fast-growing trees such as aspen and/or poplar, with suitable fast-growth shrub undergrowth. The effect of constructing berms will be positive in the reduction of noise and dust associated with equipment activity.*
- *Sprinklers will be used…*[around] *the Crusher. While the primary purpose of these will be dust suppression, they will also contribute (modestly) to noise reduction.*
- *As previously noted, the operation of... secondary crushing operation will produce a certain amount of noise that may have effects on wildlife utilizing the area, as well as causing some modest and localized disturbance to nearby neighbouring residences.*

As well, the DST report contains many recommendations intended to contribute to minimization of blast-related impacts of sound overpressure and vibration. For purposes of this impact assessment, MLi3 assumes that Broda will accept and follow these recommendations for impact prevention.

For purposes of this impact assessment, the "Base Case" reference condition will be the condition established by Broda in 2010. This will create the best context possible for assessing the effect of the change in policy allowing blasting up to 20% of the time. The impact assessment for the Base Case is set out below.

4.5.1 "Base Case" ("No Blasting") Scenario

It was assumed in 2010 and it is assumed in this impact assessment that a Continuous Surface Miner (e.g., Wirtgen or equivalent) would produce noise levels similar to that of a track-driven pavement crusher (75-95 dBa at 15 m, typically 90 dBa measured at 50 m; US EPA 1971, US DOT 2017), garden tractor (88-94 dBa) or a combine (80-105 dBa) as reported consistently in the literature (e.g., Murphy et al. 2007; US National Safety Council, undated). One trial for a Time-Weighted Average (TWA) sound-level measurement of an operating Wirtgen 2200SM found that the 10-hour TWA average over a complete work shift was 89 dBa (Bauer pers. comm. 2009). The associated crushing operation could be expected to produce sound levels similar to those from an asphalt crusher (75-95 dBa at 15 m; US EPA 1971). Comprehensive measurement data from crushers and vibrating-screen combinations in developing countries like India indicate a wide range of point-source sound levels because of the great range in technologies and their ages, from 74-101 dBa (India Central Pollution Control Board 2009). Even higher values (e.g., 120 dBa) are often used for crushers in sound impact assessments, which assume values of 100-110 dBa for trucks, loaders and excavators in those same assessments (HGC 2018).

During many of the public-consultation processes engaged in by Broda over the years, concerns about noise, especially blasting noise were raised (Tetr*ES* Consultants 2010). Sound levels reported in literature and media for various operating quarries around the world have sometimes been found to be above the guideline and regulated levels in their jurisdictions (Manoj and Prasannakumar, Clines 2014, Harrop 2015). Naturally, several local and regional residents expressed anxiety about the potential for noise impacts to their homes (Note: only three of these landowners live close to the site).

The sound levels reported in the literature for the Surface Miner-type operation could have potential to exceed allowable limits for nearby homes during certain time frames set forth by the *Quarry Minerals Regulation*, which states in Part V, s.46: "*No operator of a quarry shall permit a quarry to be established or operated that emits sound, (other than sound caused by blasting), in excess of the following limits when measured at any adjacent seasonal or permanent residence:*

> *(a) 45 dBa sound pressure level, during the hours between 10:00 p.m. and 7:00 a.m.; and*
> *(b) 55 dBa sound pressure level during the hours between 7:00 a.m. and 10:00 p.m*."

However, these sound-intensity levels cannot be experienced at the nearby residences because sound attenuates greatly with distance in the manner described by the "Inverse Square Law," (Anonymous 2009; Table 4-1; a.k.a. "Cube-Root Scaling Law", DST 2018). Sound-pressure levels have been proven to consistently reduce by 6 dB for every doubling of the distance from the noise source, a "law" of physics, as shown in the examples in the table below

Table 4-1: **Examples of Sound Attenuation with Distance**

Distance	Sound Pressure (decibel)		
	Rifle Shot	Surface Miner	Characterization of Typical Sound Levels (dBa)*
N/A	N/A	N/A	140 "Threshold of Pain"
			120 "Uncomfortably Loud"
			100 "Very Noisy Factory"
1.25	134	89	
2.5	128	83	80 "Ringing Alarm Clock at 1 m"
5	122	77	
10	116	71	
20	110	65	60 "Ordinary human conversation at 1 m"
40	104	59	
80	98	53	50 "Quiet"
160	92	47	
320	89	41	40 "An ordinary quiet office"
640	80	35	
1280	72	29	30 "Very quiet"
2560**	66	23	
5120	60	17	20 "Whisper"
N/A	N/A	N/A	
N/A	N/A	N/A	

* Sources: Beranek 1998, EPA 1971

** Estimated distance to nearest adjacent occupied dwelling.

Tetr*ES*'s previous formal filings to support Broda's applications for a Conditional Use Approval included an analysis of the potential for significant sustained impacts from the quarry operations (excluding trucking noise, which is not regulated by any regulatory authority) (Tetr*ES* Consultants 2010). The maximum possible theoretical sound levels at the two nearest neighbouring residences in this Base Case scenario (~2560 ft [~850 m] distance from the operations; highlighted in yellow above) were predicted on the basis of public-domain data for maximum possible quarry-operation noise and known sound-dissipation data for distance from a noise source. Using these theoretical maximum-reported noise-event starting-point measurements, and assuming they occurred as close as possible to the nearest neighbours on the Broda site's working face, the predicted maximum theoretically incremental noise level at the nearest residences would be 23 dBa. This incremental sound level is classified as being equivalent in human experience to a "whisper" (Beranek 1998, EPA 1971). US EPA guidance documents (e.g., USEPA 1974) also help to place this result into context:

> *"…levels of 55 decibels outdoors and 45 decibels indoors are identified as preventing activity interference and annoyance".*

Thus, at the distances from the centre of the proposed quarry to the nearest home (~850 m), and conservatively assuming:

- consistent sound propagation from the Surface Miner
- heavy machinery operating within the quarry boundary ***as close as possible*** to the nearest neighbour
- ***absence*** of perimeter berms around the site
- absence of sound-absorbing/deflecting earthen-material berms around aggregate and sand stockpiles
- ***absence*** of well-established planted and remnant native trees and shrubs, and planted shelterbelts adjacent to homes, and accordingly ***absence*** of existing vegetation screens able (especially during the summer) to mask, alter and absorb sound propagated from the site
- heavy machinery operating on the ***soil surface***, rather than on the bedrock surface…

the incremental maximum theoretical worst-case quarry-related sound level at this home cannot reasonably be predicted to exceed 23 dBa sound levels reported for a 'whisper' at 1 m distance from the human ear. The predicted incremental 23 dBa level will be lower than background sound levels associated with rural areas (typically 30-40 dBa; [Engineering ToolBox 2016]) but the difference between 23 dBa and 30-40 dBa when background levels are already typically 23 dBa are considered modest, not considered a "nuisance", and are largely unnoticed by most people not primed to be waiting for the new level of sound.

The site will be strategically bermed, and the Surface Miner would be operating at least 3 m below grade, and because of the well-established presence of significant quantities of sound-deflecting, -altering and –absorbing vegetation across the site and around adjoining homes (Photos 1, 2, 5-10), all of these facts contrary to the above-noted (highly conservative) assumptions, noise propagation is predicted by physics to be quickly reduced within a short distance of the working face of the quarry. This is especially the case after planted mitigative ranks of fast-growing and year-round vegetation are well established. Off-site nuisance sound would therefore be even less than predicted at the few individual homes and businesses at theoretical potential risk in this assessment (i.e., this SIA is over-predictive [i.e., "conservative"], consistent with Best Practice in impact assessment).

If they could be discerned from ambient nuisance sounds from trucking, industry and agriculture in the local region, off-site sound dissemination from routine operations would be likely be seasonably noticeable during only the first three summers or so, as plants are established, fertilized, maintained and grow, according to published growth-rate data for these species. Thereafter, seasonably noticeable sound would continue to diminish in effect and should relatively quickly become part of the current sound environment (already dominated, as noted, by the sounds of transportation and adjacent farming).

From this analysis, which excludes the practical realities and mitigation measures just noted and committed historically (Tetr*ES* Consultants 2010) and repeated in the confidential Conceptual Operating Plan (WSP 2019 in prep.), sound levels at the nearest home during operations using a

Surface Miner and occasional blasting are therefore predicted to be consistently less than the requirements of the QMR, (even though these obligations do not apply to private-sector operations). Therefore, no regulatory exceedances off-site would be predicted. The Blasting Impact Assessment by highly experienced blasting engineers reached the same conclusion (DST 2018).

At present, the site is within the long-term predicted 25 dB(A) "Noise Exposure Forecast" area around the Winnipeg International Airport. This means that the 20-25 dB(A) sound levels caused by airport operations are already part of the current background sound-level condition in this area (see Figure 4-7). This current ambient soundscape would be expected to completely mask any off-site sound effects of the Base Case operating scenario.

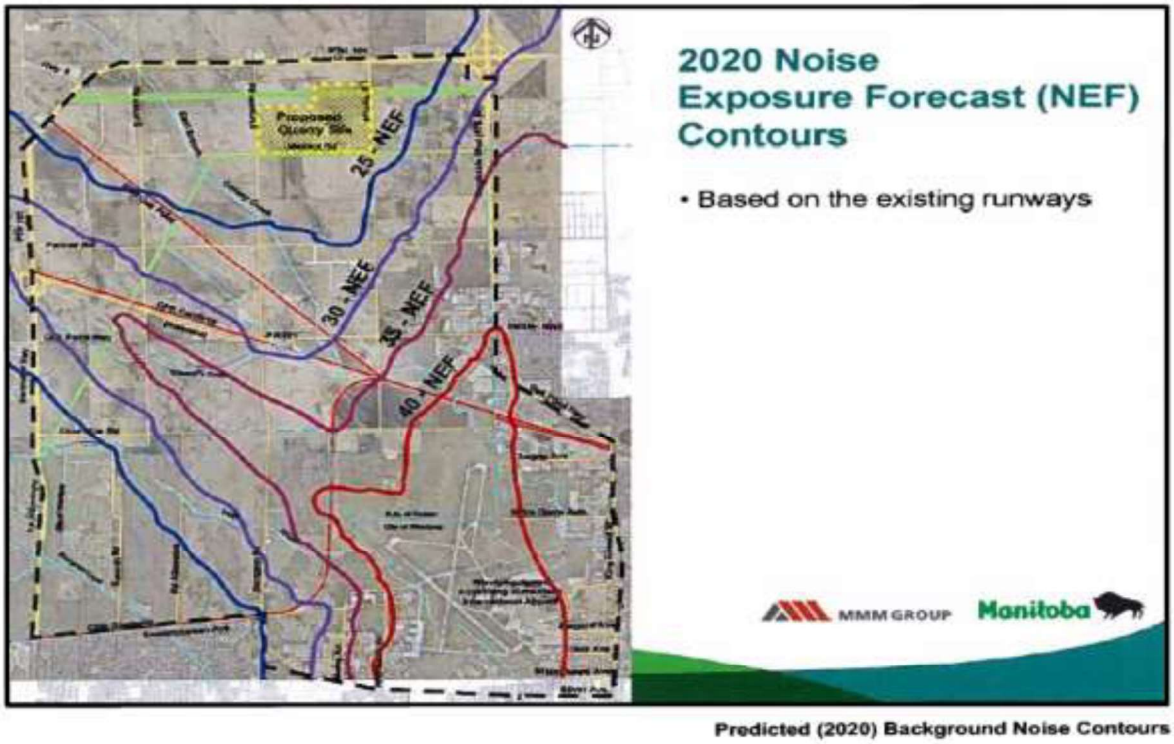

Figure 4-7. "Noise Exposure Forecast" prediction until 2020 for area around Winnipeg International Airport. Broda property within area is predicted to be exposed to background-sound levels up to 25 dB(A). Predicted sound levels caused mostly by airport operations dominating regional sound environment. Source: MMM Group 2010.

The combined effect of the Base Case sound-dissemination scenario is therefore predicted to be a sustained exposure to the 'background' level plus the 'incremental' level. This suggests an exposure to sustained intensities of about (<23 dBa + 25^{+} dBa =) <48 dBa.

To place this (highly conservative) prediction in context, the data in Table 4-1 are helpful, as is the literature for impact or nuisance thresholds summarized in section 4.4. As noted in s.4.4, about 65% of the European population is exposed to, and by daily life and pursuits apparently accept exposure to, ambient sound at levels above ~55 dBa. In the workplace, noise pollution is generally considered to

create risk of problematic exposures when sound levels exceed ~ 55 dBa. However, some epidemiological studies have shown that approximately 35% to 40% of office workers find noise levels from 55 to 60 dBa "extremely irritating" (Stellman 1998). If the noise source is continuous, the threshold level for tolerability among office workers is reported to be <55 dBa (Passchier-Vermeer and Passchier 2000). The lower threshold for sleep-disturbing sound levels has been reported as 45 dBa, or lower (Walker and Fahy 1998). Some studies have suggested that night-time sound levels of 50 dBa may increase the risk of myocardial infarction by chronically elevating cortisol production (Lercher, Hörtnagl and Kofler1993; Maschke 2003; Franssen et. al. 2004). Sound levels as low as 40 dBa are experienced by most people to be about as loud as a 'refrigerator' or 'library' (Chiltern District Council). The sound of a soft whisper experienced at a separation of 3 feet occurs when intensity thresholds reach around 30 dBa.

Thus, the over-predicted value of 48 dBa is an acoustic experience more intense than the hum of a 'refrigerator' or a 'library', close to the threshold for many people experiencing inhibited nighttime sleep or 'disturbance'.

Because the degree of compounding conservatism in the Base Case prediction is unknown, the actual probable post-mitigation level, and the amount by which it is less than these effect-threshold values, is also unknown. The degree of over-prediction of adverse effect cannot be quantified (Dipper, Jones and Wood 1998). But it suggests a degree of confidence in belief that these adverse threshold levels of around 50 dBa will not likely be exceeded and that these reported effects would not likely occur. And it must be recalled when trying to understand sound that the difference between some value <48 dBa and 50 dBa can be significant.

4.5.2 Current ("Occasional Blasting") Scenario

Since completion of an assessment of the site by blasting professionals, Broda now acknowledges that it may have to rely on blasting for up to ~20% of these actions (DST 2018). This is significantly less than the routine blasting its permitted regional competitors are allowed.

4.5.2.1 Implications for People Nearby

The scenario of occasional use of blasting, instead of complete reliance on the Surface Miner, was evaluated to satisfy the requirement for a SIA in By-law 8-15. The objective was to see if the expected effects of the change from the Base Case would likely be considered by regulators to be 'significant' at the nearest residence based on the scientific evidence and Broda's committed reliance on Best Practices to mitigate (i.e., preclude, minimize or compensate for 'un-mitigable') significant impacts.

The information from the previous formal filings by Broda to support its application for a Conditional Use Approval included an analysis of the potential for significant sustained impacts from the quarry operations (excluding unregulated trucking noise). That information was augmented by the content from the recently completed Blasting Impact assessment by DST Consulting Engineers of Sudbury.

On-site noise levels in the mining industry seem to be higher when compared with other industries. For this reason, noise exposure and noise-induced hearing loss (NIHL) are prevalent in quarrying, a key part of the mining industry.

Quarry and stone-crushing-screening operations have been found to create hearing loss among some workers on site. The most at-risk group in one key study were drivers, who were mostly exposed to the 70–79 dB(A) noise level (Onder, Onder and Mutlu 2011). The 4- to 11-year range of experienced crusher workers had high probability of loss because of high exposure to the 90–99 dB(A) noise-range class of exposure. Clearly, exposed workers near the working face are at risk. There is thus acute need for scrupulous PPE use and other impact-prevention strategies (e.g., work-shift rotations) at quarries to prevent this impact.

The maximum possible theoretical sound levels at the two nearest neighbouring residences in this Base Case scenario (~2,600 ft. separation distance from the operations; highlighted in Table 4-2 yellow below) were predicted using public-domain data for maximum possible quarry-operation noise and known sound-dissipation data for distance from a noise source. These are the same data as were used in previous assessments by Tetr*ES* Consultants (2010). For this assessment of potential impact, the data in Table 4-1 above were expanded (and are again set out in Table 4-2 below) but now with provision for sound attenuation for "blasting noise".

Table 4-2: **Examples of Sound Attenuation with Distance**

Distance	Sound Pressure (decibel)			
	Rifle Shot	Surface Miner	Quarry Blast	Characterization of Typical Sound Levels (dBa)**
1.25	134	89	144*	140 "Threshold of Pain"
2.5	128	83	138	
5	122	77	132	
10	116	71	126	
20	110	65	120	120 "Uncomfortably Loud"
40	104	59	114	
80	98	53	108	
160	92	47	102	100 "Very Noisy Factory"
320	89	41	96	
640	80	35	90	
1280	72	29	84	80 "Ringing Alarm Clock at 1 m"
2560***	66	23	78	
5120	60	17	72	
N/A	N/A	N/A	N/A	60 "Ordinary human conversation at 1 m"
N/A	N/A	N/A	N/A	50 "Quiet"
N/A	N/A	N/A	N/A	40 "An ordinary quiet office"
N/A	N/A	N/A	N/A	30 "Very quiet"
N/A	N/A	N/A	N/A	20 "Whisper"

* Quarry blast - 105 dB at 100 ft (Stabler Point Quarry Study - Minor & Assoc. 2011)

** Sources: Beranek 1998; EPA 1971; see also other sources in section 11.0

*** Estimated distance to nearest adjacent occupied dwelling.

The maximum sound level of 144 dB reported for a single quarry blast used in Table 4-2 was back-calculated based on a predicted noise level of 105 dBa, measured at a distance of 100 ft. separation distance using data available in the public domain (i.e., Minor & Assoc. 2011). That same theoretical maximum-noise-event was again used as the starting point for this assessment, to allow a strict, standardized comparison against the "No Blasting" scenario. This assumption was made in spite of the fact that the recent Blasting Impact Assessment by blasting consulting engineers calculated that the maximum theoretical sound level that can be legally used at the lite is 114.65 dBa (DST 2018, p. 10).

The assessment again assumed, very conservatively, that the 144 dBa blast event occurred, and at the same distance to the nearest neighbours from the Broda site's working face. In this scenario, the table predicts that the maximum theoretical incremental noise level at the nearest residences will be 78 dBa (at the upper end of a range of sound experience ranging from a vacuum (70dBa) and a garbage disposal unit (80 dBa); (Hansen undated).

This predicted level has more sound intensity off-site than the "no-effect" finding in the "Base Case" scenario. To create meaningful comparative context, it can be seen that the sound level from an instantaneous rifle shot, somewhat common in the local region every fall, is 66 dBa. The question is: Is this instantaneous increment likely to be evaluated as "significant" by sound-level regulators?

It is important to understand that 55-dBa level reported by the EPA is the prevailing average intensity above which increments in sound are considered to cause negative effects (i.e., "impacts"). This 55-dBa level thus approximates the average ambient level below which exists the equivalent of "acceptable' (non-nuisance) 'background' average levels of sound. The prediction above is for an ***instantaneous increment*** in sound intensity over ***average*** background sound intensity. The combined effect of the ("Occasional Blasting") sound-dissemination scenario is therefore predicted to be a sustained exposure to the average 'background' level plus the instantaneous 'incremental' level. This suggest instantaneous (millisecond) exposures to total intensities of about (<23 dBa + 78^{+} dBa =) <101 dBa, if these values were simply additive. In fact, they are not (Hansen undated).

As noted in Tables 4-1 and 4-2, this incremental sound level from a single blast would be classified in research and regulatory reports as being in the "Moderately Loud" range (Beranek 1998, EPA 1971). As noted in the tables, 80 decibels approximates the momentary sound level generated by a ringing bedside alarm clock or a garbage-disposal unit (at ~1 m separation distance). US EPA guidance (e.g., USEPA 1974) and the data summarized in section 4.4 provides some modestly helpful context for interpreting the predicted incremental instantaneous result (e.g., 103 dBa is akin to the sound levels in a "noisy factory"):

> *"…levels of 55 decibels outdoors… are identified as preventing activity interference and annoyance"…*'hazardous noise' is sound that "…*exceeds the* ***time-weighted average*** *of 85 dBa, meaning the average noise exposure* ***measured over a typical eight-hour work day***" (Stephenson, pers. com. n.d.; emphasis added).

Because the predicted sound increment from occasional millisecond blasts are of extremely short duration, they cannot significantly affect the 8-hour time-weighted averages. Also, the many differences between the characteristics of average background sounds and intensive millisecond blasts means that the human ear does not experience them in the simple additive way used above (Hansen undated). Indeed, in terms of human hearing, the instantaneous sounds are not simply additive to background sounds, they rather overshadow background sound for the interval of their duration:

"…it is only when two noise sources have similar acoustic powers, and are therefore generating similar levels, that their combination leads to an appreciable increase in noise levels above the level of the noisier source. The maximum increase over the level radiated by the noisier source, by the

combination of two random noise sources, occurs when the sound pressures radiated by each of the two sources are identical, resulting in an increase of 3 dB over the sound pressure level generated by one source. ***If there is any difference in the original independent levels*** [using an example of simultaneous sounds of 85 dBa and 88 dBa ***, the combined level will exceed the higher of the two levels by less than 3 dB. When the difference between the two original levels exceeds 10 dB, the contribution of the less noisy source to the combined noise level is negligible; the sound source with the lower level is practically not heard*** **(**emphasis added).

For all these reasons, acknowledging that up to three people may likely be offended by the attenuated sounds of occasional blasting, there should be no significant exceedance of the 55-dBa protective criterion for the people living within the 3-km radius of the development.

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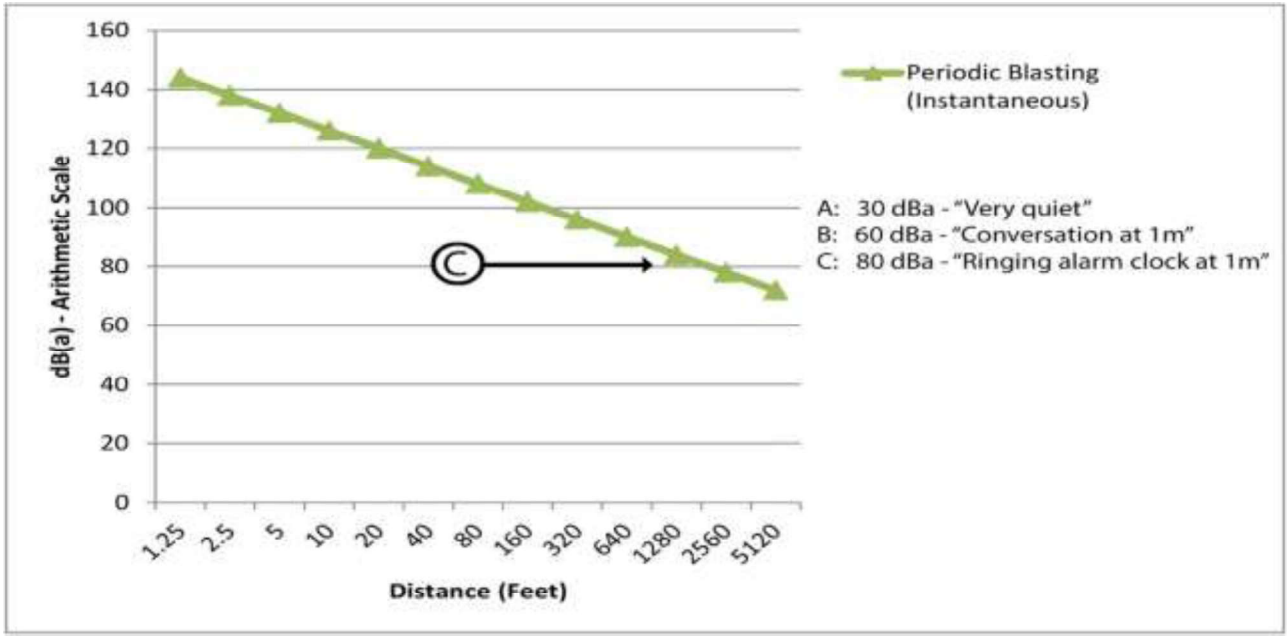

Figure 4-8A. Sound-attenuation data plotted for assessment scenarios viz. "generally acceptable" sustained time-weighted (i.e., non-instantaneous) intensities. Familiar, but technically incorrect, arithmetic scale. Nearest home is ~2560' away. "Periodic" means three instantaneous (millisecond) sound exposures every two weeks, on average. Sources: See Tables 4-1, 4-2, also information sources in Section 11.0.

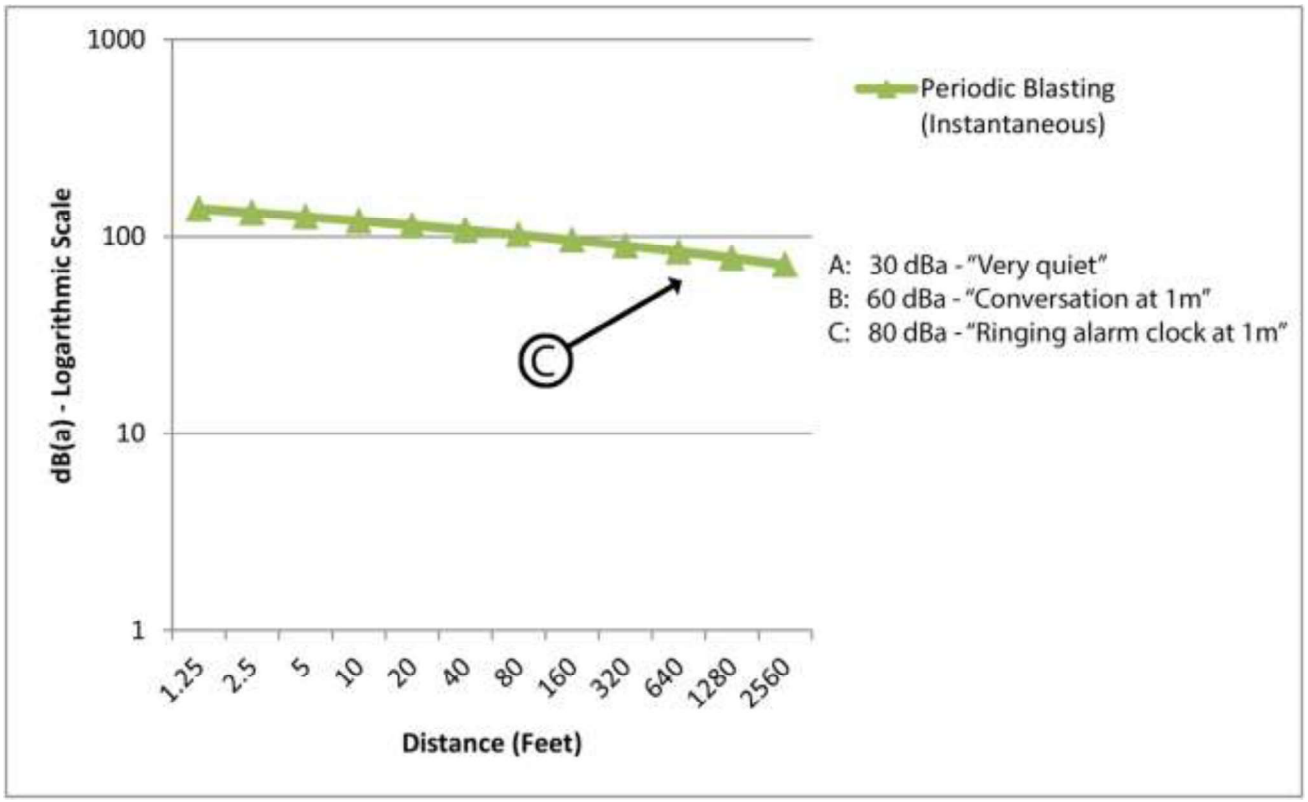

Figure 4-8B. Sound-attenuation data plotted for assessment scenarios viz. "generally acceptable" sustained time-weighted (i.e., non-instantaneous) intensities. Unfamiliar, but technically incorrect, logarithmic scale. Nearest home is ~2560' away. "Periodic" means three instantaneous (millisecond) sound exposure every two weeks, on average. Sources: See Tables 4-1, 4-2, also Section 11.0.

Figure 4-8 (especially Figure 4-8b) shows the effect of a single blast for about a millisecond would be experienced as having about the same intensity of something less than a ringing alarm clock. For some, the intensity of a ringing clock is unpleasant, typically because of the shock of the abrupt ring (like the shock of an unexpected blasting sound), but the time-weighted protective value would not be exceeded.

In this "Occasional Blasting" assessment scenario, the effectiveness of the nuisance-prevention and -mitigation measures described in the DST Consulting Engineers report (2018) are assumed, but those outlined in Broda's Conceptual Operating Plan (WSP 2019; confidential, in prep.) are again ignored. In practical terms, given this prediction but now also taking reality into account, MLi3 concludes that off-site sound dissemination from routine operations and repeated instantaneous blast occurring at some periodic (likely weekly) frequency will likely be seasonably noticeable, and potentially irritating, sources of nuisance to the two adjoining nearest neighbours during about the first three summers, as sound-absorbing/deflecting plants are established, fertilized, maintained and grow. The effect of some transient instantaneous periodically frequent off-site summer seasonal nuisance might persist longer if plant-growth challenges (e.g., drought) occur, or if smaller plants are planted than this assessment has

assumed. Thereafter, however, seasonably noticeable sound will continue to diminish in effect. Residual operating sounds will relatively quickly become part of the current sound environment dominated by the sounds of transportation and adjacent farming.

Being of still acceptable and 'normal' intensity in human experience, the sound increment is highly unlikely to be noticeable off-site beyond the two subject residences. Thus, the net incremental significance of changing from the constant use of a Surface Miner to occasional instantaneous blasting, is to move the off-site human experience for persons living in one adjacent home from a sonic equivalent of a consistent whisper to something less than the sonic experience of a bedside alarm clock ringing. MLi3 concludes that sound-level regulators will not conclude that the predicted increment in noise levels is "significant".

4.5.2.2 Implications for Livestock and Wildlife Nearby

Because a small dairy herd is the livelihood of a long-established local farmer (Grenkow), several kilometres away from the proposed quarry, and because of the presence of small numbers of wildlife in the residual aspen woodlots on the property and in remnant woodlots on adjacent properties, the potential for 'significant' impacts on domestic livestock and wildlife was considered.

The sensitivity of domestic livestock and wildlife to sound pressures has been less well studied than the sensitivity of humans (Manci et. al. 1988). Sound levels of about 90 dBa above background values have been reported likely to be aversive to mammals, and associated with such behaviour as retreat from the sound source, 'freezing' in place, or a strong 'startle' response. Sound levels below about 90 dBa have been reported to typically cause much less aversive behaviour.

Laboratory studies of domestic mammals have indicated that behavioural responses vary with noise types and levels, and that domestic animals appear to acclimate to some sound disturbances (e.g., Anthony et al. 1959; Bond et. al. 1963; Ames and Arehart 1972; Espmark et al. 1974; Ames 1978). Domesticated livestock have received some research attention. Noise levels of 80 dBa (unspecified scale) presumed within the limits of the "normal tolerance of the animal" have been reported to have caused increased feed intake and the rate of milk-releasing indices, but not to affect the milk yield of dairy cows. The everyday noise level of the animals' surroundings was reported as 50-60 dBa (Kovalcik and Sottnik 1971, cited in Manci et. al. 1988). When these same animals were exposed to a sudden incremental high-intensity noise (105 dBa), feed consumption was reduced as were milk yield and rate of milk release. The authors found, however, that if the incremental noise was increased gradually, the response was not as negative (Manci et. al. 1988). Tractor-engine incremental sound at 97 dBa was reported to have significantly increased the glucose concentration and leucocyte counts in the blood of dairy cows and markedly reduced the level of hemoglobin (Broucek et al. 1983, cited in Manci et. al. 1988). Pigs exposed to120-dBa of incremental sound for 6 hours are reported to have shown increased plasma 11-OH-corticosterone and catecholamines (Borg 1981). Exposure to 108-dBa engine sound for 72 hours resulted in a decreased corticosteroid level, followed by an increase immediately after the stimulation ceased (Manci et. al. 1988).

"No effect on growth" when young chickens (<10 weeks) were exposed to various sound intensities produced by recorded flyovers of propeller driven and jet aircraft and background airfield noises (80-118 dBa incremental sound) was reported by Stadelman (1958a; cited in Manci et. al 1988). Similar 'no effect' levels have been reported for some avifauna, including the kinds of raptors that hunt mice and voles in grasslands.

A female northern harrier hunting within a U.S. Navy bombing range was observed (Jackson et al. 1977) during aerial bombing runs. Approximately one jet per minute bombed a ground-level target from about 1,800 ft above ground level. While each 25-pound practice bombs exploded with a noise (reported to have been about as loud as a 12-gauge shotgun blast), a brief flash, and a trail of smoke, the harrier continued hunting – even when a bomb exploded within ~60 m of the bird. The greatest noise associated with the activity was from the jets. Approximately 1,500 ft to the side of the target, incremental noise levels varied between 80 and 87 dBa (Manci et. al. 1988).

Calculated noise-threshold levels of "no reaction" and "strong reaction of approximately 60 and 77 dBa, respectively, of incremental sound were reported for New Mexico pronghorns (*Antilocarpa americana*) reacting to helicopters sound (Luz and Smith 1976, cited in Manci et. al 1988). Laboratory mice exposed to intermittent sound increments of approximately l10 dBa (unspecified reference) for 100 minutes alternately during a 4-week study, and a second group of mice exposed to a single morning sound exposure of 110 dBa for 15 or 45 minutes daily, for one to three months, have been reported (Anthony and Ackerman 1955) to show only a slight decrease in circulating blood eosinophil levels approximately three hours after initiation of the sound stimulus (Manci et. al. 1988).

Based on this information, there is no basis to surmise or conjecture the likelihood of any potentially 'significant' impact on the health and well-being of the dairy herd, nor on any other domesticated animals not resident on the Broda property (of which there are none). Implications for local wildlife resident on the property on a year-round, small-travel-range basis, are neutral in character and few in number. Mechanized agriculture on and around the property has greatly reduced the value and use of the small residual habitats on the property.

4.5.3. Relevant Impact Mitigation

As part of Broda's voluntary commitment to meeting the QMR, its hours of operation will be set to occur between 7 a.m. and 6 p.m., except during times when special projects may require extended hours. The setback distances set out in the QMR, which Broda has repeatedly committed to meet, would also help to ensure that sound dissipates before reaching neighbouring residences.

The QMR states, in Part V, s.43(1):

> *"…operator of a quarry shall not excavate closer than the following distances…where the operator is mining a consolidated quarry mineral;*
>
> - *15 metres from any property line;*
> - *400 metres from any residence located beyond the property line;"*

Broda's operation will more than meet these prescriptions. In addition, MLi3 assumes that Broda will follow all the many measures recommended for impact-prevention and –mitigation measures by DST, including event-specific monitoring at the two nearest neighbours (DST 2018, sections 7 and 8). Nevertheless, in the event of a noise complaint, Broda has advised MLi3 that it remains committed to conduct checks and/or noise level monitoring and take immediate mitigative action if any such is required (Tetr*ES* Consultants 2010).

4.6 Designing the Facility

Designing the facility, especially its layout and quarry-development plan, is perhaps the single most effective way to prevent significant off-site noise impacts. Many measures are available to reduce sound propagation beyond a quarry margin. Broda has committed to many of them (e.g., earthen berming, operating equipment below grade, use of sound-absorbing seasonal vegetation). Further, the local topography and site attributes (e.g., forest remnants), in conjunction with the quarry-development plan, can significantly reduce the potential for lateral sound dissemination and off-site effect (Clines 2014).

4.7 Operating the Facility

The most frequent type of adverse effects on workers in aggregate/gravel quarries is not impacts to hearing, but rather injuries to the body. The most frequent classifications of nonfatal lost-time injuries for sand & gravel operator employees involved handling materials (37.2%) and slip or fall of person (28.3%). Sprains or strains was the most frequently reported nature of injury (35.3%), followed by fractures (20.2%) (NIOSH 2011).

With respect to the low relative risk potential of workplace-sound exposures, the many ways in which a modern quarry is operated, including its choice of equipment, can greatly contribute to reduced sound propagation beyond a quarry margin and the potential for impacts among workers or immediately adjacent landowners. Choice of workers' Personal Protection Equipment (PPE) is one of the most important mitigation measures available to operators. The data below are published by the US National Institute for Occupational Safety and Health (NIOSH). These data reveal that operator attention to improving worker safety at quarries has been consistently effective in recent years (Figure 4-9). Reference to the figure indicates that:

> *"… the number and rate of sand & gravel mining operator nonfatal lost-time injuries, excluding office employees, from 2006 through 2015. Full-time equivalent (FTE) employees are based on 2,000 employee hours worked per year. The rates and numbers have trended down over the period. The highest rate was 2.3 nonfatal lost-time injuries per 100 FTEs in 2006 to a low rate of 1.3 in 2015".*

These data indicate that operator commitments to improving workplace health and safety conditions are both increasingly occurring and effective. As done for its other facilities across Canada as a matter of corporate due diligence, Broda advises MLi3 that it will maintain the highest standard of worker care. This commitment arises from respect for workers' rights. It also reflects respect for the statutes protecting workers from unsafe working conditions.

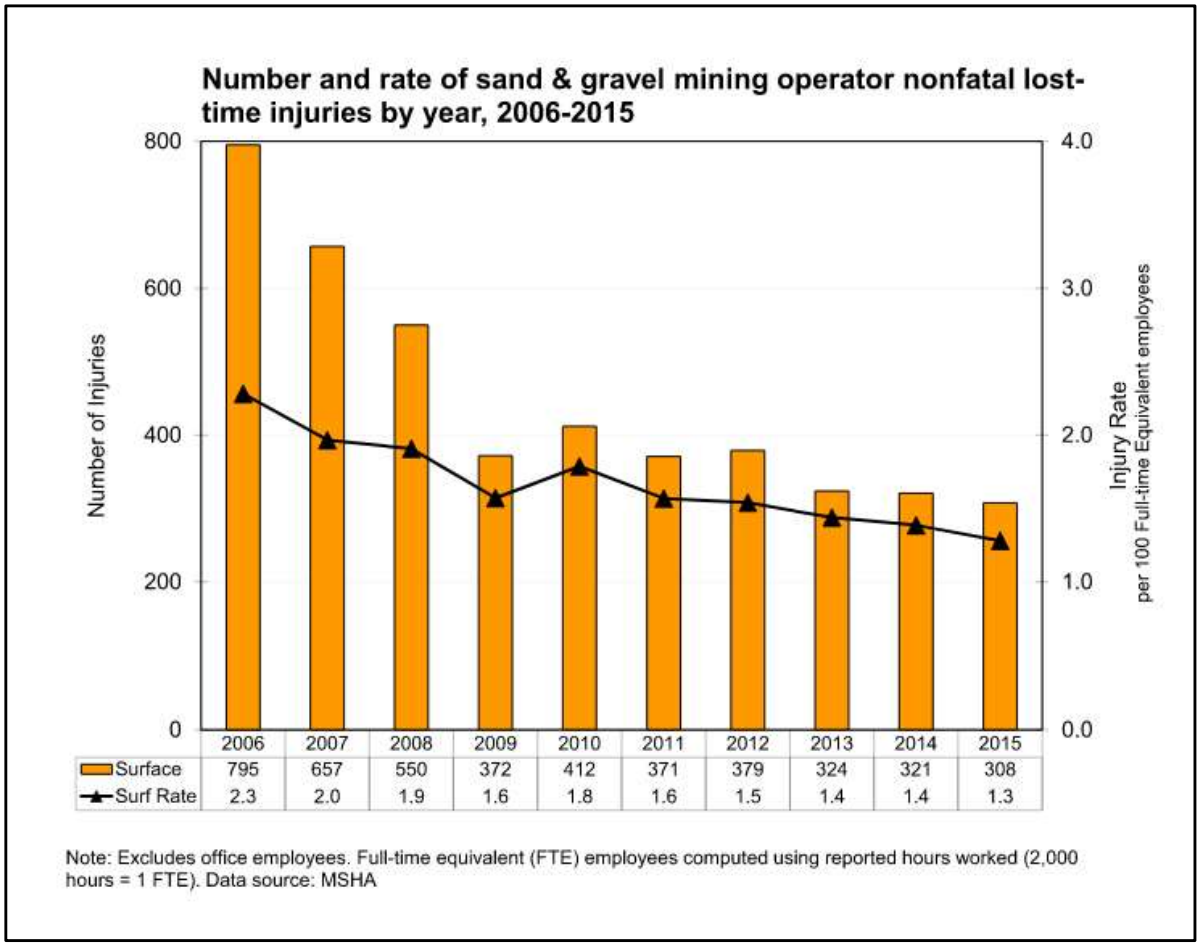

Figure 4-9 Source: The National Institute for Occupational Safety and Health (NIOSH). Undated.

4.8 Mitigating Transportation-Related Off-site Nuisance Noise

As noted previously, dialogue between Broda and Manitoba Infrastructure has previously resulted in the MI's selection of a preferred access route for the project. It involves a ~1-mile segment of Mollard Road west of Brookside Boulevard (Photo 4). Trucking to and from the site along this access will create noise nuisance for the one or two neighbours living closest to the site.

Photo 4. West-facing view of Mollard Road taken from east side of upgraded intersection with Brookside Blvd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Although this trucking noise is not the noise from site operations, which is predicted to be not significant, Broda has publicly committed to upgrade, pave, and maintain that 1-mile segment. This will help to minimize related nuisance sound levels (Tetr*ES* Consultants 2010).

4.9 Potential for Residual Post-Mitigation Noise Impacts

The following findings and conclusions continue to distinguish between: (i) a negative effect (i.e., an "impact") that could be either (a) 'significant' (e.g., creating a chronic impairment of human or ecological health, or a regulatory concern) or (b) 'not significant' (e.g., having potential to create an impact but susceptible to Best Practices, or use of Best Available Technology Economically Achievable, and therefore 'mitigable'), a distinction important to and drawn by regulators in their decision-making process, and (ii) a "nuisance".

Based on the project as currently configured (virtually identical to that described in 2010, and the impact-prevention and -mitigation measures to which Broda Properties remains committed (described above), MLi3 Inc. concludes that:

- There is no technical basis for concern about significant post-mitigation environmental or socially significant sonic impacts from operations (including periodic blasting) on workers or neighbours, including two homeowners living immediately adjacent to the short site-access route on Mollard Road west of Metro Route 90. As described below (s. 4.10.1), the site should be fully susceptible to Broda's Adaptive Management and Progressive Rehabilitation Plan drafted to ensure the property is redeveloped prudently, consistent with Broda's Site End Use Plan and with aspects of the Development Agreement that Broda intends to develop with the RM. There should be no unmitigated noise impacts during operations. One adjacent property owner will likely be subjected to occasional instantaneous-nuisance noise during blasting, about perhaps several dozen times per year on average.

- The proposed project is to occur over formally designated "High Quality" deposits that have already developed been developed for similar limestone-aggregate extraction and quarrying activities. These occurred on the southern continuity of the same geological formation, which trends beneath the Broda property towards the south-east. Little Mountain Park was developed during the rehabilitation of the former quarry excavation there as a community athletic amenity for public recreation (baseball diamonds). (Figure 1-1, Google Earth). The proposed project is no different in type than the former excavation, except for the reliance on periodic blasting to loosen rock for excavation and screening.
- Manitoba Sustainable Development (MSD) will not likely have significant residual concern about hypothetical sound impacts except for possible complaints about nuisance noise likely to be expected from one property owner living immediately adjacent to the site.
- There is no technical basis to believe that MSD would consider this a significant matter requiring follow-up by Broda Properties beyond the impact-management already committed to by Broda.
- There is no technical basis for concern about significant post-mitigation sonic impacts on domesticated livestock (or wildlife) adjacent to the site, especially with data suggesting that everyday noise level of dairy animals' surroundings is in the 50-60 dBa range and an incremental impulsive sound of approximately 60 dBa caused "no reaction" in wild ungulates.

This assessment finds that that sonic impacts of the existence and operation of the quarry will occasionally be felt, about perhaps several dozen times per year on average, by one immediately adjacent landowner. While the predicted post-mitigation impacts are not health related, they can constitute nuisance noise. They can and likely will impair the quality of life for this one adjacent landowner. There should be no concern about this possible effect for the other two properties located within ~850 m of the quarry (Figure 4-1).

That this is the case is underscored by recent information about elaboration of regional transportation infrastructure within a few miles of the site. A public Open House held November 7, 2017 provided the results of a Functional Design study for a westerly Extension of Chief Peguis Trail from Main Street to Brookside Boulevard (WSP Engineering 2017). Functional Design is an early phase of the transportation-engineering design process in which the road right-of-way and roadway design are established. A Preliminary Design is the next phase in the design process and will build on the Functional Design (WSP Engineering 2017). The 2018 Preliminary Design will include greater detail of all design elements (i.e., lane width, intersections, etc.) (Figures 4-10 to 4-13).

Key relevant aspects of the 2017 Functional Design include:

- A four-lane divided CPT roadway from Main Street to Brookside Boulevard in Rosser.
- At-grade intersection at Brookside Boulevard.
- Initial termination of the extension at Brookside Boulevard when the CPT extension is constructed, with provision for future extension directly west, parallel with Mollard Road to the north, before turning south along Klimpke Rd. towards CentrePort Canada Way (CCW), northwest Winnipeg (Highway 190 in Figure 4-10 below).

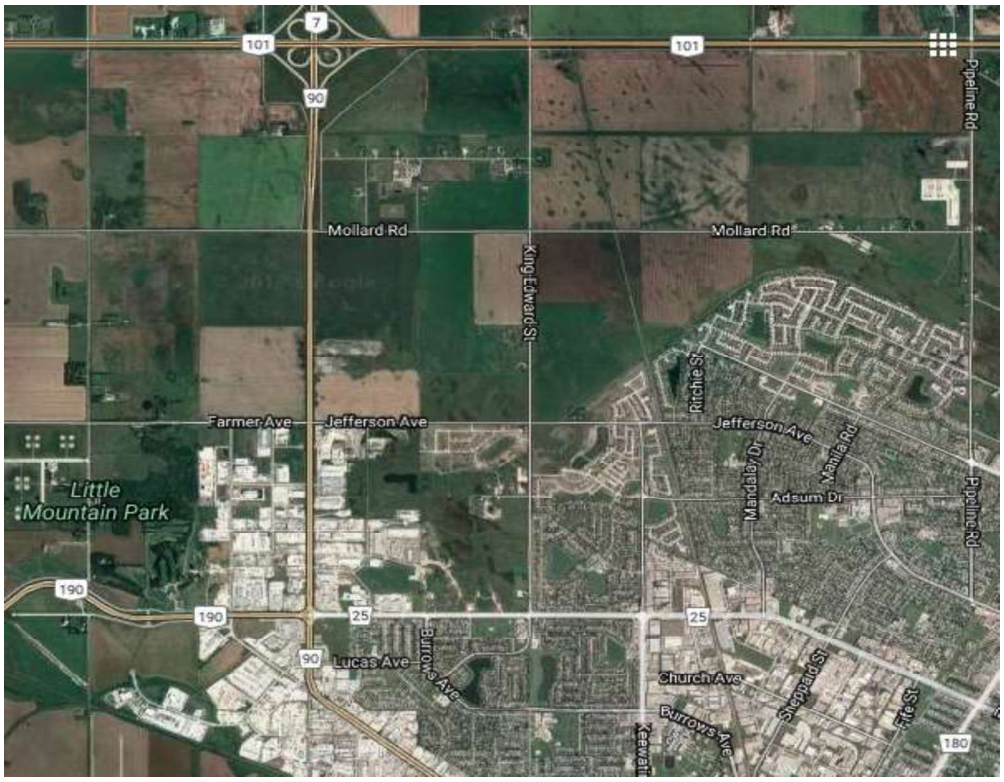

Figure 4-10. Study area for Functional Design process for the Chief Peguis Trail (CPT) extension west from Main Street to Brookside Boulevard. Source: Google Earth.

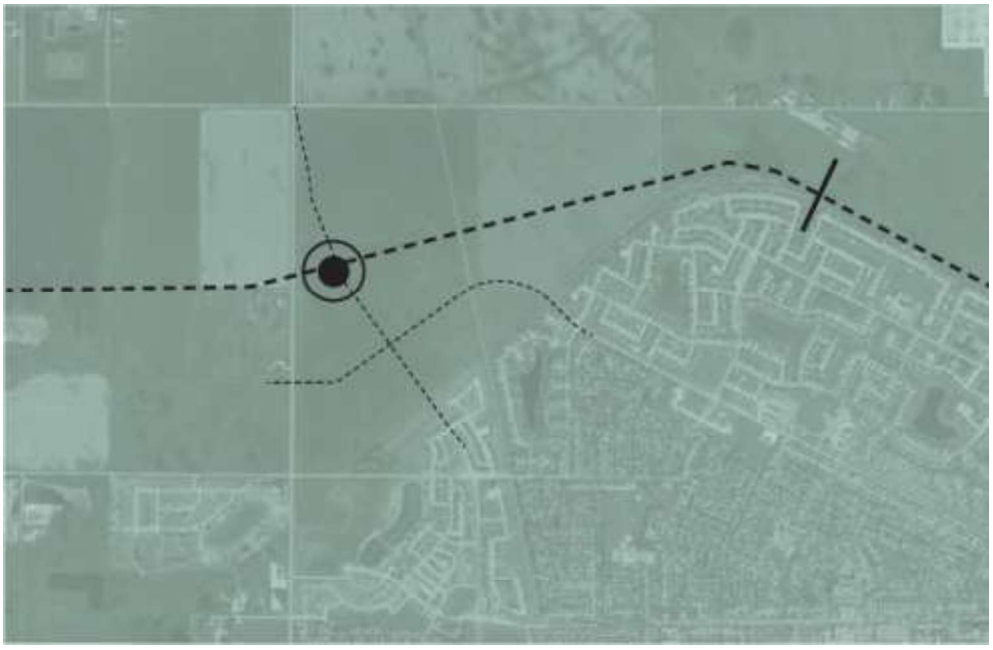

Figure 4-11. CPT extension southeast of Mollard Rd. and the proposed quarry. Source: WSP 2017.

Figure 4-12. Initial termination of CPT extension at Brookside Blvd. east-southeast of proposed quarry. Final extension to occur west of initial terminus. Source: WSP 2017.

Figure 4-13. Current CentrePort Canada planning for integrated multimodal transportation hub, relying on extension of Chief Peguis Trail southeast of Broda land. Source: CentrePort Canada 2017

Careful consideration of the WSP Functional Design study information (WSP Engineering 2017) strongly suggests that two of the three homes within ~850 m of the proposed quarry (Figure 4-1) would be impacted much more significantly by the CPT-extension project and the future connection to CentrePort Canada Way (CCW) than by the quarry operations. The combination of the CPT-extension and the CCW-connection will create a future curve in the new Chief Peguis Trail extension. This will require construction somewhere on Klimpke Rd. between Mollard Rd and Farmer Rd. (Figure 4-1 viz. Figures 4-9, 4-10 and 4-11). These interrelated infrastructure projects will create substantial visual and acoustic implications for these two homes because of the intended use of this new transportation infrastructure as a major bypass of the City. Substantial public use of the new infrastructure is expected, especially by cargo traffic to the International Airport and the rail-truck transload facility in CentrePort. Final alignments have not been chosen, nor has the location of the southerly curve towards CCW. However, consideration of the above-noted figures indicates that a substantial amount of land would be required at Klimpke where the extended Chief Peguis Trail will turn south. The construction of the curve and sustained heavy traffic will likely significantly impact those landowners at that time.

4.10 Prevention of Sonic Impacts through Collaboration and Consultation

Broda owns and operates quarries across western Canada. It is a specialist in the development and sustained operation of these facilities in ways that do not create significant impacts. One aspect of its approach to meeting this goal is to collaborate with local regulatory authorities to ensure that protective project-development guidance is embodied in the site layout and intended operations of the facility, as noted above. Another is collaboration with the operation's neighbours. Broda recently completed review of meeting records from 2005-2006 with the CAC for noise-related issues it expressed, to thereby guide the more recent data-gathering and impact-prevention activities completed to date.

As noted above, substantial progress has been made. This Sound Impact Assessment and Sound Impact Management Plan has been drafted mindful of guidance, suggestions, and thoughtful commentary received over the years from many provincial and federal government staff, habitat-restoration ecologists, native-seed harvesters and planning contractors (e.g., Prairie Habitats or Argyle Manitoba), and prairie naturalists. Many of the provincial specialists consulted have responsibilities in jurisdictions duplicated by areas of Rosser's By-law 8-15. Departments or Branches with which Broda has consulted include those noted below. The text below also sets out some of the issues, concerns, or planning requirements in their jurisdiction that this document addresses:

- **Community and Regional Planning Branch** (satisfaction of requirements for buffer zones, setback distances from homes*).*
- **MIT** (possible need for improvements at intersection of selected access/egress road at Route 90 (and possible requirement for a 'permit'); selection of and possible improvements to access/egress road to Metro Route 90 (possible need to meet RTAC standards); probable
- requirement for a "Traffic Impact Study").
- **Mineral Resources Branch** (emulation of relevant sound-related prescriptions regulated under the *Quarry Minerals Regulation*).
- **Sustainable Development (**formerly **Conservation and Water Stewardship**).

In addition to the relevant and helpful guidance received through dialogue with officials from several of the above-mentioned agencies, this document benefitted from specific guidance and consultations with personnel engaged in some of the best examples of prairie restoration (e.g., John Morgan of Prairie Habitats) and global quarry-revegetation and redevelopment specialists (including the unique "Eden Project" in Cornwall, UK; (Anonymous n.d.).

A key area of further collaborative dialogue is with MIT. The imminent existence of the above-noted new transportation infrastructure will create significant temptation for some truckers taking deliveries from the quarry to construction sites to use the Klimpke Rd south rather than the easterly access to Route 90 preferred by MIT. Broda's long-standing request for site access/egress at the northeast corner of its property, via the southern frontage road parallel to Highway 101 (Figure 4-1), would prevent any such 'short-circuiting' to CCW. More importantly in the context of this assessment, this would prevent the trucking nuisance noted above for two landowners on Mollard Rd. immediately east of the quarry.

4.10.1 Prevention of Sonic Impacts through Adaptive Management

In addition, MLi3 has prepared and Broda has adopted a parallel Adaptive Management and Progressive Rehabilitation Plan (AMPRP; MLi3 2019a). The AMPRP calls for maximum on-site use of earthen berms planted with rows of sustainable native plant materials for sound screening and summer-seasonal sound absorption, especially to screen every adjacent neighbouring property from the project. In addition to these provisions, the parallel AMPRP also calls for Broda to evolve its operations to reduce the potential for impact creation wherever possible. For example, in the AMPRP Broda committed to evolve its site operations based on "lessons learned" from ongoing monitoring of the actions of other local quarry operators doing similar activities (e.g., Stonewall Quarry Park, Quarry

Oaks Golf Course, Silver Fox Estates – Birds Hill, etc.). The plan also reflects consideration of its competitors' best practices for sound-impact prevention and mitigation. Broda advises that any improvements demonstrated in prevention or mitigation of sonic impacts by any other quarry facility in Manitoba (and, indeed anywhere else) must, and will, become the new standard of care for Broda.

Further, the Blasting Impact Assessment completed by blasting professionals recommends blasting monitoring and creation of a site- and –operations-specific "attenuation relationship" (dose-response curve) that will allow Broda to refine its blasting protocols. This new knowledge can further reduce the potential for overpressure (noise) and vibration (DST 2018, p. 16).

4.10.2 Prevention of Sonic Impacts through Sound-Propagation Reductions

Another requirement of the AMPRP is relevant. Broda has publicly committed (CUA public hearings, 2010) to progressively decommission, and to "re-commission", the site to voluntarily satisfy the intent of relevant sections of the MMB regulations and to meet a Site End Use Plan desired by the RM. One key element of the AMPRP requires Broda to satisfy the portion of The *Quarry Minerals Regulations,* which states in Part V, s.38, that:

> *"(1) Every operator of a quarry shall stockpile on the parcel of land or within the area of the quarry mineral disposition, all topsoil and overburden stripped in the process of excavating the quarry."*

Broda's site screening and native-planting plans include using dense-canopy, fast-growing, sound-absorbing, native trees (e.g., hybrid 'Tower Poplar' clones) and shrubs to vegetate the stockpiles of clean fill it will need to decommission and re-commission the property when operations cease. These stockpiles will take the form of linear berms preventing the property operations from being seen, and largely from being heard, by all but a few homes located closest to the operation. Planted with hardy and dense vegetation able to absorb seasonal sound energy, the stockpiled soils and construction materials and the vegetative screens growing on them will reduce the potential for sound impact occurring off site. The presence, placement design, and construction of these berms of stockpiled materials typically causes more vertical sound propagation than lateral propagation. This, in conjunction with the simple fact that the quarry gradually drops below the level of the ambient soil surface, greatly contributes to vertical sound propagation and reduced off-site dissemination (Clines 2016). Off-site sound dissemination from routine operations will be likely be seasonably noticeable during about the first three summers, as plants are established, fertilized, maintained and grow, based on published growth-rate data for these species. Thereafter, seasonably noticeable sound will continue to diminish in effect. They will relatively quickly become part of the current sound environment dominated by the sounds of transportation and adjacent farming.

5.0 ADDITIONAL WORK TO BE DONE

5.1 Additional Information

Broda's current planning would benefit from more information about the current sonic environment. Especially useful would be data on the current level of nuisance experienced by the neighbours closest to the site (Figure 4-1) and most likely to experience incremental nuisance. To that end, it will also be important to document the current baseline acoustic environment, and the complaint baseline, related to current heavy truck counts passing by the site. Broda has recently initiated steps to acquire all this new information. WSP Engineering completed a confidential Traffic-Impact Study for Broda in September 2018 (WESP Engineering 2018). Broda is now considering the study findings and recommendations and will file the Study with the RM for its review pursuant to the Bylaw. Now that the traffic study is done, its results will be used to refine and update the parallel Transportation Plan to be filed with and reviewed by both MI and the RM.

More information is needed on the current approach of officials to regulating sound generation, or mitigation of sound increments, at other provincial quarries. This will be solicited from these officials.

Also, important will be additional information on noise-suppressing quarrying technologies that have only recently come to the market. So too will be creation of a site- and –operations-specific "attenuation relationship" (dose-response curve) so Broda can refine its blasting protocols to further reduce the potential for overpressure (noise) and vibration (DST 2018, p. 16).

5.2 Additional Consultations

Broda will consult with regulatory officials to understand historic patterns of noise-related complaints within the immediate vicinity of the site. Dialogue with the closest and more distant neighbours could also provide information useful to understanding of whether, and to what extent, site operations might be adding incremental nuisance-sound levels, and where and when. Broda has advised MLi3 that it will reactivate the CAC, solicit new participants, update previous public and regulatory accountability procedures, and create new citizen-focused acoustic monitoring and public-accountability tools (e.g., interactive website). Solicitation of ongoing input on issues of concern from the reactivated CAG meetings will continue under Broda's previous "open-door" policy.

Dialogue with industry noise-suppression specialists may also be fruitful in the unlikely event that these prove necessary after operations have stabilized.

5.3 Additional Site Design

The site has been laid out in a conceptual manner but with sufficient detail to support the 2010 environmental assessment. Dialogue is still underway with key government personnel in MIT and WRB regarding optimum low-impact access and egress to the site, and how best to manage site-water balances. These consultation processes will result in greater precision in defining the site layout. Once more definition has been achieved, Broda will examine the layout purely from the perspective of

creating more sound barriers, and dropping the working face below the soil surface faster. This will create greater diversion of sound levels into the vertical plane rather than the horizontal plane.

When the first working face is created during the first days of quarry development, it will be at least 3 m below the top of even the most modest berm built between the property margin and the nearest homes. As sound will thus be disseminated at an angle approximately 30-50 degrees above the soil surface, the potential for sustained operational noise impacts to be consistently experienced at these homes, the closest three of which are about 850 m from the expected centre of the quarry, is very low and unlikely to be significantly noticeable over the current ambient environment.

In addition to the effects of working face depth and noise deflection by earth berms, specification of sound-absorption panels, berms and vegetation barriers will be considered in a multidisciplinary approach to reducing both sound creation and offsite dissemination. Use of sound-deadening building materials, and building orientation and angles, will be considered so that use of site buildings to create both sound and acoustic screening of the two adjacent homes can be even more effective. Explicit use of site buildings to achieve these objectives will be part of the design brief for the building designers. The final optimized design will be shared with Broda's neighbours and regulators to seek even further optimization before any contracts are awarded for site preparation and construction.

5.4 Decisions Regarding Equipment

Broda will invest in Best Available Technology, Economically Achievable (BATEA; USEPA 2008) which will be the best possible for minimizing nuisance intrusion upon its immediately adjacent neighbour. The choice of the types and size of operating equipment remains to be determined. These decisions will be highly attentive to managing the demonstrable sound-exposure risks from aggregate operations. Thus, risk is to the on-site workers rather than to the off-site neighbours (for the reason noted above [i.e., inverse square relationship of sound to distance]), as reported in numerous studies of industrial and occupational health-risk assessment; e.g., Bauer and Spencer 2008:

> *"…crushers and screens used in the processing of the sand and gravel also generate sound levels greater than 90 dB(A). Although no surveyed worker exceeded the Mine Safety and Health Administration's (MSHA's) permissible exposure level (PEL) of 90 dB(A) eight-hour time-weighted average (TWA8) labourers, mechanics, oilers, helpers, pickers and greasers are the workers most likely to be exposed to hazardous sound levels…over time.*

Based on the types chosen, options for reducing the number of pieces of heavy equipment will also be explored. So will opportunities for optimizing operational efficiency to reduce total expected operating hours per tonne of yield. Final choice of equipment will be driven by decisions around finalizing the most effective site layout. These decisions will all add significant capital, and O and M, costs to the development. Once these final layout, equipment, and operating regime decisions have been made, the implications for costs and cost recovery will be determined. These data will be important for the RM to understand in the dialogue regarding a mutually agreeable Development Agreement.

The "equipment" to be purchased will include the most sophisticated possible Personal (hearing) Protection Equipment (PPE). PPE purchasing decisions will be consistent with both proactive

corporate worker-protection policy and regulatory guidance on PPE selection (e.g., *CAN/CSA Standards)*.

The industrial, mechanical, processing, and PPE equipment chosen will likely be the most sophisticated and efficient ever selected for a quarry in Manitoba. These technologies will therefore be able to generate the least amount of sound per unit production of all previous technology choices available.

5.5 Decisions Regarding Operations

Broda is confident that its operations will conform to all formal requirements regarding sound levels / nuisance noise. Nevertheless, Broda has advised MLi3 that it will review its plans and activities regarding this topic with the appropriate government departments. It will seek approval of its plans before proceeding to a rezoning hearing, and certainly prior to beginning any quarrying operations. It is expected that project-related liaison will take place with Manitoba Workplace Safety and Health Division and the Mineral Resources Division of the Growth, Enterprise and Trade Department. Because these consultations will create constraints on quarry operations as they relate to periods of high groundwater and potential flooding scenarios, constrained site operations will reduce even further the potential for incremental sound impacts being observed off site.

Broda will ensure that operational noise levels are within regulated limits and/or will provide appropriate hearing protection for workers who may be exposed to sound levels that exceed the limits. Broda's plans to achieve these operational standards will be reviewed with the Department.

6.0 MONITORING TO ASSESS PERFORMANCE

A key element of this Plan is monitoring to support adaptive management of the noise potential from operations and to determine the effectiveness of impact prevention, mitigation, or minimization.

As noted, blasting will be used occasionally, about perhaps several dozen times per year on average, to loosen the rock and make it available to the crushers. Provincial guidance regarding monitoring of quarry blasting is provided under the Quarry Minerals Regulation (Part V, s.45) which states:

- *"An operator of a quarry shall ensure that a log book is maintained for the purpose of recording the following information with respect to blasting on the parcel of land on which the quarry is operated:*

  (a) a sketch of the blast area showing the location, depth, weight and composition of charges and the type of arrangement and delay timing of each detonator used;

  (b) the time of each firing;

  (c) details of the time of and reason for any malfunction or misfiring; and

  (d) corrective action taken as a result of each malfunction or misfiring.

- *An operator of a quarry shall keep the log book maintained under subsection (1) on site and shall make it available for inspection at all reasonable times by:*

(a) any person authorized by the municipality or local government district in which the blasting takes place; and

(b) any employee of the Mines Branch of the Department of Industry, Trade and Mines, the Environmental Stewardship Division of the Department of Conservation (now Manitoba Sustainable Development) *or the Mines Inspections Branch of the Department of Labour and Immigration".*

This will be important for meeting requirements set out in the Development Agreement with the RM. Broda will complete development of its multidisciplinary preliminary Environmental Monitoring Program such that its parameters (e.g., including time-weighted periodic sound-intensity levels at property boundaries, the "log" required under the QMR, and the many other parameters recommended by DST Consulting Engineers [DST 2018, p. 16]) and disclosure methods (e.g., interactive website, periodic reports to the CAC and regulators, "Sound-Level Thermometer" maintained at the site entrance and at the property boundaries closest to neighbouring landowners; City of Vancouver 2017) meet both local landowner and government needs for regular information on operational performance. The log of blasting will be available onsite to any interested party and will be copied monthly to the CAC. The accountability disclosures will also allow local and government judgements to be made about whether corporate commitments to impact prevention are successful.

Monitoring will take different forms, and occur at different intervals, satisfying the QMR prescriptions (notwithstanding that they do not legally apply to Broda), tracking a wide variety of parameters to support Broda's ability to evolve the Plan, as and if needed. These will include the following.

6.1 Periodic Proponent Monitoring

During quarrying operations, as per DST recommendations, Broda will monitor sound and vibration levels at the site and, as needed, at locations off-site. Monitoring at the project site will be necessary to satisfy the WSHD requirements, which require that any workplace generating noise levels exceeding 80 dBa must take periodic noise-level measurements (Manitoba Guideline for Hearing Conservation and Noise Control 2007). Such acoustic surveys will use the same techniques and survey locations as previously studied in 2009-10 to allow assessment and reporting of time-series trends.

Consistent with widely-reported and –adopted Best Practices (e.g., Clines 2016), Broda will undertake periodic noise mapping around the facilities and at different site operating areas. This will allow better understanding where residual noise issues are. It will help to define additional noise-mitigation measures for workers (e.g., making use of PPE hearing protection mandatory rather than worker-discretionary; new colour-coded and task-specific location labels so employees can more easily identify whether an area requires no hearing protection, modest hearing protection, specialized hearing protection or requires both specific hearing protection and limited exposure time).

Broda will also maintain periodic checks on the health, growth rates, plant density, and height of the sound-deadening species of native plants that will be placed on the berms of stockpiled materials and all around the site margins. While plants can absorb some of the disseminated sound, their ability to be part of the solution is compromised if they don't grow, or die, because of desiccation, insect infestation, or other constraint. If replacement of dead plants, watering, fertilization or other measure is

needed to grow the plants faster, higher, and more densely, Broda's Adaptive Management Plan will ensure this is done. Any such remedial measures will be documented in the annual accounting of the effectiveness of the AMPRP (MLi3 2019a), a third documentation log of public accountability.

Monitoring will track whether socioeconomic benefits expected to be created by the project will be realized and capable of sustained measurement. The operation of the facility will create both site-confined noise impacts and off-site noise nuisance. Experience demonstrates that the potential for impacts from aggregate operations are localized (risk to workers can be substantial) but the risk can be (and usually is being) mitigated and reduced to regulated and acceptable levels (Bauer and Babich 2007; Bauer and Babich 2006).

Monitoring may be able to use the sophisticated data-capture and –management capabilities of monitoring-drone technology. Interlocking suites of digital and aerodynamic technologies, drones used in environmental surveillance are increasingly practical for even the smallest operator of an operation requiring routine monitoring and/or disclosure. Recent Transport Canada regulations may preclude drone use close to the James Richardson International Airport However, which lies within the 9-km "no fly" zone near aerodromes.

Figure 6-1. Drone-surveillance technology is increasingly practical for even small-scale environmental monitoring programs. Often used to demonstrate regulatory compliance, satisfaction of pre-development corporate commitments, or assurance of venture capital providers, programs are frequently delivered by project proponents and regulators. Some surveillance programs are co-designed, co-managed- co-delivered and co-documented by 'the regulator' and 'the licensee'. Even unfunded ratepayers engaged in "citizen science" and poorly-funded academic researchers can afford the rapidly evolving technology. Source: Public domain.

Broda's independent consultants will track time-series trends in the data from monitoring onsite and at property boundaries for sound-intensity levels, vibration, and air overpressure, as per the DST recommendations. Such tracking will be important for demonstration of the typical patterns of sound attenuation with distance. It will also demonstrate satisfaction of industry and government guidelines for vibration and air overpressure from routine operation (and occasional blasting). As recommended by DST Consulting Engineers, data recorded with dedicated monitoring units will be used to evolve the Blasting Plan using a site-specific "attenuation curve" to design more productive blasting that doesn't disturb, or reduces nuisance to, the site's one immediately adjacent neighbour at theoretical risk of nuisance-noise. There would be even less concern about this effect for the 3 neighbours living within ~850 m of the quarry (Figure 4-1). If need to evolve the Blasting Plan becomes clear, Broda will engage the CAC to assist in the monitoring

of possibly effective options for reducing sound propagation off-site (e.g., hole-to-hole delay, adoption of non-electric initiation system, adoption of deck-charging, use of sequential blasting machine, effective muffling blast holes, etc.; DST 2018; Manoj and Prasannakumar 2002).

6.2 Periodic Regulatory Dialogue and Independent Surveillance

It is fully expected that the sound-management measures planned for the quarry operation will satisfy the requirements related to minimizing both worker and neighbour sound exposure. Sustained dialogue will be maintained with key government personnel from the Community and Regional Planning and Sustainable Development to determine whether their needs are being met. The quarry operations will also be subject to 3rd party inspection by WHSD and possibly MSD. In the event of any exceedances of the regulations, measures would be immediately undertaken to address those exceedances.

6.3 Responses to Neighbour Concerns

Broda will maintain regular contact with its neighbours, in part through ongoing constructive engagement with a reactivated local Citizens Advisory Committee. Noise-level monitoring at off-site locations would be undertaken if a complaint(s) was received from a neighbour. Off-site sound levels ("NEFs") were considered in the 2009 EIA (Tetr*ES* Consultants Inc. 2010) and were predicted to be at levels similar to a 'whisper' (23 decibel) by the time the sound reached an adjoining property. Notwithstanding this, Broda will be attentive to the concerns of its neighbours. It has committed to respond to any noise complaint that is registered.

6.4 Public and Regulatory Disclosure and Accountability

Broda will be subject to inspection and enforcement by Provincial Workplace Safety and Health Inspectors, as are all other industries.

6.5 Selected Benefits Monitoring

Monitoring of projected project benefits will be maintained, for many reasons, including to meet public and regulatory accountability requirements and expectations. One specific goal of a component of ongoing environmental monitoring at the property will be to discern the presence of any "acoustic sanctuaries" on the site. These could most likely occur in habitats supporting designated species (if present) being protected (for creation of additional ecological project benefits) from vibration and air overpressure from routine operations (and from occasional blasting). Data from sound monitoring will help Broda to evolve the Blasting Plan to design more productive blasting (which would have the effect of reducing or even precluding nuisance to the few adjacent landowners).

7.0 PLAN CONSISTENCY WITH "BEST PRACTICE"

The design and operation of the development will seek to engender respect for the project by adherence to Best practices in quarry design and operations. Best Practices for hearing protection for workers is defined in the 2007 *Manitoba Guideline for Hearing Conservation and Noise Control.* Broda will be

attentive to the requirements set out in this document. Broda will track and will adhere to impact-prevention implications of research results published by epidemiologists monitoring workplace exposures (e.g., Bauer and Babich 2007; Bauer and Babich 2006). This will ensure that its operations comply with evolving EPA, NIOSH, and federal and provincial Best Practice prescriptions.

This is the most effective plan that could be developed for this site and operations utilizing environmentally "Best Available Technology Economically Available" (BATEA). The concept dates to the early 1970s, with the rise of environmental protection statutes and regulations, especially in the US (e.g., 1972 *Water Pollution Control Act [Public Law 92-500],* also known as *the" Clean Water Act"):

> *".. industry shall use* ***the best treatment technically and economically achievable*** *for a category or class of point sources. Under this concept, pollution control will consider such factors as the age of the facilities and equipment involved, processes employed, engineering aspects of the control techniques, process changes, cost of the reductions, and environmental impacts other than water quality, including energy requirements"* (emphasis added) (US EPA 2008. See also Wikipedia).

This plan represents Broda's best efforts at defining BATEA for this site-specific project.

8.0 PLAN EVOLUTION

This Plan will evolve as performance metrics accumulate and as performance trends can be identified and tracked. The major factors affecting how the Plan will evolve through time is the truck traffic, the greatest source of immitigable proximate impacts, and the evolution in quarry operations.

Components of the current confidential Conceptual Operating Plan (WSP 2019 in prep.) that affect the SIMP component of this SIMPSIA could cause evolution of the SIMP because the Conceptual Operating Plan must be further refined through collaboration with MIT, MMB and the CAC. Both the SIMP and the underlying Operating Plan would be refined again if Broda develops the property south of Mollard Road.

Broda will track any nuisance-noise complaints from quarry neighbours and through ongoing constructive engagement with a reactivated local Citizens Advisory Committee. For example: modifications to site-access patterns or quarry operations or to this management Plan will occur if monitoring reveals that exposure levels to workers were being exceeded or if neighbours were being subjected to persistent unacceptable nuisance noise. For another: periodic seasonal noise complaints could be received in the early years of operations. Off-site sound dissemination from routine operations may be seasonably noticeable during a longer period than the first three summers, as expected now, plants are established, fertilized, maintained and grow. Seasonal or chronic plant-growth inhibition could occur because of such factors as drought or insect predation. These are expected to be prevented or mitigated by Broda's routine landscaping maintenance activities. If more intensive mitigation effort is needed, then additional planting and berming can occur. These new or incremental actions would constitute evolution of on-site practice and plans, as prescribed and committed to in Broda's Adaptive Management and Progressive Rehabilitation Plan (MLi3 2019a). Thereafter, because of the adaptation

to the conditions developed though neighbour dialogue, the incremental adaptations in sound management should become noticeable. As a result, seasonably noticeable sound should again continue to diminish in effect to become part of the local sound environment (dominated by the sounds of highway transportation and nearby farm-equipment use).

The above-mentioned dialogue process and response process will be tracked in another (5^{th}) documentation log. This record of any such evolution in impact-mitigation needs and associated mitigation actions will be maintained and shared annually with provincial officials.

Broda will implement any new impact-prevention or –mitigation measures arising from epidemiological research and monitoring of workplace sound-level exposures that cause evolution in Best Practice prescriptions and/or the definition of BATEA. This will ensure that site operations evolve to maintain compliance with evolving federal, provincial, US EPA, and US NIOSH requirements. Thus, occasional plan evolution should be effective in meeting Broda's goal that the SIMP be the best plan that could be developed for site operations utilizing BATEA.

Often, this use is for demonstrating satisfaction of conditions of an environmental license, approval or permit because the digital character and associated precision of the data-capture capacities now meet tests for proving Chain of Custody and for 'reproducibility'. Drones are increasingly being used in multiple fields as a survey and monitoring tool. In doing so, they are increasingly replacing the more expensive, less flexible, less frequent, more logistically-demanding, and lower-resolution satellite-imaging option that revolutionized surveillance 3 decades ago (e.g., Hardy et. al. 2017; Watson 2016; Beregovoi, Younes, & Mustafin 2017; Kelly 2017).

9.0 CLOSURE

The proposed project is to occur over formally designated "High Quality" deposits already developed for similar limestone-aggregate extraction and quarrying activities. These occurred on the southern continuity of the same geological formation, trending beneath the Broda property towards the south-east. Little Mountain Park has been developed during the rehabilitation of the former quarry excavation there as a community athletic amenity for public recreation (baseball diamonds). (Figure 1-1, Google Earth).

Potential nuisance sound effects of the development should be confined to about 17 instantaneous events per year, on average, experienced by one immediately adjacent landowner. This landowner would be one of the two landowners living east of the site on Mollard Rd. that would experience nuisance sound from truck movements to and from the site, not by on-site operations. Occasional use of blasting and routine operations-related noise should not significantly create sonic intrusion into the lives of regional landowners, especially as the Blasting Plan evolves over time.

These predicted nuisances to two landowners could require additional mitigation, consistent with Broda's Conceptual Operating Plan (WSP 2019; confidential, in prep.) , the preliminary Environmental Monitoring Plan (also in preparation; MLi3 2019f; confidential, in. prep.), and the Development Agreement expected with the RM. These potential sonic impacts should be prevented, minimized, or mitigated by the low population density (only three homes) within ~850 m (Figure 4-1), and by

Broda's adherence to an integrated site sound-screening system of perimeter and localized strategic vegetated berming, and situation of most heavy equipment below-grade. As noted in section 4.9, for two of the three homes within the ~850-m radius of the quarry, planned new regional highway infrastructure focussed on CentrePort in Rosser is likely to create greater impact than nuisance from the quarry project.

This Sound Impact Assessment and Sound Impact Management Plan will support negotiation of a mutually agreeable Development Agreement with the RM. It embodies the "state of the art" in progressive management of the potential for sound impacts form a modern quarry during its operational phase. Its submission is to demonstrate Broda's partial completion to date, and intention to complete, all relevant and applicable portions of Rosser By-law 8-15. Its development and execution also demonstrate satisfaction of the requirements set out in *The Special Planning Area Regulation* 49/2016 and the *Inland Port SPA Planning Regulation No. 48/2016* that, taken together, allow a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") on the CentrePort land base. Adherence to the ongoing and evolving Plan will also help guide the planning for transition to an end use(s) desired by a reactivated and strengthened Citizens Advisory Committee.

This Plan has been developed in consultation with government personnel who have applicable expertise. It is intended to be the best possible Plan that could be developed for this site and operations utilizing environmentally "Best Available Technology Economically Achievable".

The Plan demonstrates satisfaction of previous corporate commitments to: (i) the CAC, (ii) participants at several public Open Houses and RM of Rosser public hearings about the proposed project, (iii) three neighbour landowners within about a half-kilometre of the Broda property; and (iv) Manitoba Mines Branch.

MLi3 has observed that Broda strives to set itself apart as a professionally managed, environmentally responsible, corporate citizen. MLi3 Inc. believes that Broda will take the necessary steps to ensure that its site sound-screening (and related adaptive-management) practices support this goal, consistent with its stated acceptance of the prescriptions of this plan (and other plans) prepared for Broda Properties Inc. by MLi3 Inc. (Broda *pers comm*. 2018).

The foregoing is unbiased independent work and assessment by MLi3 Inc.

10.0 CITATIONS

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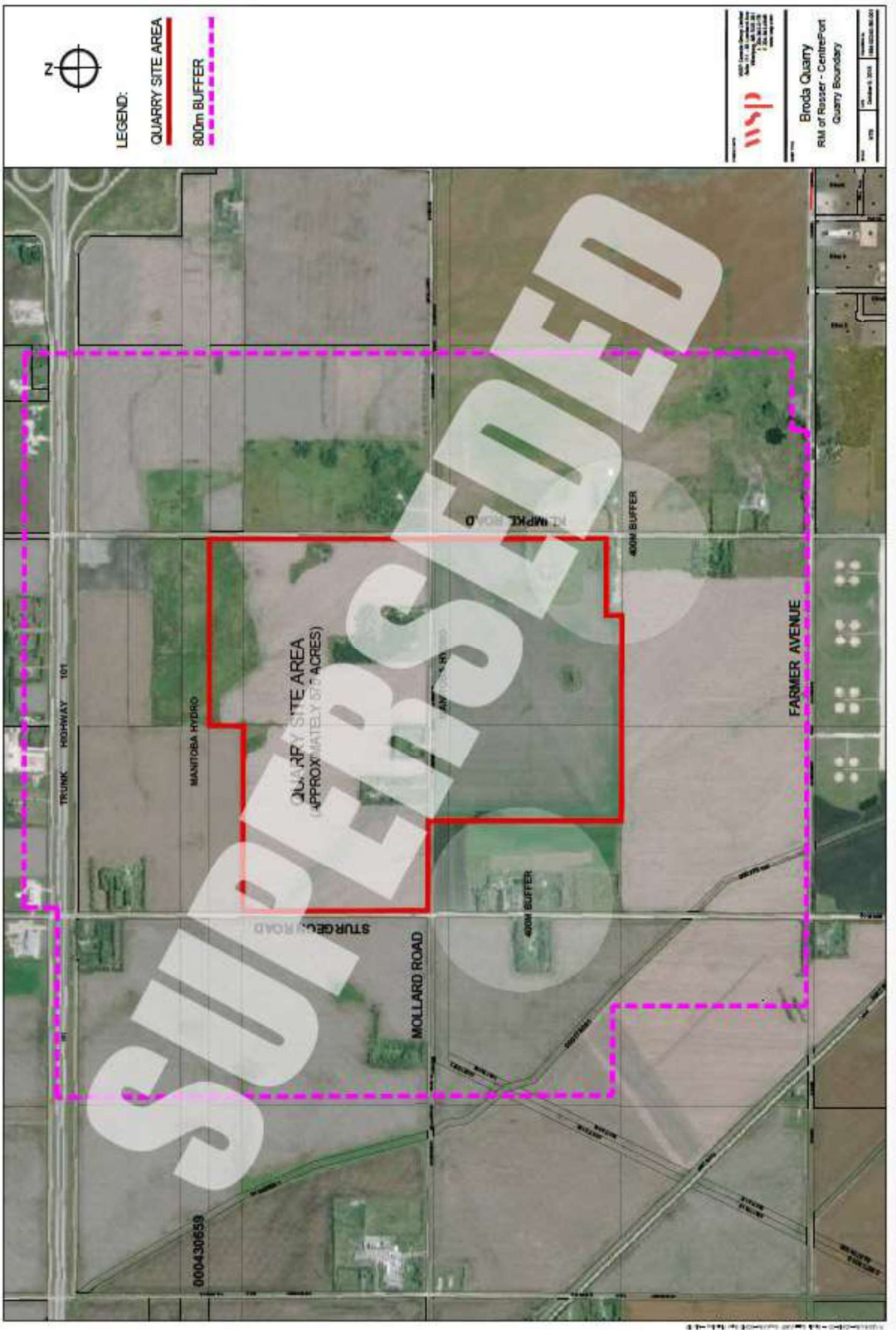
APPENDIX A CONCEPTUAL SITE OPERATING PLAN

Initial Site Layout and Development Schematics

The conceptual operating plan, which continues to evolve, has been built around a core commitment to the use of Continuous Surface Miner technology. A typical Surface Miner, in this case, manufactured by Wirtgen, is shown in figure A-1 below.

Figure A-1. A Wirtgen 4200SM Surface Miner.

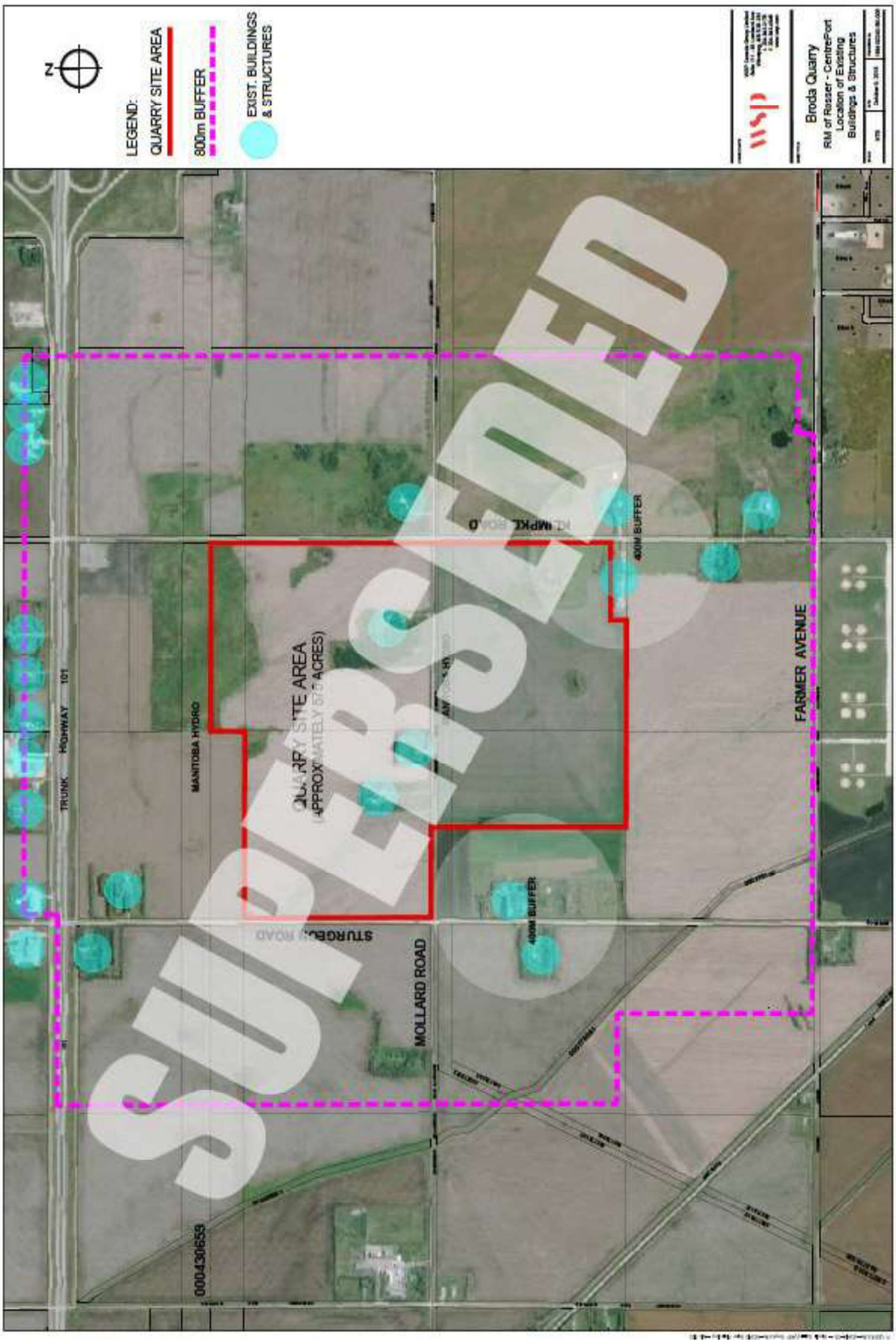
The most important elements of the current working draft of the Conceptual Operating Plan are preliminary site layout drawings which have been developed mindful of (i) the physical attributes of the site; (ii) the intended reliance on Surface Miner technology; (iii) the intention to minimize surface water ponds and groundwater accumulations on the site; and (iv) many corporate commitments to preclude, or minimize, visual and sound impacts being experienced at adjoining properties. The current draft drawings follow below; these draft drawings have recently been superseded and will continue to evolve before being finalized and submitted for review by the RM of Rosser.

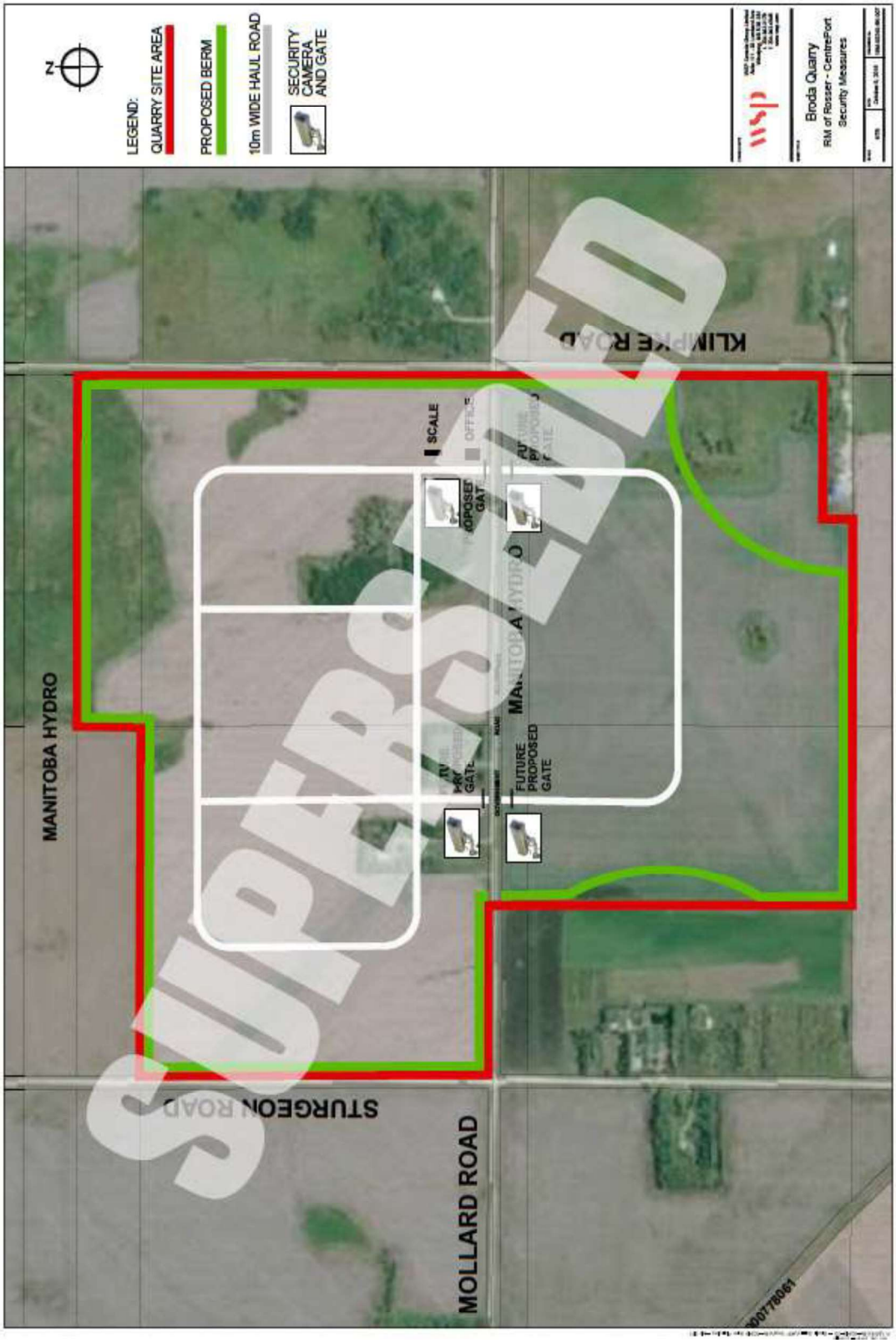

LEGEND:
QUARRY SITE AREA
800m BUFFER
Broda Quarry
RM of Rosser - CentrePort
Quarry Boundary
QUARRY SITE AREA
(APPROXIMATELY 57.5 ACRES)
400M BUFFER
400M BUFFER
MANITOBA HYDRO
TRUNK HIGHWAY 101
MOLLARD ROAD
FARMER AVENUE
000430653
SUPERSEDED


LEGEND:
QUARRY SITE AREA
Broda Quarry
RM of Rosser - CentrePort
Land Area and Excavation
MANITOBA HYDRO
MOLLARD ROAD
SUPERSEDED


N
LEGEND:
QUARRY SITE AREA
Broda Quarry
RM of Rosser - CentrePort
Phasing
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
MANITOBA HYDRO
MOLLARD ROAD
SUPERSEDED


N
LEGEND:
QUARRY SITE AREA
REHABILITATION AREA
Broda Quarry
RM of Rosser - CentrePort
Site Rehabilitation
MANITOBA HYDRO
MOLLARD ROAD
SUPERSEDED


LEGEND:
QUARRY SITE AREA
800m BUFFER
EXIST. BUILDINGS & STRUCTURES
Broda Quarry
RM of Rosser - CentrePort
Location of Existing Buildings & Structures
SUPERSEDED
TRUNK HIGHWAY 101
MANITOBA HYDRO
400M BUFFER
FARMER AVENUE
MOLLARD ROAD
0004306659


LEGEND:
QUARRY SITE AREA
PROPOSED BERM
10m WIDE HAUL ROAD
SECURITY CAMERA AND GATE
Broda Quarry
RM of Rosser - CentrePort
Security Measures
MANITOBA HYDRO
MOLLARD ROAD
FUTURE PROPOSED GATE
SUPERSEDED


N
LEGEND:
QUARRY SITE AREA
PROPOSED BERM
10m WIDE HAUL ROAD
STOCKPILES
Broda Quarry
RM of Rosser - CentrePort
Quarry Layout
STOCKPILES
SCALE
OFFICE
TOPSOIL
CRUSHER LAYDOWN AREA
FUTURE
MANITOBA HYDRO
MOLLARD ROAD
SUPERSEDED

APPENDIX B CONTINUOUS SURFACE MINER TECHNOLOGY

Wirtgen Technology and Models in Particular

From: https://www.wirtgen.de/en/technologies/application/surface-mining/surface_mining.php

As the surface miner moves forward, a special cutting drum rotates against the direction of travel, cutting layers of material from the rock formations and crushing it in the process. The primary conveyor picks up the material in the drum housing and transports it towards the rear of the machine, where it is then accepted by the slewable and height-adjustable discharge conveyor. The discharge conveyor loads the material into trucks or dumpers or discharges it to the side of the miner. The discharge height can be adjusted to the height of the transport vehicles. The surface miner is driven via four steerable and height-adjustable track units. An automatic levelling system ensures precise adherence to the cutting depth, thus enabling even thin seams or layers to be mined selectively and with maximum accuracy.

Strict environmental standards in terms of noise and dust emissions make the vibration-free surface mining process attractive in comparison to drilling and blasting. The stable, precise and level surfaces produced in mining, earthworks and rock operations are suitable for immediate use as pavements, slopes or tunnel floors.

From: https://media.wirtgen-group.com/media/02_wirtgen/media_1/media_1_06_surface_miners_2/media_1_06_surface_miners_2_00_general_information/W_brochure_Surface-Mining_0116_EN.pdf

The economical exploitation of primary resources in opencast mining is becoming increasingly difficult as the mineral content of many deposits is dwindling due to difficult geological conditions. In rock construction, machines are required for precise levelling operations under restricted space conditions. Our patent remedy in both cases is mechanical exploitation by means of surface mining. Being the innovative leader in this technology, Wirtgen is passionately driving the development of this economical and environmentally gentle process, using its expertise to successfully master the even more demanding challenges lying ahead.

We not only develop innovative machines of the highest quality. With our machine technology, we also constantly endeavour to keep environmental pollution as low as possible. A WIRTGEN surface miner is a perfect example of this philosophy: it impresses with its environmentally friendly technology as it cuts, crushes and loads rock in a single operation. A tremendous advantage of selective mining is that the vibrationless mining operation without drilling and blasting is accompanied by low levels of dust and noise. The low environmental impact also permits maximum exploitation of the deposit right up to the edge of residential areas. The selective mining of high-quality materials requires considerably less space than conventional mining methods. Our fuel-efficient, intelligently controlled engines comply with the strictest exhaust emission standards.

Figure B-1. A Wirtgen 4200SM Surface Miner.

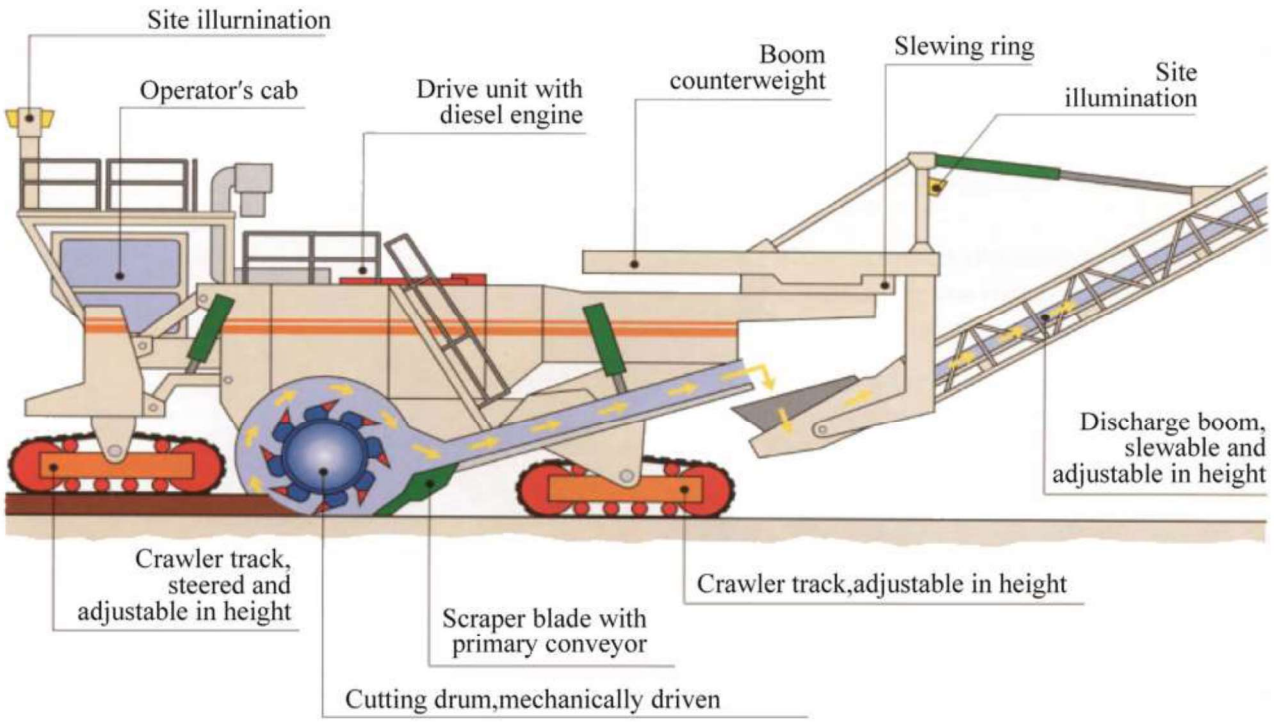


Figure B-2. A cross section of a Wirtgen surface miner in operation.

Figure B-3. A Wirtgen 4200SM Surface Miner.

Figure B-4. A Wirtgen 4200SM Surface Miner.

Figure B-5. A Wirtgen 2500SM Surface Miner.

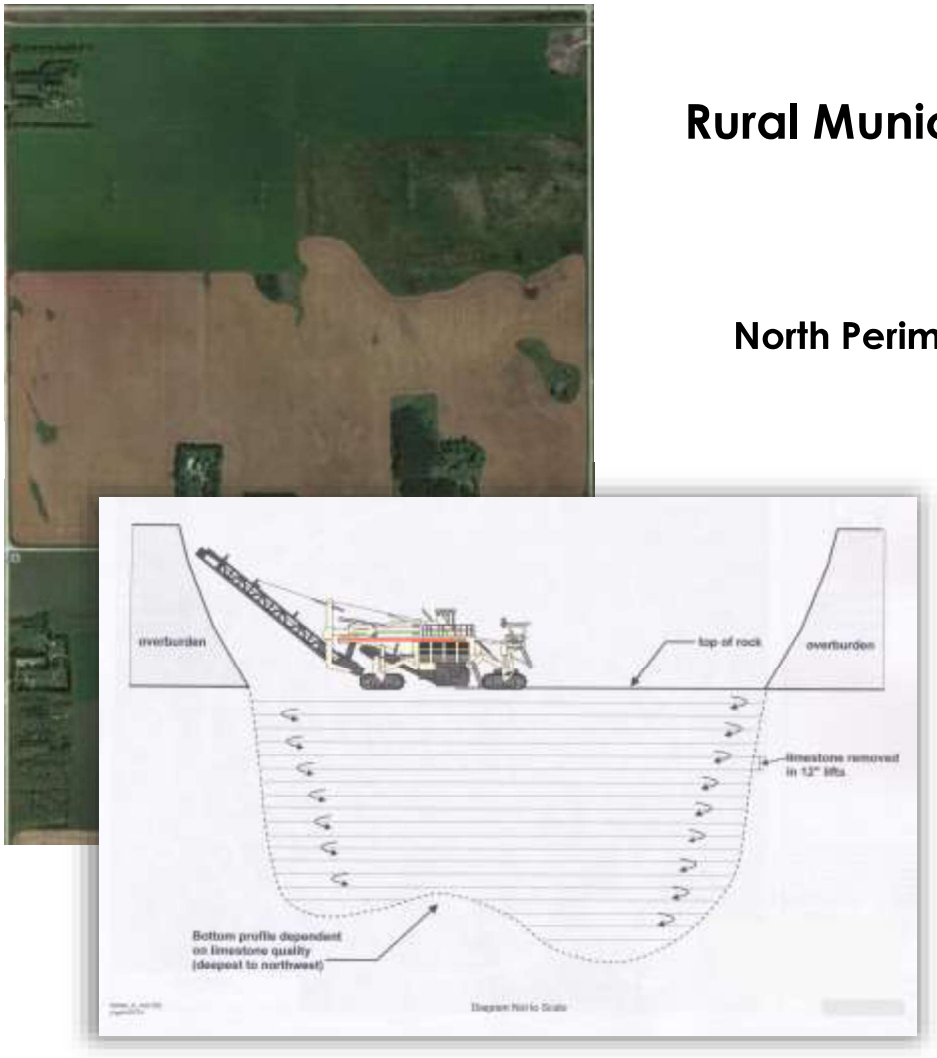
Figure B-6. A Wirtgen 2500SM Surface Miner.

VISUAL IMPACT ASSESSMENT

04

NORTH PERIMETER AGGREGATES QUARRY

VOLUNTARY VISUAL IMPACT-MANAGEMENT PLAN and VISUAL IMPACT-ASSESSMENT REQUIRED in SATISFACTION of RURAL MUNICIPALITY of ROSSER QUARRY OPERATION BY-LAW NO. 8-15



SUBMITTED TO:

Rural Municipality of Rosser

SUBMITTED BY:

North Perimeter Aggregates Inc.
Broda Properties Inc.

PREPARED BY:

MLi3 Inc.

February 14, 2019

ACKNOWLEDGEMENTS

MLi3 Inc. acknowledges with gratitude the guidance and suggestions received from government representatives who offered input into the development of either the Assessment or the Plan. Further, gratitude is expressed for the guidance and suggestions offered by neighbouring landowners who voluntarily participated in the 2005-2006 Citizens Advisory Committee process to constructively critique (i) Broda's design of the evolving project, and (ii) Tetr*ES* Consultants Inc.'s Environmental Impact Assessment of the then-current project. Relevant information prepared by DST Consulting Engineers Inc., WSP Engineering and HCG Engineering is acknowledged with appreciation.

STUDY TEAM

Mike McKernan	Environmental Scientist; Principal in Charge
Mike Sweet	Environmental Scientist
Jacki Reidy	Environmental Scientist
Richard Bruneau	Researcher; Information Management Specialist
Anna Morrison	Researcher, Document production and QA

DISCLAIMER

MLi3 Inc. accepts no responsibility for damages of any kind, if any, suffered by any third party as a result of a of decisions made or actions based on this Voluntary Visual Impact-Management Plan and Visual Impact-Assessment ("this report"). All conclusions, views and opinions expressed in this report are those of MLi3 Inc.

USE OF THIS REPORT:

This report has been prepared for the sole benefit of Broda Properties Inc. ("Broda", or "the Client" or its agent) and may not be used by any third party without the express written consent of MLi3 Inc. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT:

The information, opinions, and/or recommendations made in this report are in accordance with MLi3 Inc.'s present understanding of the Client's site(s) and/or the project(s) and/or actions referenced herein. If the proposed site-specific locations, site uses, actions and/or project(s) differ(s) or is/are modified from what is described in this

plan, or if the site conditions as described herein are altered, this report is no longer valid unless MLi3 Inc. is requested by the Client to review and revise the report to reflect the differing or modified location, land use, action and/or project specifics and/or the altered site condition(s).

STANDARD OF CARE:

Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in Manitoba for the specific professional service provided for the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS:

All site-specific descriptions, and statements regarding their influence on the findings and recommendations made in this report, are based on site conditions encountered by MLi3 Inc. at the time of its site-specific work and at the specific testing and/or sampling locations on the Client's property(s) examined by either Tetr*ES* Consultants Inc. or Stantec Consulting Ltd. by whom the author was employed over the periods, respectively, of 1990 - 2010 and 2010 -2015. Environmental descriptions and other classifications and/or statements of site condition(s) have been made in accordance with normally accepted professional practices which are judgmental in nature; no specific description in this report should be considered exact, but rather to be reflective of the anticipated behaviour of the material or matrix in question. Extrapolation of in situ conditions can be made only to some limited extent beyond the understandings set out herein, being in turn based on specific localized sampling or test points. The extent depends on variability of the soil, rock, groundwater conditions, species composition, habitat types, habitat uses, etc., as influenced by geological processes, time, seasons, planned construction activity, and intended site use(s).

VARYING OR UNEXPECTED CONDITIONS:

Should any site or subsurface condition(s) be encountered in the future, if the proposed land use or project proceeds, that are different from those described in this report or encountered at the test locations referenced herein, MLI3 Inc. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. MLi3 Inc. will not be responsible to any party for damages incurred as a result of that party failing to notify MLi3 that differing site or sub-surface condition(s) are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION:

Development or design plans and specifications should be reviewed by MLi3 Inc., sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, financing, etc.), to confirm that this report completely addresses the elaborated location, land use and/or project specifics and that the contents of this report have been properly interpreted. Specialty Quality Assurance services (e.g.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Intent to Develop High-Quality Aggregate Quarry

Broda Properties Inc. (operating in Manitoba as "North Perimeter Aggregates Inc.") has been trying to develop a high-quality aggregate-supply business on the property it owns in the Rural Municipality (RM) of Rosser. The proposed multi-stage development is located close to and west of the intersection of Mollard Road and Metro Route 90, ~3 km (~2 miles) south-east of the intersection of the Perimeter Highway (Provincial Trunk Highway [PTH] 101) and PTH 7 (Figure 1-1).

Figure 1-1. Development is located 1-2 miles south of Perimeter Highway, west of intersection of Mollard Road and Metro Route 90, between Sturgeon Rd (west), Klimpke Rd. (east). Sources: Google Earth, KGS Group 2010, TetrES Consultants Inc. 2010

The proposed operation is not a use that was permitted under the former land-use planning and administration scheme that applied

to the lands before creation of CentrePort in 2008.The property is zoned for agriculture, the prevailing local land use (Figure 1-2).

Figure 1-2. The development is planned for land now zoned and used for agriculture south of Perimeter Highway, west of Metro Route 90. Source: Google Earth, MLi3 Inc.

The prevalence of the agricultural land use is evident in digital imagery captured on satellites (Figure 1-3):

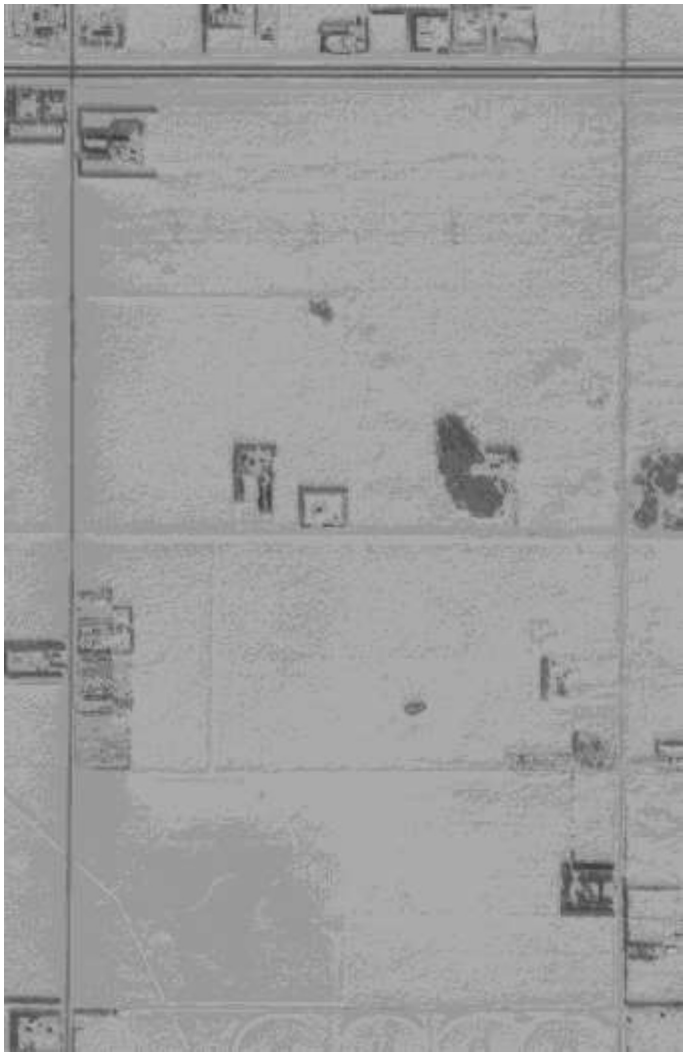


Figure 1-3. Prevalence of agriculture is reflected in unsupervised classification mapping of grey-toned "spectra signature" for cropland in recent satellite image. Darker polygons are shelterbelts, woodlots, houses, machine sheds, etc. Source: Google Earth, MLi3 Inc.

Accordingly, to support applications for Conditional Approval of the proposed new land use, Broda worked closely for several years with the information and guidance from a Citizens Advisory Committee (CAC) of neighbouring landowners. This Committee collaborated briefly with Broda in 2005 – 2006 to help plan a project where all possible potential impacts could be identified, assessed and precluded. This was then expected to occur through a

combination of careful project development and impact mitigation, ongoing environmental monitoring, and collaboration with the CAC. At the time, Broda's proposal represented a provincially unprecedented level of corporate commitments to the highest standards of possible environmental and socioeconomic care in the aggregate industry. Notwithstanding the proactivity of Broda's approach, the several applications for the requested change in land-use zoning were rejected by Rosser Council. Broda continues to believe that there was, and is, significant growing economic need and opportunity. Broda has therefore continued to invest in building the knowledge necessary to develop the site in a highly sensitive fashion, consistent with the state-of-the-art in limestone quarry development and operations.

Recent (2016) changes in the planning processes applying to the lands within the CentrePort Special Planning Area (SPA) acknowledge that quarries should be a "permitted use". This intent is consistent with the Inland Port SPA Regulation 48/2016, specifically its Aggregate Policy 6.1.2.3. This Policy notes that in "an area designated by the appropriate provincial authority as having 'high' or 'medium' mineral content must have the mineral extracted prior to it being developed for other uses, unless otherwise approved by the authority".

The Broda property is located above the last undeveloped provincially-designated 'High Quality" limestone ore body (Figure 1-4) Recovering these high-value construction materials can reduce the costs of infrastructure construction in the Winnipeg-centred region, improving all construction-project economics.

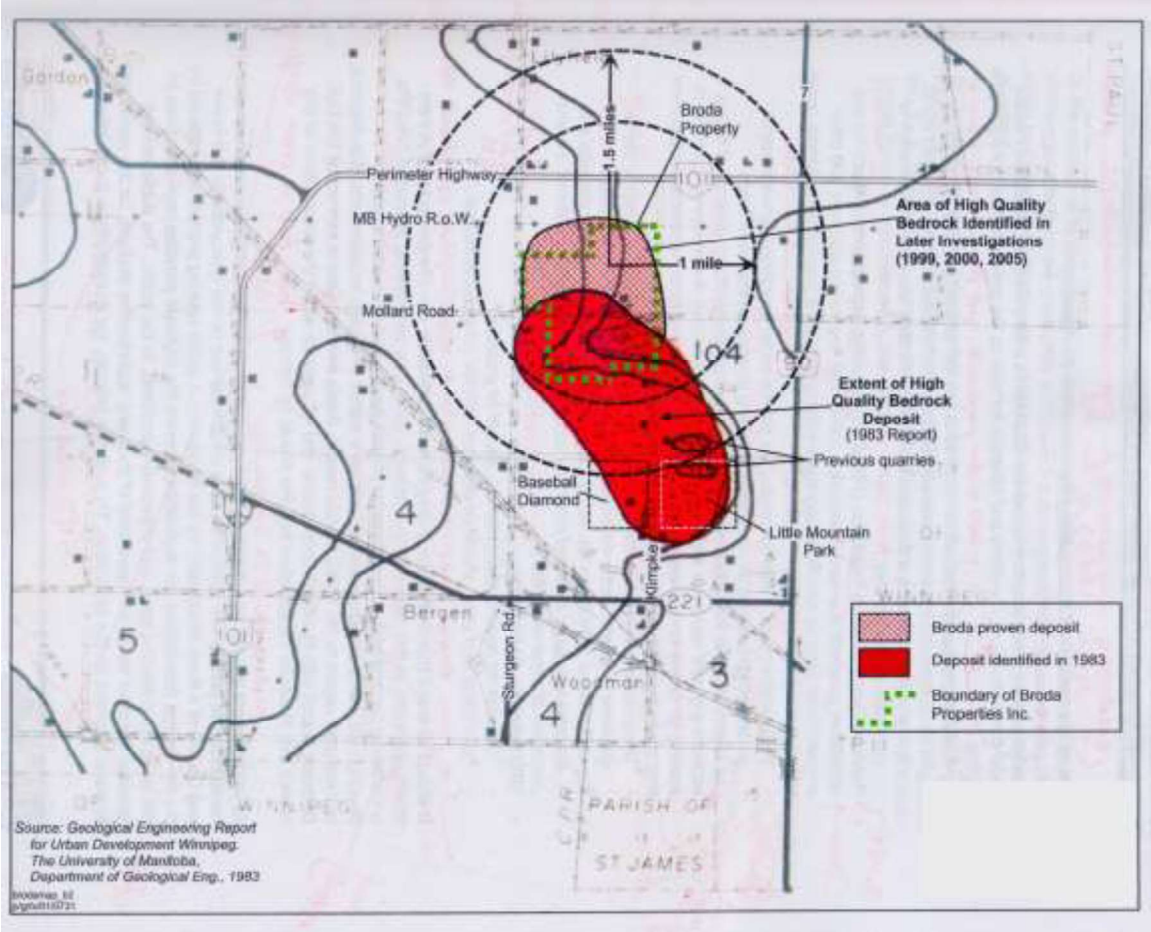


Figure 1-4. Development is located above the last undeveloped provincially-designated 'High Quality" limestone-ore body. Deposits under Broda land has variable surficial topography, and is northern continuity of a geological formation trending to south-east, previous excavated and redeveloped as community athletic amenity for public recreation Sources: Google Earth, KGS Group 2010, TetrES Consultants Inc. 2010

To be developed in five stages, the highest concentration of the highest-value materials, located generally north of Mollard Rd., will be quarried first (Figure 1-5). This first stage of the project development is termed "Stage 1" throughout this report (and in related documents prepared by MLi3 for Broda). A portion of Little Mountain Park south of the property (Figure 1-4) was the developed after surficial aggregate materials were quarried and removed in previous years from the same geological deposit.

Figure 1-5. Initial development stages will address variable elevations and thicknesses of last undeveloped provincially-designated 'High Quality" limestone-ore body. Shape of complete excavation is nominal; i.e. expected but not certain. Shape will depend on field conditions. Sources: Google Earth, KGS Group 2010, TetrES Consultants Inc. 2010

1.2 Provincial Regulatory Guidance for Quarry Development

The Province has powers to ensure that quarries developed on Crown lands satisfy the stringent requirements for Environmental and Community-Interests Protection under the *Mines and Minerals Act.* The planning, operations-related, monitoring and decommissioning requirements set out under *The Quarry Minerals Regulation* (QMR; MR 65/92) amplify these protections in the form of specific prescriptions for beneficial action and specific preventions of unwanted action. These prescriptions apply strictly to projects proposed on Crown lands. Their protective value, however, means that they are often applied in various processes for permitting or approvals for a development on private land. One example would be decisions by municipalities to add these QMR prescriptions as conditions, for instance, for the Conditional Use

Approval (CUA)that Broda has several times sought for the site. Clause 43(1)(b)(ii) of the QMR requires minimum separation/setback distance of 400 m between any rural residence and the aggregate-mining boundary. Most rural municipalities regulating aggregate operations set this setback distance as a condition in a CUA decision to create a "buffer zone". This is usually done to create a barrier against off-site export of nuisance visual or acoustic effects on the nearest neighbouring lands. Another example would be decisions by Manitoba Stewardship to include several of these QMR prescriptions as conditions if a license were to be issued under *The Environment Act*.

1.3 Guidance for Quarry Development on CentrePort Lands

The *Inland Port SPA Planning Regulation MR 48/2016* allows a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") in the CentrePort lands within the RM of Rosser. Approval of a proposed quarry pursuant to rezoning recommendations of the Inland Port SPA Planning Authority Board (PAB) having jurisdiction over these lands must be made by the Minister of Indigenous and Municipal Relations. The Minister's decision can only occur after public review of the proposal, including a public hearing administered by the PAB.

1.4 R.M. of Rosser Quarry Operations By-law

In addition to these levels of environmental and community protection, including the requirements for a public hearing, and review and approval conditions by an independent Planning Board that it co-chairs, Rosser has created a special Bylaw ("Quarry Operations By-Law"; Bylaw No. 8-15; a.k.a. the "Aggregate Bylaw") to create further control over such aggregate operations.

1.4.1 Assessments and Plans Required by Quarry Operations By-law

As one type of control measure included in the Aggregate Bylaw, the Bylaw sets out requirements for several formal Plans that Rosser requires review and approval over. As prescribed in the Bylaw, set out in Clause 13 and Schedule A, and among others (e.g. MLi3 2019f) that Broda will prepare to satisfy requirements of the Bylaw, these specific Plans include the following:

- Adaptive Management Plan (submitted as the Adaptive Management and Progressive Rehabilitation Plan; ["AMPRP"]; MLi3 2019a);
- Progressive Rehabilitation Plan (subsumed within the AMPRP; MLi3 2019a);
- Sound Impact Assessment (submitted as the Sound Impact Management Plan and Sound Impact Assessment; ["SIMPSIA"]; MLi3 2019b);
- Transportation Plan (MLi3 2019c);
- Visual Impact Assessment (submitted as the Visual Impact Management Plan and Visual Impact Assessment; ["VIMPVIA"]; MLi3 2019d); i.e. this Plan;
- Water and Natural Resources Management Plan (MLi3 2019e)
- Preliminary Environmental Monitoring Plan. MLi3 Inc. 2019f; confidential, in prep.)
- Rosser Quarry Conceptual Operating Plan. WSP Engineering (WSP Canada Group Limited). 2019 (confidential; in prep., Appendix A).
- Proposed Limestone Quarry in The RM of Rosser Traffic Impact Study. WSP Engineering (WSP Canada Group Limited). 2018.
- DST Consulting Engineers Inc. 2018. Blast Impact Assessment – Proposed North Perimeter Aggregates Quarry, Rural Municipality of Rosser, Province of Manitoba. Final report to Broda Properties Inc. October 25, 2018. Sudbury.

Broda has instructed MLi3 Inc. of Winnipeg to develop these documents (and review those prepared by others) to support its application for rezoning of its property within the RM of Rosser (Broda *pers* comm. 2018*).* The MLi3 documents have been

considered, adopted and committed to by Broda. All the documents will be formally filed in support of Broda's request for rezoning of its property.

In terms of satisfying the Bylaw, this document integrates a voluntary Visual Impact Management Plan (VIMP) with the required Visual Impact Assessment (VIA) in a combined Visual Impact Management Plan and Visual Impact Assessment (VIMPVIA). It does so because the two subjects are so closely inter-related. More importantly, it does so because impact assessments are conducted by considering the effects of proposed impact-prevention and -management measures for militating against creation of significant off-site impacts (e.g. CEAA 2016, Beanlands and Duinker 1983, Sadler 1995). The "Visual Impact Assessment" required by the Bylaw is therefore contained herein. It follows a description of the planned project, including all relevant planned mitigation measures. The VIA evaluates the potential for significant off-site nuisance visual impacts after consideration of the expected effectiveness of the impact-prevention and –mitigation measures that Broda has proposed. The VIA component of the VIMPVIA relies on published non-peer reviewed research reports and data, published peer-reviewed reports and data, common sense, regulatory practice and precedent in Manitoba, extensive relevant professional experience, limited academic research and personal communications with provincial regulators.

2. PURPOSE

This Visual Impact Management Plan and Visual Impact Assessment (VIMPVIA) is one of several foundation-support documents underpinning the Site Rehabilitation Plan (SRP) and the

Site End-Use Plan (SEUP) that Broda will: (i) develop through dialogue with the RM and Manitoba Mines Branch (MMB), (ii) file for formal approval by the MMB, and (iii) use to support negotiation of a Development Agreement with the RM. The Plan will demonstrate satisfaction of previous corporate commitments to prevent or mitigate off-site visual impacts made to: (i) the CAC, (ii) participants at several public Open Houses and RM of Rosser public hearings about the proposed project, and (iii) directly and personally to several neighbour landowners adjoining the Broda property (there are only 3 homes within ~0.8 km of the planned quarry boundary). It embodies the "state of the art" in progressive management of a quarry during its operational phase and to guide the planning for transition to an end use(s) desired by a reactivated Citizens Advisory Committee and the site's neighbours and the elected officials of the RM. Its submission is to demonstrate Broda's partial completion to date, and intention to complete, all portions of Bylaw 8-15 applicable to Broda's proposed high-quality aggregate quarry in the RM of Rosser. Its development and execution is also to demonstrate satisfaction of the requirements set out in or under The Special Planning Area Regulation 49/2016 and the *Inland Port SPA Planning Regulation No. 48/2016* that, taken together, allow a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") on the CentrePort land base.

The Visual Impact Assessment component of this VIMPVIA draws from Broda's prior examinations of this subject. These occurred in prior public-review processes administered under *The Planning Act*. The most recent filing of information assessing the potential for the proposed project to create impacts on the visual environment occurred in 2010 (Tetr*ES* Consultants Inc. 2010). This filing supported a Condition Use Approval application by Broda Properties to the RM of Rosser and the South Interlake Planning District. It built upon similar work to support a similar application (Tetr*ES* Consultants Inc. 2010).

The impact-prevention and/or –mitigation components considered in this assessment embody the 'state of the art' in proactive management of a modern, well-capitalized and –operated quarry during its operational phase. They are intended to help develop and maintain strong positive relations with the site's neighbours.

With further respect to requirements of Bylaw 8-15, this Plan has been prepared and adopted by Broda Properties to satisfy the Rosser Secondary Plan, another requirement of the Bylaw.Its development and submission is also to demonstrate satisfaction of the requirements intended to prevent creation of off-site nuisances set out in or under The Special Planning Area Regulation 49/2016 and the *Inland Port SPA Planning Regulation No. 48/2016*.

3. COLLABORATION

The development of the Assessments and Plans noted in section 1.4.1 above to satisfy specific requirements of the Aggregate Bylaw (including this VIMPVIA) has benefitted from guidance, suggestions and thoughtful commentary received from many provincial staff having responsibilities in jurisdictions that areas of Rosser's Bylaw 8-15 duplicates. These Departments or Branches include those noted below. The text below also sets out some of the issues, concerns or planning requirements in their jurisdiction that Broda's Assessment and Plans address:

- Community and Regional Planning Branch (satisfaction of requirements for buffer zones to create setback distances from homes; requirements for visual screening (especially through use of native plant materials*);*
- Manitoba Infrastructure's (MI's, formerly MIT's) possible need for improvements at intersection of selected access/egress road at Route 90 (and possible requirement for a 'permit'); selection of and possible improvements to

access/egress road to Metro Route 90 (possible need to meet RTAC standards) (c.f. MLi3 2019b)
- Sustainable Development (guidance from Sustainable Innovations Development Fund)
- Manitoba Naturalists Society
- Wildlife Habitat Canada
- World Wild Life Fund Canada (guidance from Prairie Conservation Action Plan)

In addition to the relevant and helpful guidance received through dialogue with officials from several of the afore-mentioned agencies, this document benefitted greatly from guidance and consultations with staff in Minerals Resources Branch, and from personnel engaged in some of the best examples of quarry redevelopment in the world.

In addition to collaboration with regulatory and other government departments, Broda will maintain a collaborative approach with its neighbours. Broda intends to reactivate and maintain collaborative dialogue with a Citizens Advisory Committee (CAC) that Broda created in 2005. Broda supported several meetings with the CAC through 2006 to explore its needs for information and input to project planning until Committee members saw no further value in participation (after the project was rejected by Rosser Council) in 2010. New participants in the Committee will be sought to augment the core of members willing to maintain their participation from the earlier years. Management of site visual-impact potential will be a priority for attention in the dialogue process. So too will dialogue with the neighbours about using site layout, equipment, berming, native plant materials and building shapes, orientations, sizes and exterior materials to preclude off-site visual nuisance. These measures collectively will greatly militate against off-site visual nuisance to the site's three neighbours within ~850 metres. The previous corporate mechanisms for public accountability will be strengthened with

new digital techniques. These will provide for public input to and surveillance of quarry operations, and new techniques (e.g. interactive website) for public and regulatory accountability.

4. PERFORMANCE OBJECTIVES

The text below sets out qualitative performance objectives and, where applicable and possible, measurable performance metrics established by Broda, to satisfy the relevant requirements of the various regulatory and planning regimes and jurisdictions in developing this Visual Impact Management Plan and Visual Impact Assessment. These objectives can be used by any party to determine whether the VIMP component of the VIMPVIA is working, and having the desired effect(s).

4.1 Visual Impact Assessment

The performance goals and objectives of this assessment are consistent with the state of the art of impact assessment and impact prevention/mitigation (e.g. CEAA 2016, Beanlands and Duinker 1983, Sadler 1995). They are:

- Complete a credible evidence-based assessment of the potential for the proposed project to impact the ambient visual environment sufficient to impact the comfort of the site neighbours, especially the two closest to the site.
- Use credible methods best able to support a thorough and credible assessment of the potential for impacts to be created.
- Consider the state-of-the-art in prevention, minimization and mitigation in evaluating the potential for significant post-mitigation visual impacts.

4.2 Visual-Impact Management

Broda's quarrying operations must conform with corporate and regulatory visual-impact-prevention objectives in several ways, by:

- Prevention
- Minimization
- Mitigation.

The key elements of Broda's plan to prevent, minimize or mitigate visual impacts are embedded in; (i) the conceptual site layout, which will be further refined through dialogue with MI, MMB and the CAC, (ii) Broda's Standard Operating Procedures (which are generic), and (iii) the confidential site Conceptual Operating Plan (which when fully refined will be site-specific).

During operations (and after they cease), Broda has publicly committed to voluntarily satisfy the intent of relevant sections of the MMB regulations which seek to prevent off-site visual impact. One key element of the operations is satisfaction of a portion of the *Quarry Minerals Regulations,* which states in Part V, s.38, that:

"(1) Every operator of a quarry shall stockpile on the parcel of land or within the area of the quarry mineral disposition, all topsoil and overburden stripped in the process of excavating the quarry."

Clean non-marketable materials recovered during the initial site preparation, especially from the removal of the underlying bedrock, will be saved to create valuable site berming. It will also be used to create several strategically located earthen berms to provide significant visual screening from specific sightlines off site, and an elevated surface for planting fast-growing trees and shrubs. Together, these measures will make site operations effectively invisible to neighbours after initial vegetation growth.

A key element of the draft Conceptual Operating Plan (Appendix A) and related SOPs (in preparation) is the use of a small, progressively-moving 'open face' of the pit as the quarry operation progresses across the site in the form of an excavation channel, created by a "Continuous Surface Miner" (Appendix B). This means that the working surface of the base of the trench will typically be about 5-8m into the rock. The combination of a working surface well below grade (with most of the operational equipment below ground elevation) and the elevated top surface of the earthen berms, means that most operating equipment will not be visible to the neighbours. Further, the vegetation screening Broda has advised it will create will further create separation between site features, operations, buildings and site neighbours. Consistent with Best Practice elsewhere, Broda may accept clean fill from pre-approved off-site sources (e.g. from City of Winnipeg) to accelerate berm creation. Such acceleration to elaborate the vegetated-berm system will occur if the visual-impact mitigation program requires stimulus to satisfy off-site neighbours.

Consistent with an early commitment to the then-active CAC, Broda still intends to return the site to agricultural, recreational or other use. This would be consistent with the CentrePort planning regime (e.g. *The Inland Port SPA Planning Regulation* MR 48/2016). Broda advises that it will seek concurrence with the proposed final land use by the RM before finalizing its SEUP and SRP. A key element of this commitment is selection of the vegetation to be used for visual screening. Vegetation choices will emphasize native plant species, especially fast-growing trees (e.g. hybrid poplar), and water-transpiring shrubs (e.g. diamond willow). These species are common at the margins of agricultural lands in the region (Manitoba Forestry n.d.). Although local farmers use 'lure crops' to attract waterfowl to their lands to support local hunting (c.f. RM Rosser Website

[www.rmofrosser.com]), Broda will not use such species because the adjacent airport seeks to avoid bird attractants.

The performance objectives and /or metrics are:

- Developing and securing MMB endorsement of a conceptual SEUP and SRP (that include commitments to visual-impact prevention) submitted to MMB after receiving approval of the requested zoning change. This would satisfy the intent of Clause 188(1) of the *Mines and Minerals Act.*
- Stockpiling and using site-sourced non-marketable materials, and clean, pre-approved off-site soils, for constructing sound-absorbing berms planted with fast-growing native vegetation well suited to creates seasonal and annual visual screening (c.f. MLi3 2019 b,d).
- Adapting, creating and implementing SOPs and a site-specific Operating Plan requiring excavation of a progressively moving 'open face' of the pit as the quarry operation progresses across the site, with the Surface Miner (Appendix B), loaders and excavators operating at the trench invert (bottom elevation) to preclude visibility by neighbours.
- Returning the site to agricultural, recreational or other use, consistent with the CentrePort planning regime and/or the proposed final land use desired by the RM, to maximize the visual consistency of the site with the ambient environment.
- Satisfying concerns and responding effectively to CAC suggestions for operational improvements.

5. WORK DONE TO DATE

5.1 Conceptual Operating Plan

The current Conceptual Operating Plan (WSP 2019; confidential, in prep.) must be further refined through collaboration with MI,

MMB and the CAC. This refinement process is now underway. Appendix A contains some information from this draft Plan.

The Conceptual Operating plan sets out the current intended layout and expected quarry operations for the five development stages (Appendix A). For purposes of this VIMPVIA, the content of the confidential current Conceptual Operating Plan is considered to be the "Project Description" being evaluated in the VIA.

The operation will eventually consist of: (i) an evolving subsurface (small-scale, open-pit) type of quarry, (ii) site-perimeter berming and landscaping to create a visual screen of native species adapted to the agricultural landscape of the region, (iii) an office facility, (iv) a scale and scale house, (v) a larger structure (obscured by visual screening) for large-vehicle maintenance and repairs, (vi) a small workshop for small-equipment repairs, (vii) protection of existing woodlots and shelterbelts, and (ix) a parking area. The latter will be located at a screened distance north of Mollard Road.

The entire operation will be set back from Mollard Road. This will minimize visibility of the site and its operations. Significant potential visual impacts should be prevented, minimized or mitigated by an effective combination of:

- the low population density (only three homes within ~850 m, and only about a dozen within as far as 3 km; c.f. Figure 5-1);
- existence of remnant river-bottom forest woodlots and mature residential shelterbelts blocking views of most of the sightlines to the nominal location of the quarry (Figure 5-2);
- situation of the Surface Miner and most large equipment and some material stockpiles below-grade, and;
- Broda's commitment to develop an integrated visual-screening system of strategically-placed vegetated berms across the few remaining viewscapes of the quarry location.

Figure 5-1. Distribution of the few occupied dwellings near the initial development stages of proposed quarry. Sources: Google Earth, TetrES Consultants Inc., MLi3 Inc.

The site will be largely surrounded by perimeter earthen berms. This will reduce off-site views of buildings or equipment. Stockpiles will be screened by additional strategically placed and higher berms, or stockpiling below grade, to minimize visibility of these operations from off-site (and to maximize absorption of nuisance sound; c.f. MLi3 2019c). Berms will be landscaped with rows of native tree species like hybrid poplars (female cultivars, to prevent release of nuisance 'cotton') and water-transpiring trees and shrubs (e.g. and operations will not likely ever be seen after about the first 3 summers (based on published growth-rate data for these species; e.g. willow).

Broda will plant fast-growing species on the strategic-screening berms such that summer visibility of most site buildings will be minimal after establishment of the plantings. Slower-growing coniferous tree species will also be planted in proximity to the faster growing deciduous trees and shrubs (c.f. Manitoba Forestry n.d.; University of Minnesota n.d.)., for protection from the elements and to promote increased survival and growth. Techniques will be identical to those used for planting rural home and farm shelterbelts (PFRA 2015), especially those immediately nearby (Photos 1a, 1b). The intended species composition is intended to develop visual screening complexity, especially at the location of berms strategically placed to block the very few sightlines of the initial quarry stages now available to the few adjoining landowners (Figure 5-2).

Photo 1a. Local rural shelterbelts typically use outer ranks of relatively faster-growing native deciduous trees (e.g. trembling aspen) protecting inner rows of slower-growing coniferous trees (e.g. Englemann, white or black spruce); see Photo 1b. Shelterbelts are typically associated with remnant woodlots of river-bottom forest (oak, ash, aspen, black poplar), as shown here on Broda's property. Sources: Google Earth, MLi3 Inc.


Photo 1b. Typical local shelterbelt of deciduous trees (e.g. aspen) protecting conifers (e.g. spruce), near intersection of Mollard Road and Brookside Blvd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Photo 1a. Local rural shelterbelts typically use outer ranks of relatively faster-growing native deciduous trees (e.g. trembling aspen) protecting inner rows of slower-growing coniferous trees (e.g. Englemann, white or black spruce); see Photo 1b. Shelterbelts are typically associated with remnant woodlots of river-bottom forest (oak, ash, aspen, black poplar), as shown here on Broda's property. Sources: Google Earth, MLi3 Inc.

Photo 1b. Typical local shelterbelt of deciduous trees (e.g. aspen) protecting conifers (e.g. spruce), near intersection of Mollard Road and Brookside Blvd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

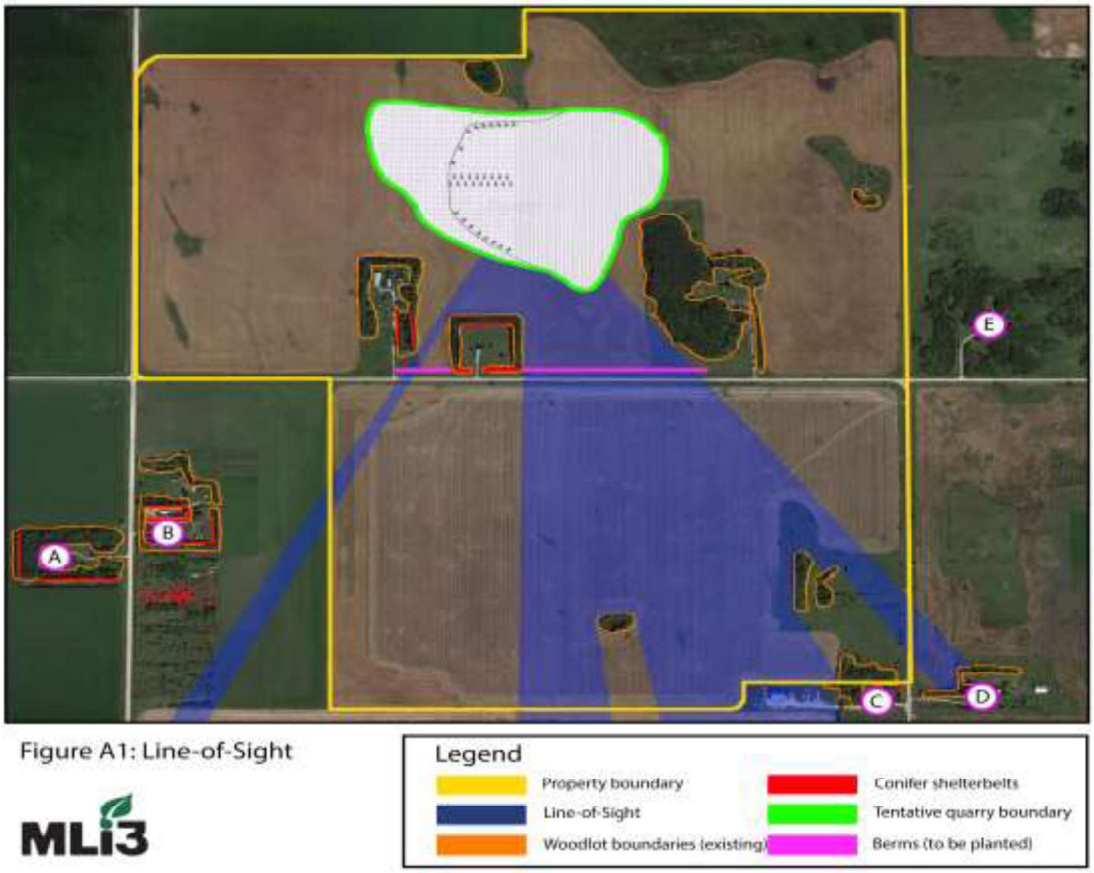


Figure 5-2. Sightlines for the few adjoining land owners are from south of Mollard Rd. Will be blocked by new berms planted with fast-growing hybrid trees. Source: MLi3 Inc.

Broda intends to use a Continuous Surface Miner (Appendix B) ~80% of the time, and judicious blasting techniques up to 20% of the time (where rock is excessively hard), to loosen rock as efficiently as possible. Blasting will be as advised by MMB. Use of the Surface Miner will exceed the best current practices in the Manitoba quarrying industry. Broda plans to quarry the limestone using a progressive-trenching excavation (Figure 5-3).

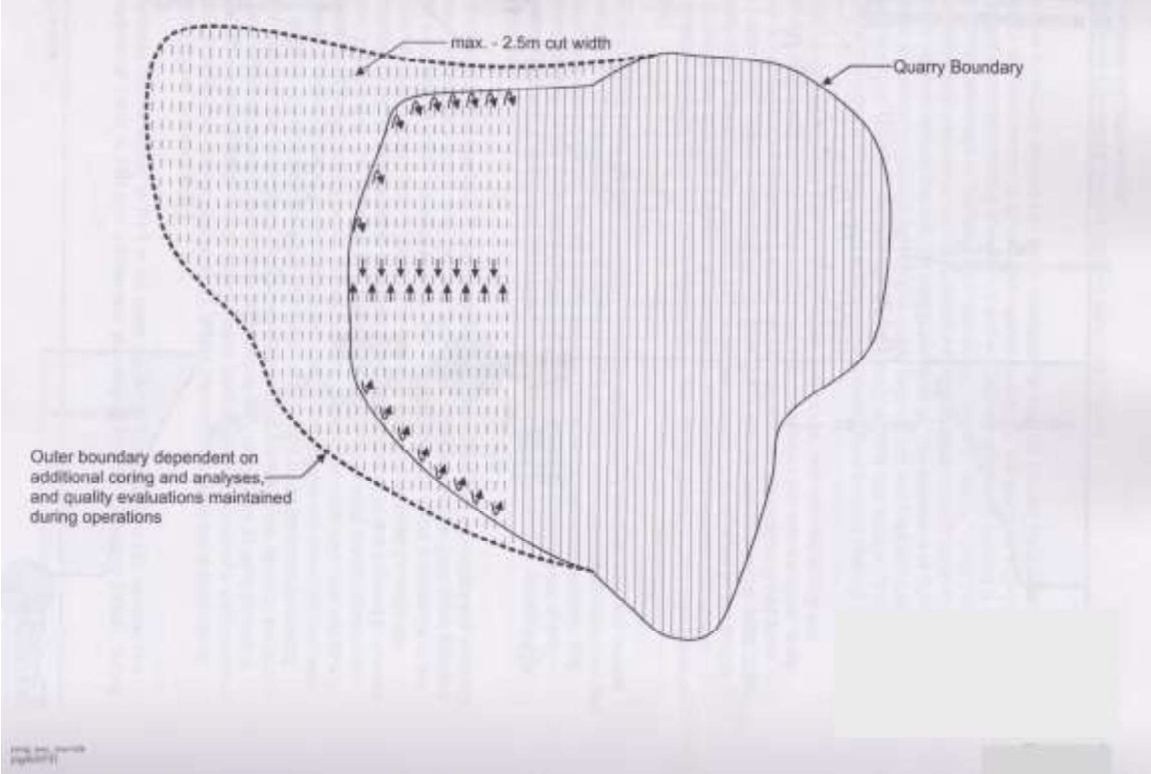


Figure 5-3. Initial quarry-development stages will address variable elevations and thicknesses of limestone-ore body using progressive-trenching excavation method. Final shape of complete excavation is nominal and will depend on field conditions. Sources: Google Earth, KGS Group 2010, TetrES Consultants Inc. 2010

This technique will excavate loose rock down to its nominal design depth of ~5-8 m (Figure 5-4) so it can be crushed and conveyed to subsurface and surface stockpiles until sale and delivery off-site. Final depth of excavation will depend on future varying combinations of excavation conditions, groundwater elevations and markets for the various types of construction materials that can be created from the crushing operation.

As previously noted, the Surface Miner and most heavy operating equipment will be placed or will operate at the base of the excavation (Figure 5-4). This places the major operating equipment well below the sightlines of neighbouring homes.

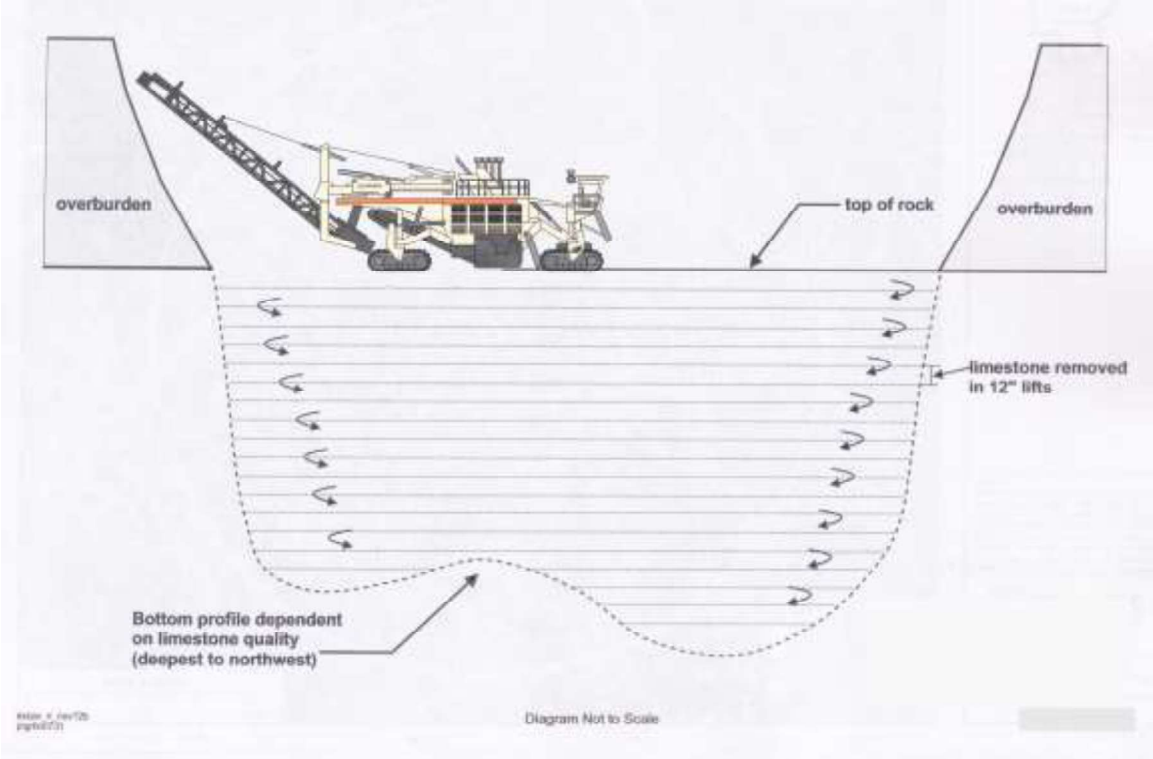


Figure 5-4. Excavators and conveyors delivering aggregate to surface will be well below sightlines of adjoining properties. Final depth is nominal and uncertain; will depend on field conditions. Sources: Google Earth, KGS Group 2010, TetrES Consultants Inc. 2010

As noted, the limestone would be quarried from an evolving, slowly moving and reconfiguring single pit, developed progressively as a moving-trench excavation (Figure 5-3) ~5-8 m into the rock, travelling sequentially back-and-forth across the property over the years (see Section 4.2.2 herein). Broda intends that overburden from above portions being quarried will be used to sequentially backfill areas behind the moving face. Thus, ongoing daily excavation operations will also, *de facto*, serve as execution of key elements of Broda's Adaptive Management and Progressive Rehabilitation Plan (AMPRP; MLi3 20127a).

The quarry is intended to operate from April to November. Broda advises that the production goal is 5,000 to 6,000 tonnes/day of limestone, achieved during a Monday to Friday work week, 7 a.m.

until 6 p.m. (Saturdays 9 a.m. until noon). Broda estimates 15 to 20 seasonal workers will be hired during the operation phase, for a period up to a nominal 20+ years. When the "Stage 4 and 5" lands (south of Mollard Rd.) are developed, staff size could increase.

Stockpiled limestone products will be hauled by trucks to clients who need the aggregate. Broda expects 150 - 200 trucks/day at peak production, and 50 - 75 trucks/day when aggregate demand is low. Proximity of the quarry to the Winnipeg Capital Region means that haul costs will be substantially reduced over trucking from Stony Mountain and Stonewall, as will GHG emissions from haulage.

During consultations on February 3, 2010 with Manitoba Infrastructure and Transportation, MIT advised that it would not allow direct access to the Perimeter Highway (No. 101) by quarry vehicles, notwithstanding Broda's request for such access to reduce the visual impact of haulage past the one resident close to the site on Mollard Road. Consistent with this dialogue, and the preference received December 18, 2017 from MI (see Broda's Transportation Plan; MLi3 2019 c), access to the site is therefore still planned to be westerly along a ~1-mile section of Mollard Road to Brookside Boulevard (Photo 2); c.f. MLi3 2019c).

Photo 2. Recently upgraded intersection of Mollard Road and Brookside Blvd, looking north from Mollard. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Broda will enforce proper site access and egress. It will also ensure no chronic local road-dust nuisance is created by truck traffic. It plans to pave and maintain the short portion of Mollard Road (Photo 2) between its site and Brookside Blvd., and to integrate that upgraded road section with the recently upgraded intersection with Brookside Blvd. (Photo 3; c.f. MLi3 2019c). Other improvements to this intersection may be necessary, depending on the results of a Traffic Study which has recently been completed (c.f. MLi3 2019c) which will be filed with MI for its review.

Photo 3. West-facing view of Mollard Road taken from east side of upgraded intersection with Brookside Blvd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Broda also intends to maintain this upgraded access route (e.g. thereby removing these costs from the RM's annual budget). In response to complaints, Broda has committed to check and take immediate corrective action (TetrES Consultants 2010).

The quarry is being planned to satisfy regulatory requirements and be subject to public regulatory agency reviews. Quarry operations will be the subject of a benefits-sharing Agreement "Development Agreement" including impact-mitigation measures that Broda will negotiate with the RM of Rosser. Relevant work authorized by Broda and completed to date to develop the VIMPVIA includes:

- Review of records for CAC meetings from 2005 -2006 for issues it expressed, to guide data-gathering and impact-prevention activities, including development of the WSP Conceptual Operating Plan (WSP 2019, in prep.).
- Examination of the current state of botanical and topographic visual screening of the site along sightlines from adjoining homes and properties north of the Perimeter Highway in relation to: (i) viewscape barriers created by topographical variation along surface profiles between homes and properties close to the property and the quarry centroid (c.f. Figure 5-5); (ii) the types, spatial distribution, height, planting density and apparent condition of existing native species in remnant river-bottom forest woodlots on site, and of remnant shelterbelt species around the existing buildings on the property (c.f. Figure 5-4; Photos 4, 5, 6 and 7).

Photo 4. Typical remnant shelterbelt on site and remnant native aspen wood near intersection of Mollard Rd. and the half-mile section line before Road 9E (Sturgeon Rd.) at west edge of Broda land. Photo taken Oct 28, 2017. Source: MLi3 Inc.

-  Photo 5. Typical remnant shelterbelt on site and remnant native aspen wood located near intersection of Mollard Road and Klimpke Road, at eastern edge of Broda property. Photo taken Oct 28, 2017. Source: MLi3 Inc.

- Documentation of key potential viewscapes in the site vicinity that could be 'visually intrusive' or 'visual nuisance' for adjacent homeowners (e.g. Photo 8, Photo 9).

- Examination of the northerly surface-elevation profiles plotted to establish relative elevation differences between vantage points at homes or businesses north of the Perimeter Highway and the nominal quarry edge, prior to development, to define initial sightline-impact potential before construction of new strategically-placed vegetated berms to block these northern sightlines.

This analysis was also important within the VIA for its abilities to:

- Ensure setback prescriptions in the MMB QMR would be met if the quarry were excavated at the centroid of the first three quarry stages, and
- Assess whether there would be high potential for "significant" post-mitigation impacts of nuisance views for adjoining landowners 2-3 summers after the new vegetated berms had been placed and planted to block the few northern sightlines (Figures 5-6 to 5-10);

Figure 5C: Shelterbelt Location C - Mollard Road

Photo 6. Typical remnant native aspen wood located near intersection of Mollard Road and Klimpke Road, at eastern edge of Broda property, north of Mollard Rd. Source: Google Earth 3D.

Figure 5E: Shelterbelt Location E - Klimpke Road

Photo 7. Typical two-species (deciduous, coniferous), single-ranked shelterbelt located on Klimpke Rd., at eastern edge of property, north of Mollard Rd. Source: Google Earth 3D.

-  Photo 8. Typical local view of accumulated farm equipment and non-functioning vehicles and a trailer placed in long-term highly visible locations close to municipal road allowance and sightlines from the few adjacent homes. Located near eastern edge of Broda property. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Photo 9. Typical local view of non-functioning vehicles, industrial equipment (plow blade) and unused trailer in highly visible locations close to municipal road allowance and sightlines. Located near eastern edge of Broda property. Photo taken Oct 28, 2017. Source: MLi3 Inc.

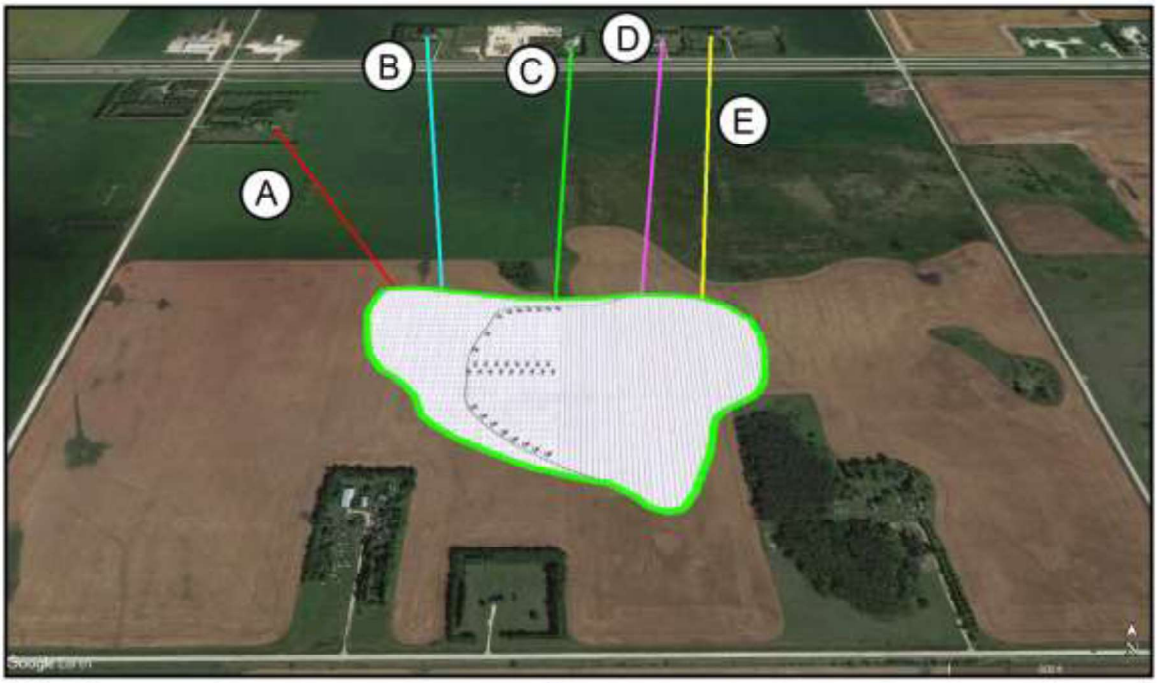


Figure 5-5. Distribution of surface-elevation profiles from northerly properties to the nearest (nominal) edge of the early-stages quarry north of Mollard Rd. Sources: Google Earth 3D, MLi3 Inc.

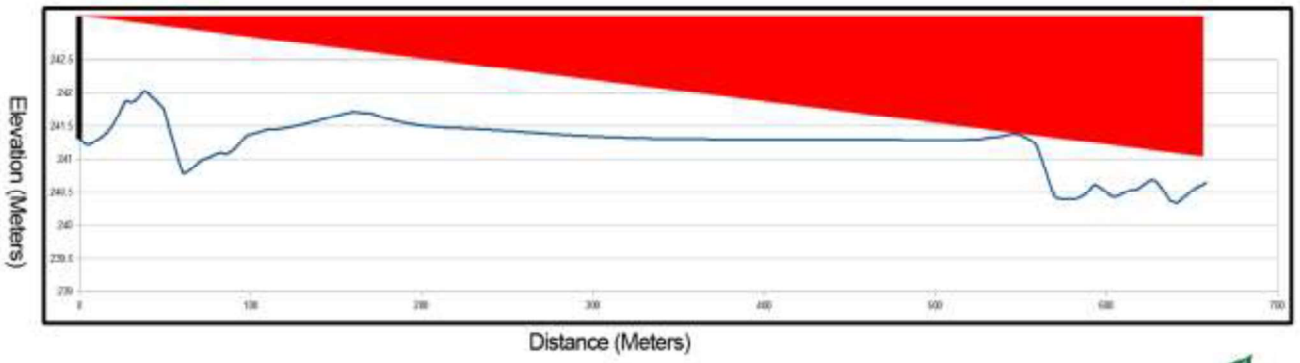


Figure 3A: Vantage Point over Path A,
Assuming a Person 6 ft Tall

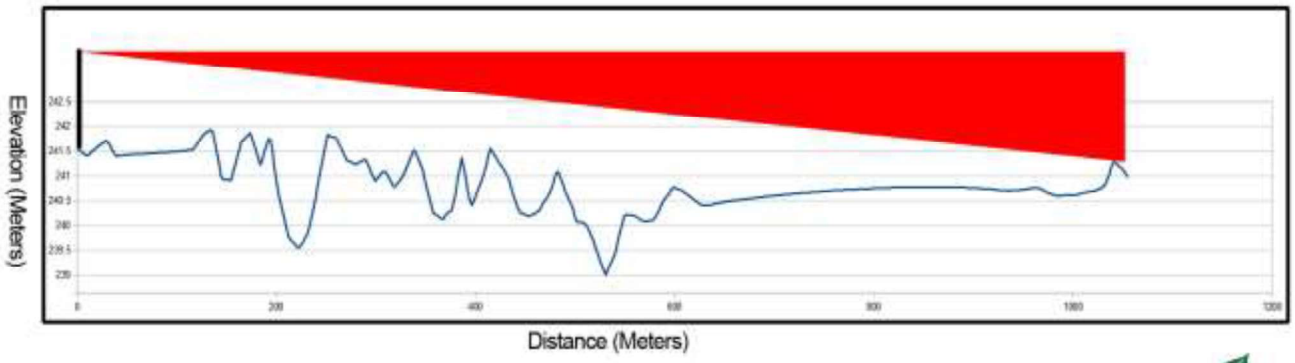


Figure 3B: Vantage Point over Path B,
Assuming a Person 6 ft Tall

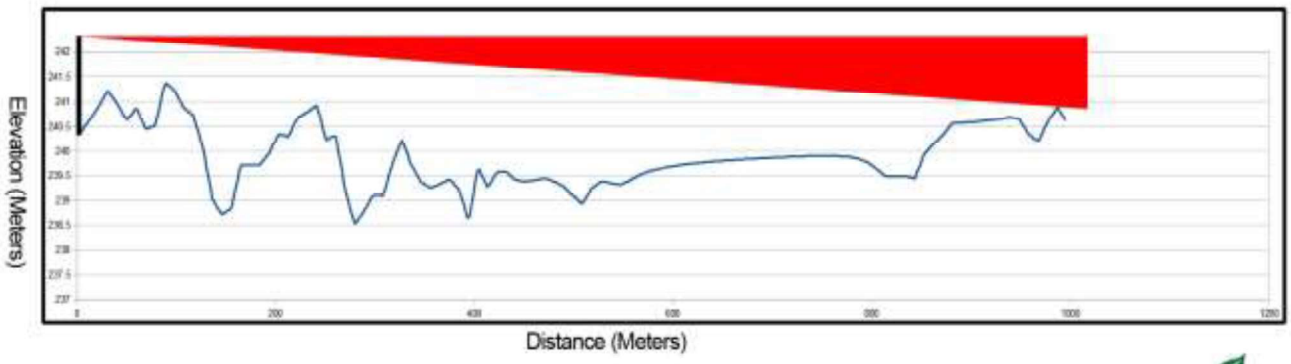


Figure 3C: Vantage Point over Path C,
Assuming a Person 6 ft Tall

Figure 5-6, 5-7, 5-8. Surface profiles from northerly properties to nearest (nominal) edge of the early-stages quarry north of Mollard Rd., establishing pre-development sightlines along viewscapes from north of Perimeter Highway. Sources: Google Earth 3D, MLi3 Inc.

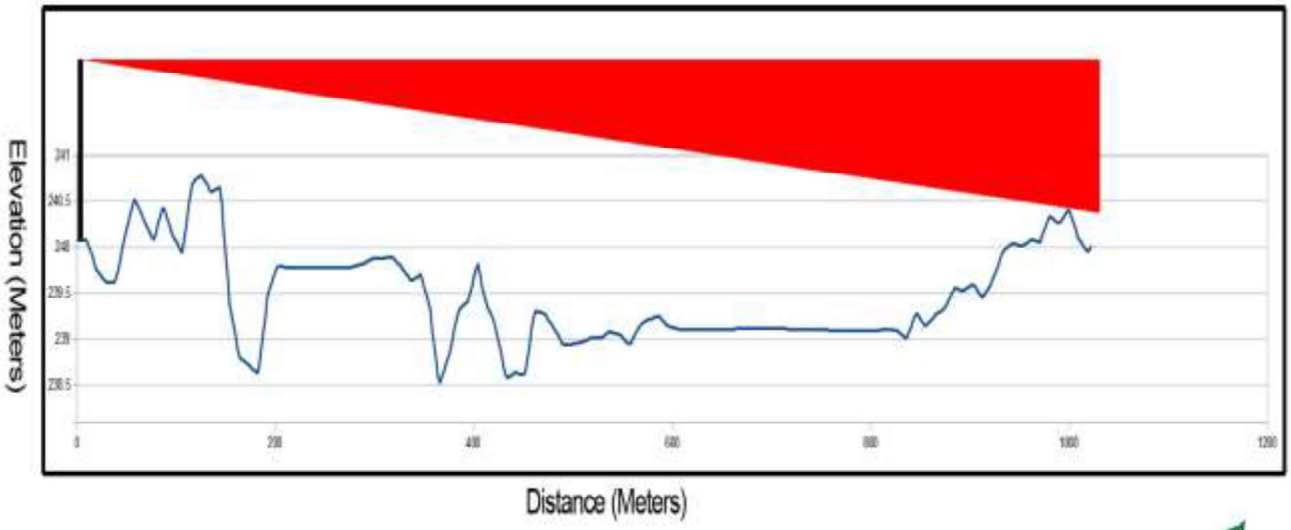


Figure 3D: Vantage Point over Path D, Assuming a Person 6 ft Tall

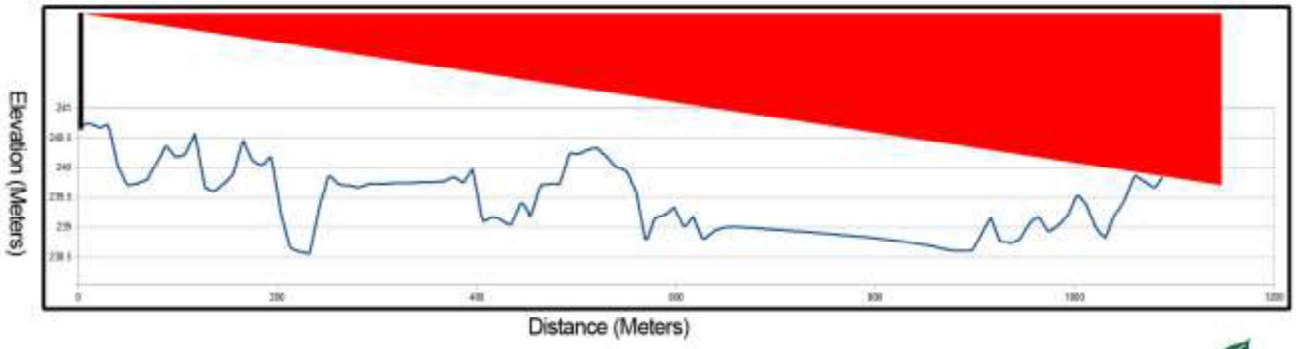


Figure 3E: Vantage Point over Path E, Assuming a Person 6 ft Tall

Figures 5-9, 5-10. Surface profiles from northerly properties to nearest (nominal) edge of the early-stages quarry north of Mollard Rd., establishing pre-development sightlines along viewscapes from north of Perimeter Highway. Sources: Google Earth 3D, MLi3 Inc.

- Completion of new site groundwater-level surveys to better understand seasonal, annual and decadal groundwater dynamics. This has helped planning of site layout, operations and infrastructure placement (including visual screening earthen berms and rows of native trees and shrubs), and

options thereto, in case adaptation of site planning is needed, especially if in response to unexpected site conditions or events (e.g. sustained rise in regional groundwater table).

- Limited examination of visual-screening measures employed by other licensed and regulated quarries across Manitoba and Ontario (especially by Lafarge) for insights helpful to site-layout planning, vegetation-selection and planting planning, and operations planning for prevention of visual impacts.
- Completion of a comprehensive assessment of the site's aggregate resource in 2015 (because of such requirements for sites designated as being of 'high' quality). The masses and types of non-marketable material that can be used as clean fill for initial site berming, and to support other elements of site landscaping (e.g. Photo 10) are now much better known (Stantec Consulting 2015). In so doing, this action satisfies Rosser Secondary Plan aggregate policy number 7.2.1.

Photo 10. Lithic materials assessed qualitatively and quantitatively in recent assessment of geological resource. Located on Broda land north of Mollard Rd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

5.2 Determination of Site-Vegetation Supplier-Contractors

Relevant work to date includes the following:

- Initial dialogue with experienced suppliers in both Manitoba (Prairie Habitat Inc.) and Saskatchewan (HELP International)

of native plant materials, custom native seed harvesters, and special application methods for using native plant materials for visual screening and preventing off-site visual nuisance.

- Development of a conceptual botanical visual-screening concept with these experienced suppliers built around their recommendations for; (i) ongoing progressive rehabilitation of the site during site operations, (ii) choice of material-stockpiling areas, (iii) choice and placement of native trees, grasses, forbs and shrubs and (iv) preservation of wildlife habitats in remnant native species assemblages on the site.
- Sharing of the draft conceptual site-screening planting scheme with one of the candidate service providers for native planting and seed sources, so cost and scheduling estimates could be developed for Broda, contributing to development of the Conceptual Workplan and Conceptual Site Layout.

6. ADDITIONAL WORK TO BE DONE

While Broda has completed much preparatory work, more work remains to be done. Broda wants this work completed as soon as possible. The additional work includes such important tasks as:

- Reactivation of the former CAC, solicitation of new participants, updating of previous public and regulatory accountability procedures, and creation of new citizen-directed environmental monitoring and public-accountability tools (e.g. interactive website).
- Establishment of a more baseline information on the pre-development ambient visual environment. These additional data, photographs (e.g. Photos 1-10) and computer graphics can further support planning for berm placement, berm-planting campaigns, habitat protection, and other actions designed to minimize visual impacts of the site.
- Negotiation with (and pre-approval of) off-site sources (e.g. City of Winnipeg contractors) for occasional supplies of

clean fill from off-site sources to support enhanced site berming, per the prescriptions in the evolving Conceptual Operating Plan, SRP and SEUP.

- Use of new resource-inventory data detailing the masses and types of non-marketable material that can be stockpiled and used as (i) clean fill for berming, versus for (ii) trench backfilling and future progressive site rehabilitation.
- Development, tendering and award of contract for sourcing of native plant materials, custom native seed-harvesting services, and use of special application methods as the site is systematically and progressively rehabilitated.
- Finalization of the current draft Conceptual Operating Plan.
- Guided by the parameters of the final Operating Plan, development of a design approach to re-purposing of existing buildings on the site (e.g. Photo 11) including, possible relocation, to maintain the current agricultural and/or rural residential visual character of the site and area

Photo 11. Existing rural residential dwelling located on Broda land north of Mollard Rd. eligible for re-design and repurposing (e.g. Office/Scale house). Photo taken Oct 28, 2017. Source: MLi3 Inc.

7. MONITORING TO ASSESS PERFORMANCE

A key element of Broda's site-specific Preliminary Environmental Monitoring Plan (MLi3 2019f; confidential, in prep.) is monitoring to determine the effectiveness of site operations and other

management in meeting the requirements set out in the approved SRP and SEUP. An additional purpose is to support on-going adaptive management of the site. Routine and periodic monitoring will be of several types and frequencies, tracking a wide variety of parameters to support Broda's ability to evolve the various Plans, if needed. Monitoring will include tracking complaints about visual nuisance reported by neighbours close to the site. Another parameter will be survival and relative health of native deciduous (i.e. seasonal leaf-dropping) tree and shrub species planted to create visual landscaping and screening.

Some typical expected monitoring parameters will be:

- Periodic documented dialogue with (and accountability to) site neighbours who do not or cannot participate in the CAC to determine whether their needs for respectful, adaptive site-management are being met (e.g. whether the growing visual screening is considered too sparse, or not sufficiently lengthy between the site and the adjacent property(s).
- Documented tracking of survival, species composition, growth rate and vigour of native plant materials used in progressive site screening (both photographically and mathematically), to determine whether impact-mitigating effects are occurring as intended.
- Documented tracking of the import and use of non-marketable site material and off-site clean fill used for the progressive site rehabilitation required by the SEUP and SRP, to develop the earthen-berm perimeter (and several strategic visual earth-berm barriers) of the site as fast as possible, especially between the nearest neighbours east and southeast of the site, to support progressive visual screen planting with native trees and shrubs.
- Documented tracking of the growth, development and aesthetic appeal of the slower-growing coniferous native species visual-screening plantings and landscape elements developed on the site over time.

- Tracking time-series trends in the accumulating data from the multidisciplinary Preliminary Environmental Monitoring Plan (c.f. MLi3 2019f; confidential, in prep.), especially the botanical component, and disclosure of trends to the CAC and regulators, to facilitate evaluation of whether corporate commitments to impact prevention are successful.
- Documented, disclosed responses to visual nuisance complaints (and the extent of complainants' acceptance of the mitigation measures committed to or provided).

8. PLAN CONSISTENCY WITH "BEST PRACTICE"

This Plan has been developed mindful of the highest standards of relevant environmental and neighbour sensitivity in the world. This Plan sets out an extremely high standard of care, and corporate commitment to the Best Practices possible for this site.

This is the most effective plan that could be developed for this site and operations utilizing environmentally Best Available Technology Economically Achievable (BATEA). The concept dates to the early 1970s, with the rise of environmental protection statutes and regulations, especially in the US (e.g. 1972 *Water Pollution Control Act [Public Law 92-500], also known as the "Clean Water Act"):*

> *".. industry shall use* ***the best treatment technically and economically achievable*** *for a category or class of point sources. Under this concept, pollution control will consider such factors as the age of the facilities and equipment involved, processes employed, engineering aspects of the control techniques, process changes, cost of the reductions, and environmental impacts other than water quality, including energy requirements"* (emphasis added)
> (US EPA 2008. See also Wikipedia):

This plan represents Broda's best efforts at defining BATEA for this site-specific project. Certainly, the planned site visual-screening methods should be equal to, more likely superior to site visual screening of all regional aggregate operations and most industries and farms in the region. Over time, the developing visual screening should increase property value, enhancing and motivating implementation of the SEUP, incentivizing Broda's ongoing planting and vegetation-care activities on site each year.

9. PLAN EVOLUTION

The Visual Impact Management Plan of this VIMPVIA will evolve. Broda's Resource Verification Study (Stantec 2015) provided data helpful for development of a site Operating Plan maximizing capture of the usefulness of all the construction materials available on the site. It has helped Broda to understand better the expected operation lifespan of the proposed operation, and the mass of non-commercial materials available for use in constructing site berming for visual screening. Ongoing monitoring will provide data indicating the need, from time to time, to adapt Visual Impact Management Plan (and, possibly, the final Operating Plan) to better meet the intentions of Bylaw 8-15, the SEUP or the SRP or another regulatory requirement. One goal will be to seek opportunity to increase the import and use of off-site clean fill to develop the perimeter earthen-berm (and several specific, strategic visual earth-berm) barrier(s) of the site as fast as possible, especially between the nearest neighbour to the east on Mollard Rd. (Figure 5-1)

Data from visual-impact complaints monitoring will help Broda to evolve the Visual Impact Management Plan. This evolution will be consistent with the concepts embodied in Broda's Adaptive Management and Progressive Rehabilitation Plan (MLi3 2019a). Such evolution will seek more (or better) ways of creating visual

screening for neighbours complaining of site-operations visual impacts, once the earthen berms and initial site screening plantings are in place. Assuming reasonable growth of these native species, and the intended ongoing planted berm-system elaboration, this should reduce or preclude ongoing persistent nuisance to the three adjoining landowners after the second (or third) growing season.

Advice from the site's neighbours and the CAC will undoubtedly be heard and will influence evolution of the Visual Impact Management Plan. Thus, the plan approved by the RM and the MMB will evolve through ongoing dialogue with the parties.

10. VISUAL IMPACT ASSESSMENT

10.1 Impact Assessment Concept and Approach

In terms of satisfying the Rosser Aggregate Bylaw, this chapter provides the required Visual Impact Assessment (VIA). It does so within this Visual Impact Management Plan and Visual Impact Assessment (VIMPVIA) because the two subjects are so closely inter-related. More importantly, it does so because impact assessments are conducted by considering the effects of proposed impact-prevention and -management measures for militating against creation of significant residual impacts:

> *"Residual effects include…those beneficial or adverse effects that may remain at each stage of the Undertaking after proposed mitigation or enhancement measures are implemented…"* (CEAA 2016).

This Visual Impact Assessment is predicated upon the fundamental assumption that the foregoing chapters of this VIMPVIA that constitute a "Project Description", including all relevant planned mitigation measures, accurately describe what will occur on site as intended by Broda and as Broda has advised MLi3 Inc. (This

assumption has been confirmed by Broda Properties Inc. [Broda *pers comm.* 2018]). The VIA therefore evaluates the potential for significant off-site nuisance visual impacts after MLi3's consideration of the expected effectiveness of the impact-prevention and -mitigation measures that Broda has proposed. Consistent with Best Practice in Impact Assessment, the VIA also takes into consideration the existing ambient visual environment. Especially relevant is the current 'quality' of the ambient pre-development visual environment. Any predevelopment viewscapes that would either be like the viewscapes associated with the proposed development, or that could be argued to be existing visual "nuisance' or 'intrusion", logically militate against any conclusion about significant new visual impact or nuisance being introduced by the proposed development. This is especially the case if these arguable visual nuisances are already on the site, and have been for some time, or are near the site and have been for some time.

In preparing this VIA, MLi3 has relied on the draft Conceptual Operating Plan, the relevant reports prepared by others in respect of the proposed quarry, impact assessments completed on other proposed limestone quarries, published non-peer reviewed research reports and data, published peer-reviewed reports and data, common sense, regulatory practice and precedent in Manitoba, extensive relevant professional experience, limited academic research and personal communications with provincial regulators, and the current state of the ambient visual environment.

10.2 Assessment of Potential Significant Post-Mitigation Visual Impacts

It could, perhaps, be argued that the initial existence of the site and its operations might create modest nuisance to some sensibilities, possibly including the three nearest neighbours. This argument would be difficult to sustain in the circumstances. This is the case

because: (i) most operating equipment (other than trucks) will be located about 8-10 m below grade, and 10-15 m below the top of the earthen berms that will surround the site margins after the first year or two, especially where the boundary faces the neighour located east on Mollard Rd., (ii) site industrial equipment operating on the surface that could perhaps occasionally be seen by a neighbor(s) will be identical to heavy agricultural and industrial equipment used throughout the region, and often parked on adjacent land, including on adjacent farms (e.g. front-end loader, earth-moving equipment (e.g. grader [c.f. Photo 9], skidder, pick-up trucks, grain trucks); (iii) stockpiles possibly visible on the surface after the first two or three summers will be similar, at times identical to, stockpiles on adjoining agricultural, commercial and industrial lands (e.g. gravel, crushed rock; approximating in size and shape regional stockpiles of dirt, grain, manure, gravel, sand,, etc.); (iv) buildings will be identical in appearance to those at numerous industrial, commercial and agricultural operations throughout the region, including nearby (c.f. Photo 11), and (v) the current conceptual planning for layout and operations of the site, especially in consideration of the facts and corporate commitments noted above, ensure that the intentions of the setback prescriptions set out in the QMR will be met.

Likely most significantly contributing to the non-sustainability of this judgement about potential off-site chronic visible nuisance is the fact that the existing site is already well-protected to the west and east by vegetation growing at property margins, in remnant woodlots of river-bottom forest, in remnant and maintained shelterbelts near and around the site buildings likely to be re-purposed. Except from Mollard Road, and only directly south of the current field where the quarry will first be excavated, the future area of the quarry is not visible now to the three nearest occupied homes, nor to some of the homes and businesses north of the traffic using the Perimeter Highway, even after ‘leaf-off’ of the deciduous trees (c.f. Photos 1, 4-11, Figures 5-6 to 5-10).

Other than this highly unlikely, short-term, potentially ephemeral nuisance (not "impact"), there is no basis to conclude a likelihood of significant visual impact to the three nearest off-site neighbours except during the initial stages of site preparation and building construction. Such a highly conjectural effect could occur, moreover, only from a viewpoint immediately south of Mollard Road, where no homes are located. Accordingly, placement of short vegetated berms to create visual screening of these few sightlines (Figure 5-2) will be a high priority along the north-facing face of Mollard Road. Such visual screening will, therefore, provide impact mitigation for riders in cars driving on Mollard and looking (very briefly) immediately north of the road. Plantings will be in keeping with the existing remnant plantings and shelterbelts still existing along Mollard Road (e.g. Photos 1a, 1b, 2,4,5, 6, 12), although plantations could also occur with intention to harvest the wood product once trees reach merchantable girth and height. Such 'economic shelterbelt/woodlots', while highly regular in their layout (e.g. Photo 13) are nonetheless contributors in their own right to visual screening. Such organized plantations would likely be consistent in layout with any plantings of local fruit or ornamental trees on adjacent lands in the region.

Photo 12. Typical remnant shelterbelt on site (remnant native oak) north of Mollard Road west of Klimpke Road, east of Broda property. Photo taken Oct 28, 2017. Source: MLi3 Inc.


Photo 13. Typical geometric hybrid-poplar plantation/shelterbelt, likely after only ~ 2-3 years' initial growth. Source: Open source public domain

Thus, these highly conjectural potential nuisance views for drivers on Mollard Road would include only such common, current, ephemeral land publicly-accepted local views as: (i) delivery of all site building materials and heavy equipment (ii) site-clearing activities, (iii) building-construction activities, (iv) initial excavating activities by heavy equipment, (v) berm-construction activities, (vi) tree- and shrub-planting activities, and (vii) initial product stockpiles being developed on site.

The latter activities would likely be visible directly and very briefly by only drivers on Mollard Road and would be through the initially thin plantings of caliper-stock trees and shrubs (caliper stock meaning having stems about the size and thickness of a finger or thumb). These views would likely become less visible as the species selected for planting develop root and the above-ground biomass, and leaf canopies, proliferate. After two full summers of growth, well-maintained plantations of hybrid poplar (one of the targeted species; c.f. Photo 13) and diamond willow (another desirable species) can typically double the leaf canopies and project them as high as 2 m above ground surface (in this case,

above the surface of the earthen berms, about at least 2.5 – 4.5 m above grade).

Along with the combined effects of existing dense (and almost completely encompassing) visual screening, a deepening excavation, and progressively more operations becoming situated deeper within the developing quarry, the effects of the visual-screening activities along the south face of Mollard Road are expected to be significantly positive. Combined with an expected site layout that emphasizes separation distance from the two nearest neighbours, these measures and design features reduce the potential to post-mitigation levels that would be considered acceptable by regulators.

The planned site visual screening should be as effective as, or even superior to, site visual screening of all regional aggregate operations (and most industries and farms in the region). The developing visual screening should increase property value. This should incentivize Broda's ongoing planting and vegetation-maintenance activities each year.

Ongoing monitoring can provide (and MLi3 understands is currently planned to provide) data indicating any need to adapt the Visual Impact Management Plan (and, potentially, the final Operating Plan) from time to time to better meet the intentions of Bylaw 8-15, the SEUP or the SRP or another regulatory requirement. Further, mechanisms exist to calibrate the monitoring data against the experiences of the nearest neighbours likely to be concerned about nuisance views. Periodic documented dialogue with, and accountability to, neighbours not participants in the CAC has been committed by Broda. This should be effective in determining whether their needs for effective site management are being met (e.g. whether the growing visual screening between the site and the adjacent property(s) is too sparse, or too short).

Finally, the site's neighbours and the CAC will undoubtedly provide their views to Broda about the effectiveness of the VIMP. Broda's track record strongly suggests that this advice will be heard. It will therefore very likely influence evolution of the Visual Impact Management Plan. Thus, the impact-prevention plans approved by the RM will evolve through ongoing dialogue with the parties, including those at most interest in visual impacts.

MLi3 concludes, based on the foregoing Project Description and Broda's proposed and (publicly) committed impact-prevention- and -mitigation measures, that there will not be significant impact as judged by regulators of Manitoba Sustainable Development.

Further support for this conclusion can be seen in a decision made the former Manitoba Conservation whether to regulate the project. Upon reviewing the confidential corporate due-diligence Environmental Impact Assessment document shared with these regulators by Broda in 2010 (Tetr*ES* Consultants 2010), the Director of Environmental Approvals declined to exercise the discretion available to her under *The Environment Act* to declare the proposed quarry a regulated "development" within the meanings of the statute. The decision to decline the use of this discretion, to compel Broda's formal public submission of the confidential internal Board-briefing document, and then formal EIA review and even, possibly, discretionary public hearings, was based on the Director's conclusion that all potential impacts had been prevented or mitigated to a "not significant" status by Broda's combination of site layout, equipment choices, Conceptual Operating Plan and impact prevention- and -mitigation measures. MLi3 believes that he combination of such measures at the time had, and still have, no equal in Manitoba's aggregate industry.

11. CLOSURE

The potential nuisance effects of the development should be confined to one (possibly two) adjoining landowners. Once the initial visual-screening berming and vegetation plantings north of Mollard Road are in place (likely the first 2 summers), localized nuisance would occur on an ongoing basis by only the sight of truck movements to and from the site, not by operations visible at the site. This would require mitigation consistent with Broda's Operating Plan, Preliminary Environmental Monitoring Plan, and Development Agreement with the RM. These potential visual impacts should be prevented, minimized or mitigated by: (i) the low population density (only three homes within ~850 m), (ii) Broda's integrated site-visual-screening system of vegetated perimeter and strategic berming, and (iii) situation of most heavy equipment many metres below-grade.

This Visual Impact Management Plan and Visual Impact Assessment is one of several foundation support documents to the Site Rehabilitation Plan and the Site End Use Plan that Broda plans to develop through dialogue with the RM and MMB, file for formal endorsement by the MMB and use to support negotiation of a Development Agreement with the RM. The Plan is expected to demonstrate satisfaction of previous corporate commitments to prevent or mitigate off-site visual impacts Broda made to the CAC, participants at several public Open Houses and RM of Rosser public hearings about the proposed project, and directly and personally to several neighbour landowners adjoining the Broda property. It embodies the "state of the art" in progressive management of a quarry during its operational phase, and to guide the planning for transition to an end uses) desired by a reactivated and strengthened Citizens Advisory Committee and the site's neighbours and the elected officials of the RM. Its submission is intended to demonstrate Broda's partial completion to date, and intention to complete, all relevant and applicable portions of Rosser Bylaw 8-15 to Broda's proposed high-quality aggregate quarry in the RM of Rosser. Its development and execution is also

intended to demonstrate satisfaction of the requirements set out in or under *The Special Planning Area Regulation* 49/2016 and the *Inland Port SPA Planning Regulation No. 48/2016* that, taken together, allow a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") on the CentrePort land base.

This Plan has been developed in consultation with government personnel who have applicable expertise. It is intended to be the best possible Plan that could be developed for this site and operations utilizing environmentally "Best Available Technology Economically Achievable".

MLi3 has observed that Broda strives to set itself apart as a professionally managed, environmentally responsible corporate citizen. MLI3 Inc. believes that Broda will take the necessary steps to ensure that its site-screening and adaptive-management practices support this goal.

The foregoing is unbiased independent work and assessment by MLi3 Inc.

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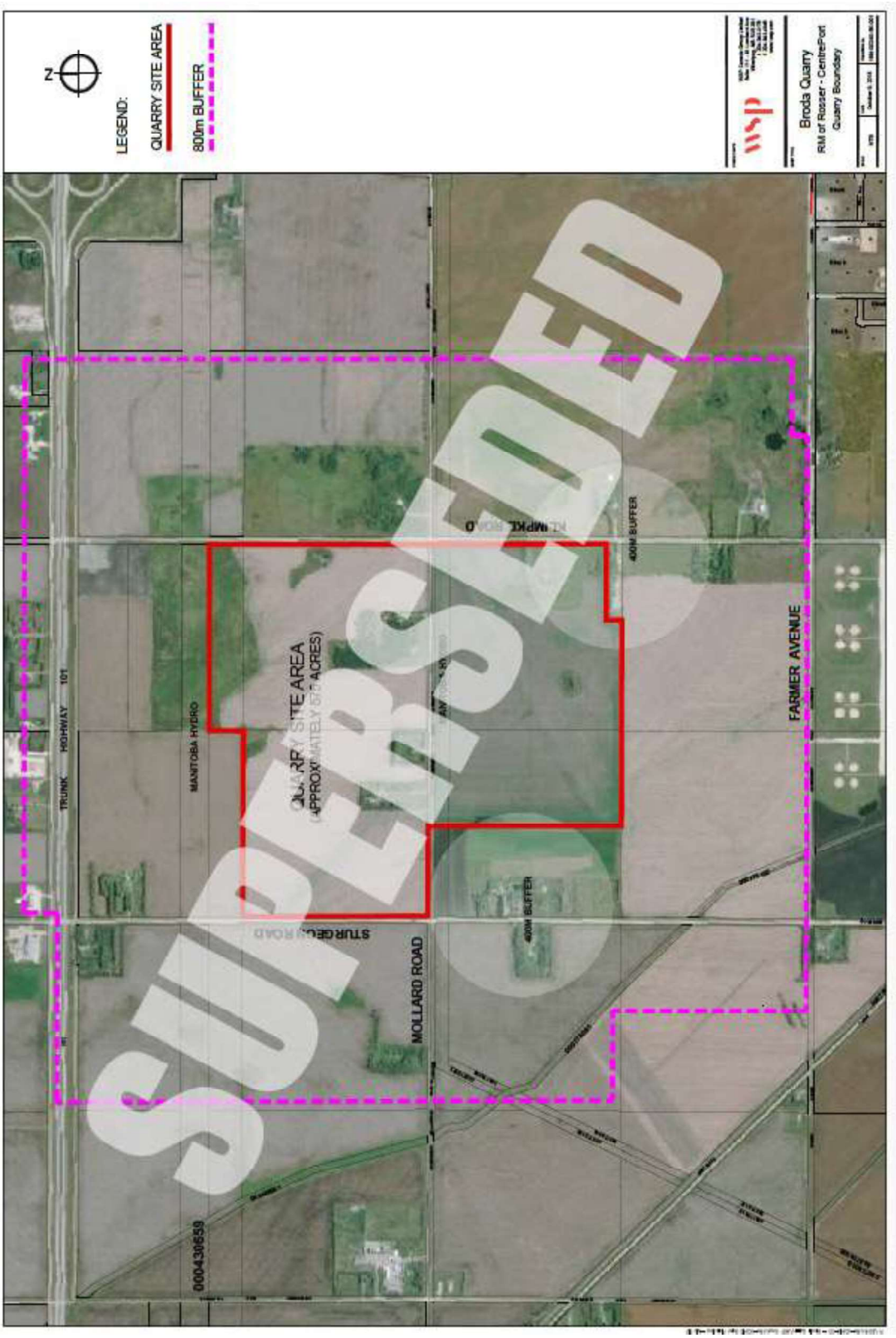
APPENDIX A CONCEPTUAL SITE OPERATING PLAN

Initial Site Layout and Development Schematics

The conceptual operating plan, which continues to evolve, has been built around a core commitment to the use of Continuous Surface Miner technology. A typical Surface Miner, in this case, manufactured by Wirtgen, is shown in figure A-1 below.

Figure A-1. A Wirtgen 4200SM Surface Miner.

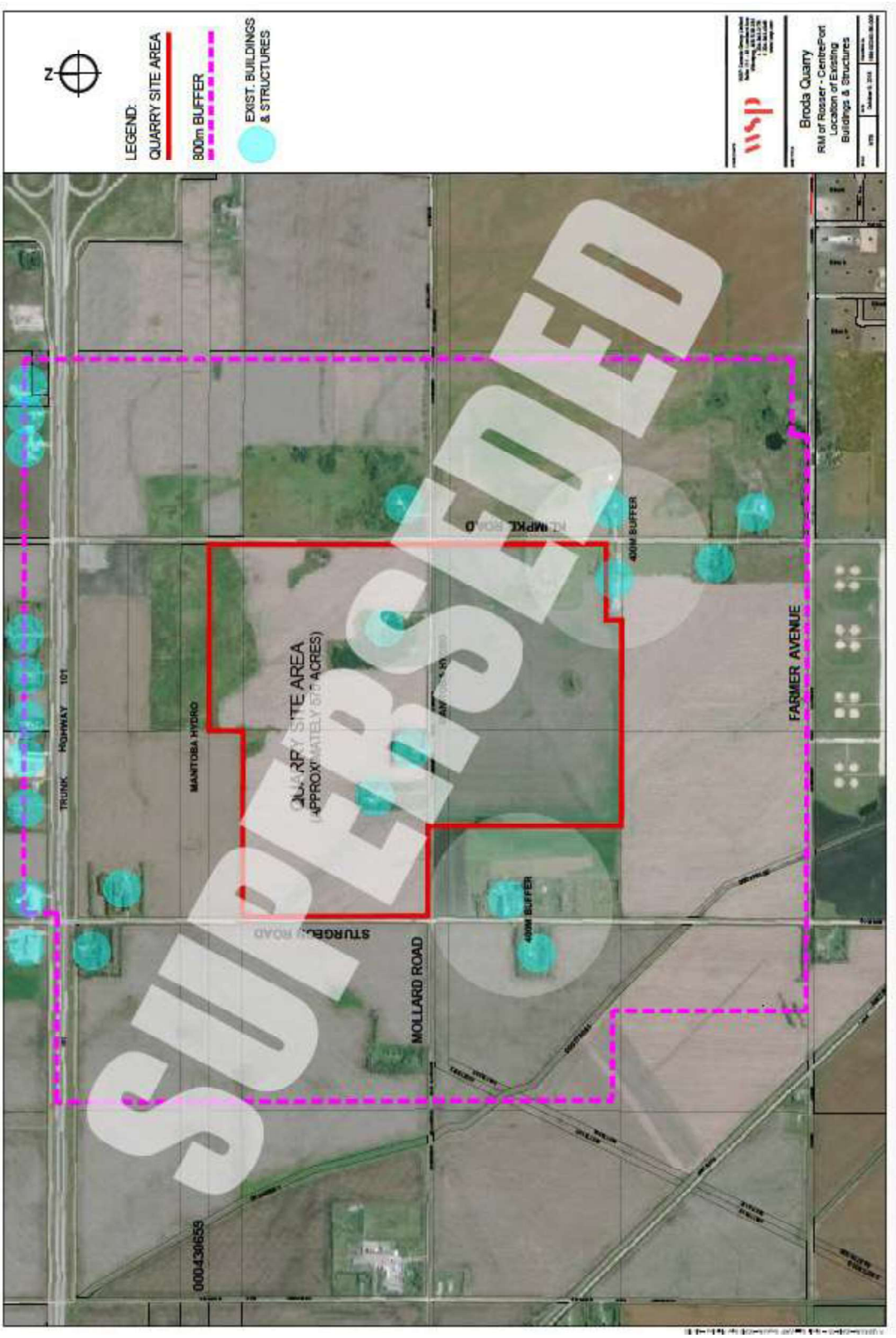
The most important elements of the current working draft of the Conceptual Operating Plan are preliminary site layout drawings which have been developed mindful of (i) the physical attributes of the site; (ii) the intended reliance on Surface Miner technology; (iii) the intention to minimize surface water ponds and groundwater accumulations on the site; and (iv) many corporate commitments to preclude, or minimize, visual and sound impacts being experienced at adjoining properties. The current draft drawings follow below; these draft drawings have recently been superseded and will continue to evolve before being finalized and submitted for review by the RM of Rosser.

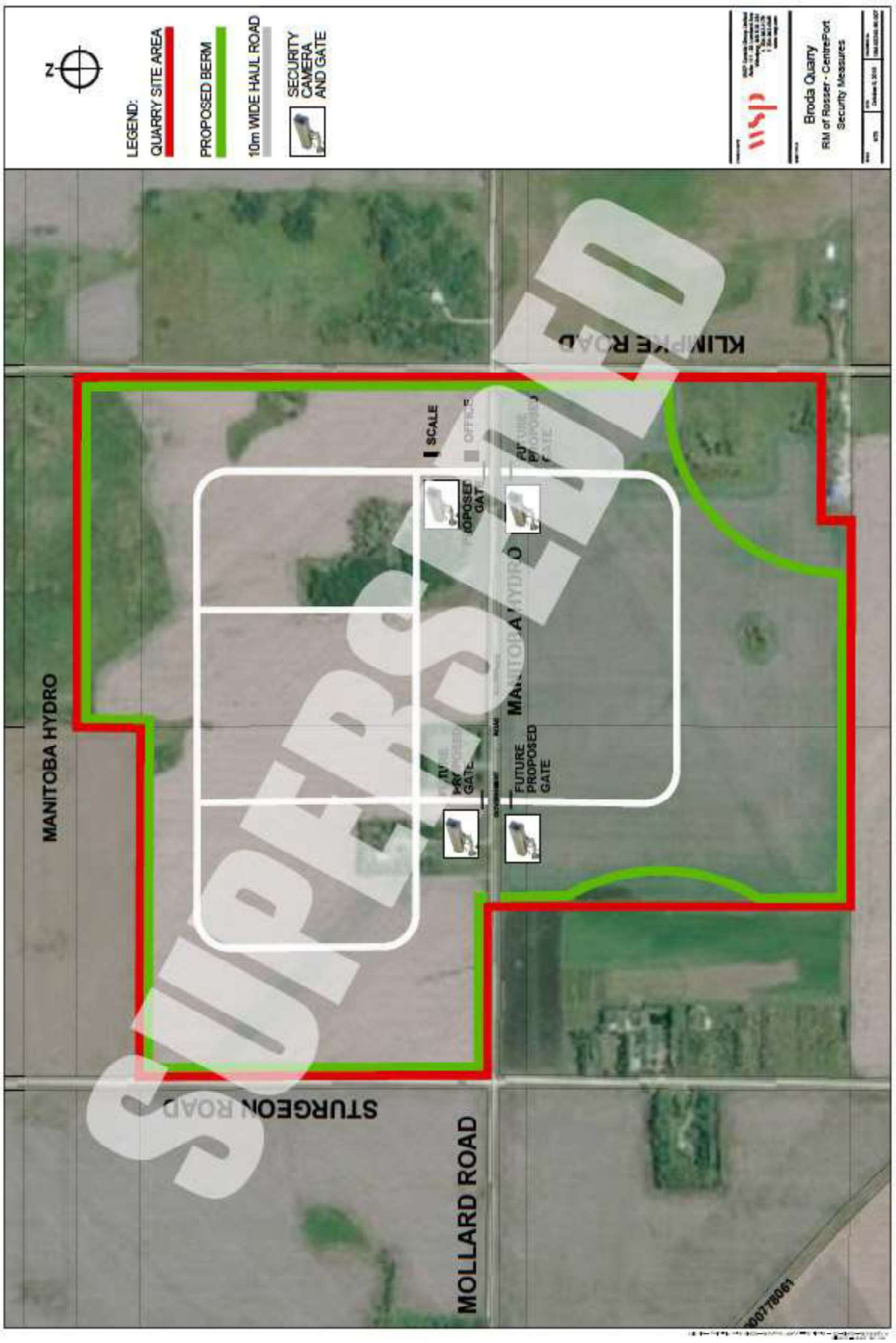

LEGEND:
QUARRY SITE AREA
800m BUFFER
Broda Quarry
RM of Rosser - CentrePort
Quarry Boundary
SUPERSEDED
TRUNK HIGHWAY 101
MANITOBA HYDRO
400M BUFFER
FARMER AVENUE
MOLLARD ROAD
000430658

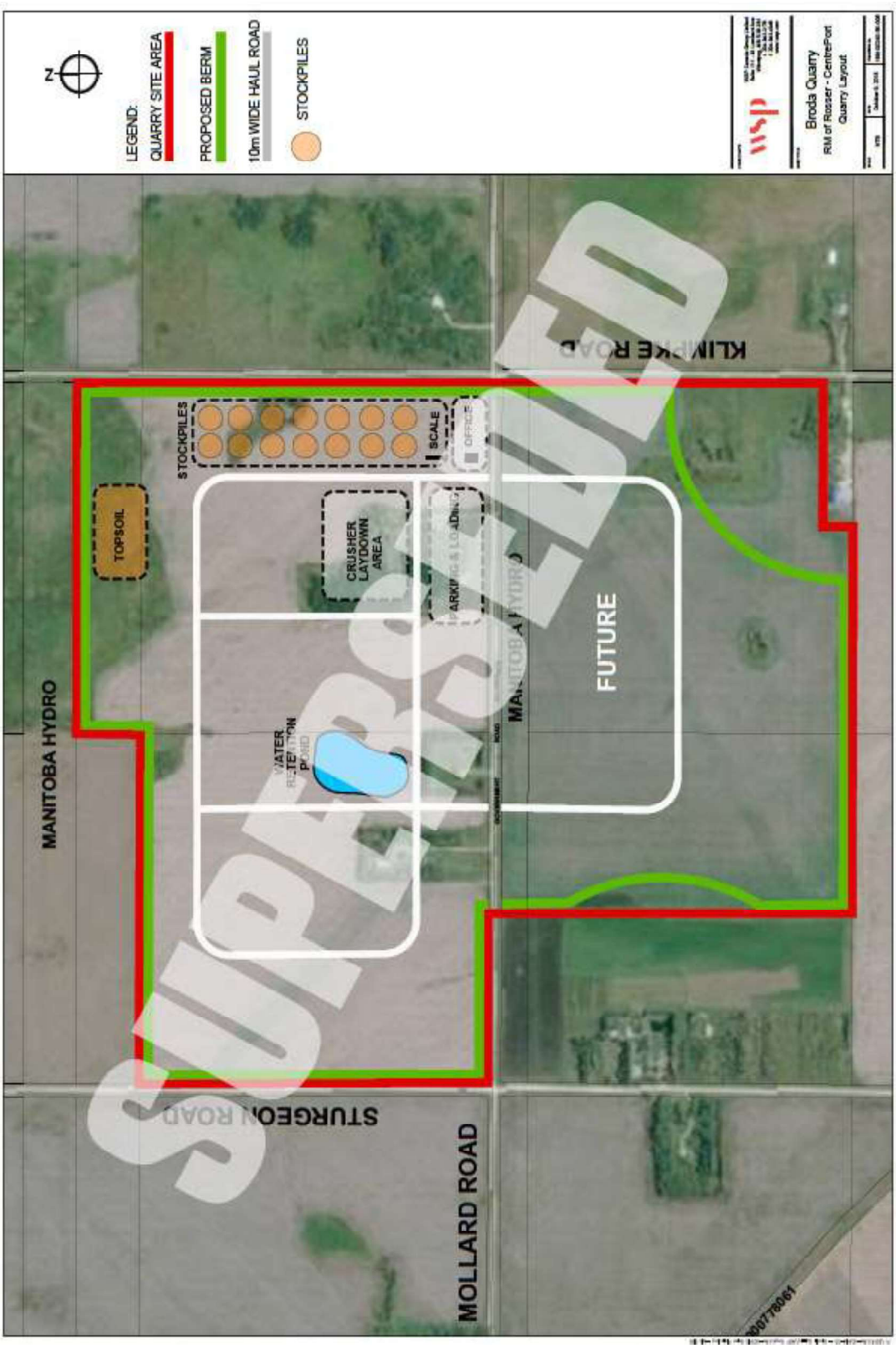

LEGEND:
QUARRY SITE AREA
Broda Quarry
RM of Rosser - CentrePort
Land Area and Excavation
MANITOBA HYDRO
PROPOSED QUARRY AREA = 2,326,942 Sq.m
APPROXIMATE DEPTH OF EXCAVATION = ±10 m
STURGEON ROAD
MOLLARD ROAD
SUPERSEDED


LEGEND:
QUARRY SITE AREA
Broda Quarry
RM of Rosser - CentrePort
Phasing
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
MANITOBA HYDRO
MOLLARD ROAD
SUPERSEDED


LEGEND:
QUARRY SITE AREA
REHABILITATION AREA
Broda Quarry
RM of Rosser - CentrePort
Site Rehabilitation
MANITOBA HYDRO
MOLLARD ROAD
SUPERSEDED


LEGEND:
QUARRY SITE AREA
800m BUFFER
EXIST. BUILDINGS & STRUCTURES
Broda Quarry
RM of Rosser - CentrePort
Location of Existing Buildings & Structures
TRUNK HIGHWAY 101
MANITOBA HYDRO
400M BUFFER
FARMER AVENUE
MOLLARD ROAD
000430655
SUPERSEDED


LEGEND:
QUARRY SITE AREA
PROPOSED BERM
10m WIDE HAUL ROAD
SECURITY CAMERA AND GATE
Broda Quarry
RM of Rosser - CentrePort
Security Measures
SCALE
MANITOBA HYDRO
MOLLARD ROAD
FUTURE PROPOSED GATE
SUPERSEDED


LEGEND:
QUARRY SITE AREA
PROPOSED BERM
10m WIDE HAUL ROAD
STOCKPILES
Broda Quarry
RM of Rosser - CentrePort
Quarry Layout
MANITOBA HYDRO
MOLLARD ROAD
STURGEON ROAD
TOPSOIL
STOCKPILES
SCALE
CRUSHER LAYDOWN AREA
FUTURE
SUPERSEDED

APPENDIX B CONTINUOUS SURFACE MINER TECHNOLOGY

Wirtgen Technology and Models in Particular

From: https://www.wirtgen.de/en/technologies/application/surface-mining/surface_mining.php

As the surface miner moves forward, a special cutting drum rotates against the direction of travel, cutting layers of material from the rock formations and crushing it in the process. The primary conveyor picks up the material in the drum housing and transports it towards the rear of the machine, where it is then accepted by the slewable and height-adjustable discharge conveyor. The discharge conveyor loads the material into trucks or dumpers or discharges it to the side of the miner. The discharge height can be adjusted to the height of the transport vehicles. The surface miner is driven via four steerable and height-adjustable track units. An automatic levelling system ensures precise adherence to the cutting depth, thus enabling even thin seams or layers to be mined selectively and with maximum accuracy.

Strict environmental standards in terms of noise and dust emissions make the vibration-free surface mining process attractive in comparison to drilling and blasting. The stable, precise and level surfaces produced in mining, earthworks and rock operations are suitable for immediate use as pavements, slopes or tunnel floors.

From: https://media.wirtgen-group.com/media/02_wirtgen/media_1/media_1_06_surface_miners_2/media_1_06_surface_miners_2_00_general_information/W_brochure_Surface-Mining_0116_EN.pdf

The economical exploitation of primary resources in opencast mining is becoming increasingly difficult as the mineral content of many deposits is dwindling due to difficult geological conditions. In rock construction, machines are required for precise levelling operations under restricted space conditions. Our patent remedy in both cases is mechanical exploitation by means of surface mining. Being the innovative leader in this technology, Wirtgen is passionately driving the development of this economical and environmentally gentle process, using its expertise to successfully master the even more demanding challenges lying ahead.

We not only develop innovative machines of the highest quality. With our machine technology, we also constantly endeavour to keep environmental pollution as low as possible. A WIRTGEN surface miner is a perfect example of this philosophy: it impresses with its environmentally friendly technology as it cuts, crushes and loads rock in a single operation. A tremendous advantage of selective mining is that the vibrationless mining operation without drilling and blasting is accompanied by low levels of dust and noise. The low environmental impact also permits maximum exploitation of the deposit right up to the edge of residential areas. The selective mining of high-quality materials requires considerably less space than conventional mining methods. Our fuel-efficient, intelligently controlled engines comply with the strictest exhaust emission standards.

Figure B-1. A Wirtgen 4200SM Surface Miner.

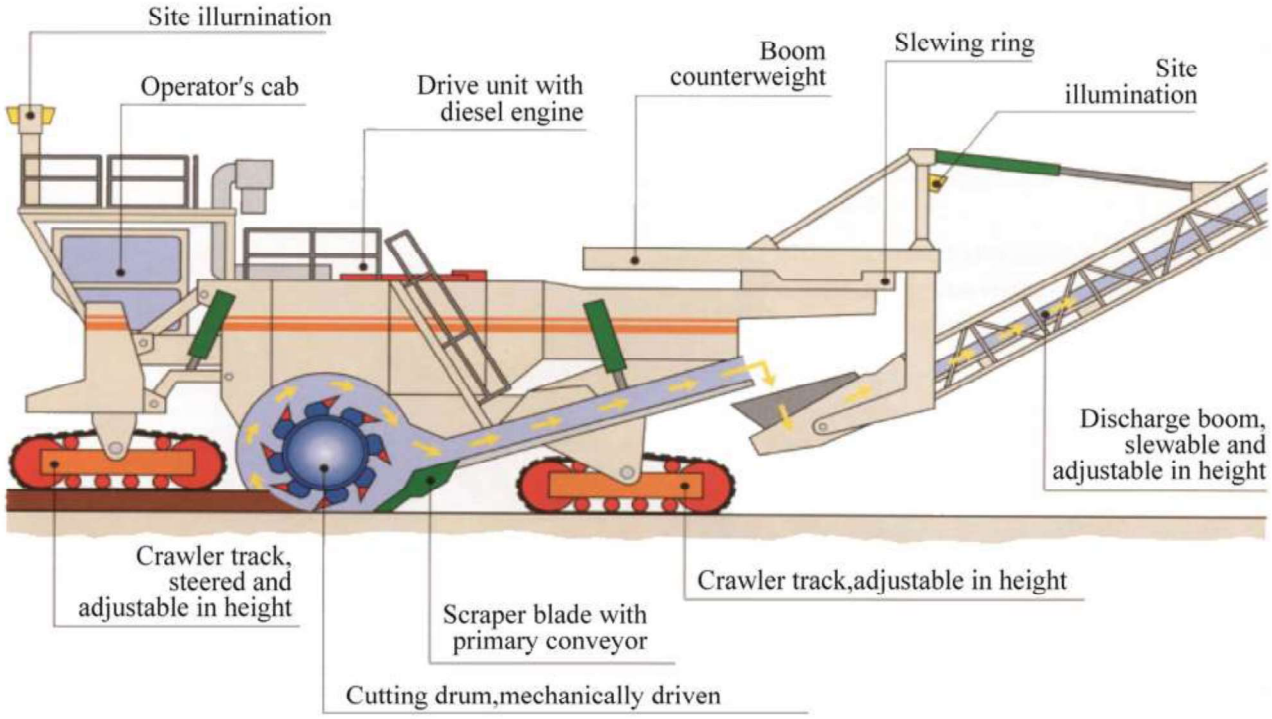


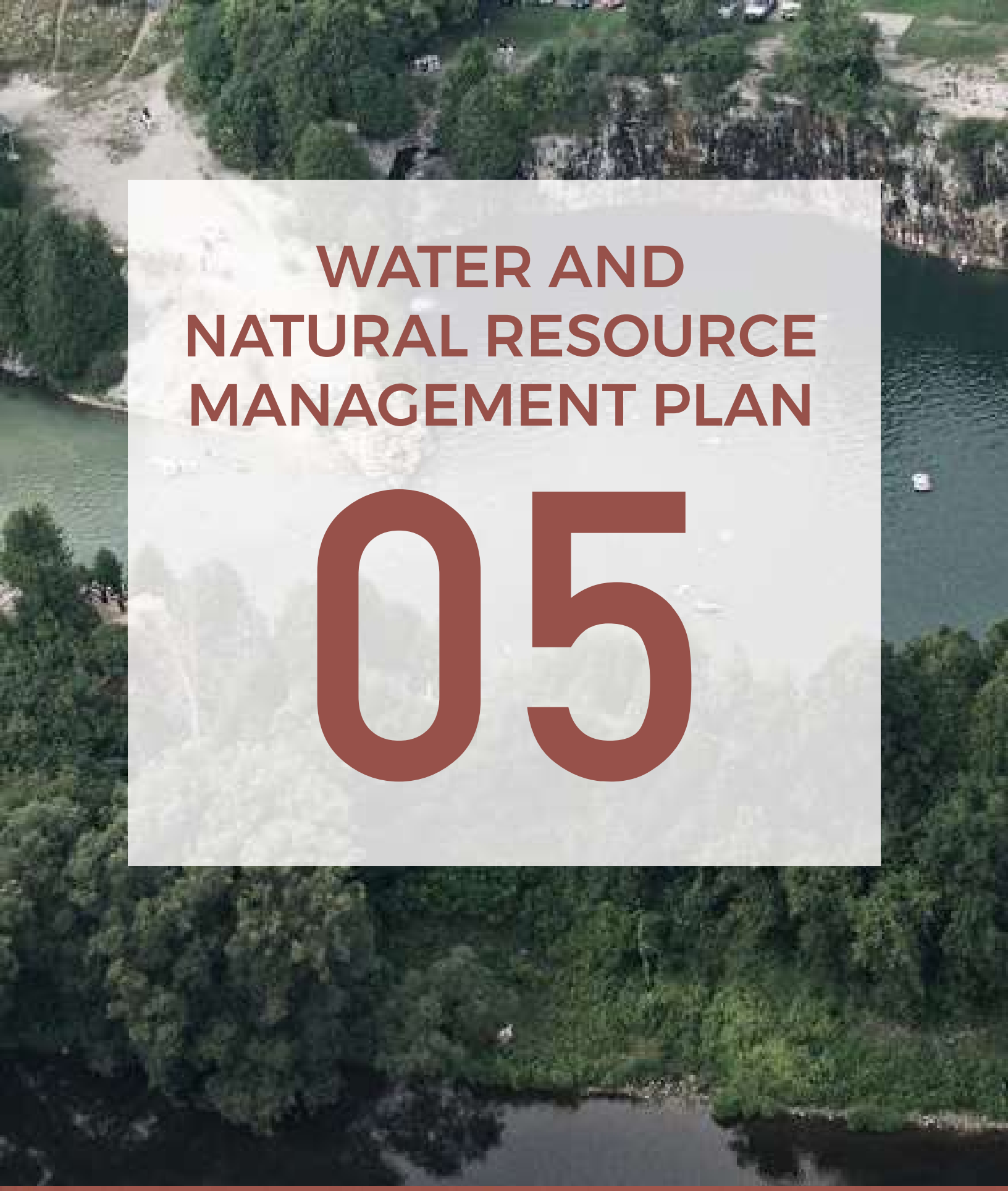
Figure B-2. A cross section of a Wirtgen surface miner in operation.

Figure B-3. A Wirtgen 4200SM Surface Miner.

Figure B-4. A Wirtgen 4200SM Surface Miner.

Figure B-5. A Wirtgen 2500SM Surface Miner.

Figure B-6. A Wirtgen 2500SM Surface Miner.



WATER AND NATURAL RESOURCE MANAGEMENT PLAN

05

NORTH PERIMETER AGGREGATES QUARRY

Friesen DRILLERS

March 13, 2019

Mr. Gordie Broda
President – Broda Properties Inc.
RR 2, Site 4, Comp. 207, Stn. MPP
Prince Albert, SK | S6V 5P9

Dear Mr. Broda,

Subject **Desktop Hydrogeological Investigation – Proposed Quarry Site**
Section 4-12-2 EPM and 33-11-2 EPM, Rural Municipality of Rosser, Manitoba

Friesen Drillers Ltd. is pleased to present this report to detail the results of our desktop hydrogeological investigation for the proposed quarry site at sections 4-12-2 EPM and 33-11-2 EPM, within the Rural Municipality (RM) of Rosser, Manitoba. The investigation included a review of local and regional hydrograph records and the generation of water table/potentiometric surface maps to establish conditions at the quarry site within a regional hydrogeological context. In addition, the available groundwater geochemistry data was obtained and reviewed.

This investigation was undertaken using existing data and reports in the area. The GWDRILL database maintained by Manitoba Sustainable Development (MSD) was accessed for information relating to groundwater wells in the region (GWDRILL, 2016). The well inventory conducted in this study did not involve intrusive well testing, flow testing, water sampling or site visits of any kind.

Project Background

The area around the site is predominantly agricultural with some residential acreages and small farms. Some areas are well treed, with other areas developed for livestock and dairy cattle production. The area is slightly elevated from the surrounding land surface, and natural drainage heads both towards the east and towards the west / southwest.

It is our understanding that the property at sections 4-12-2E and 33-11-2 E is currently owned by Broda Properties Inc. The site is located immediately south of the Winnipeg Perimeter Highway (Hwy 101), between Sturgeon road and Klimpke road, as shown below on Figure 1.

Figure 1 – Proposed quarry site, RM of Rosser. (Google Earth, 2019)

Scope of Work

The following scope of work has been developed for the project:

- Prepare a report on the conditions of the site and characterize the site conditions within the regional hydrogeological system.
- Obtain and review available local well records in the area and update the inventory undertaken in 2006.
- Review and update hydrographs in the area.

It should be noted that this review did not include regulatory information on approvals other than some commentary related to the Water Rights Act.

Regional Geology

The surficial geology of the region has been highly influenced by the subcrop of the Stony Mountain Formation. A slightly elevated upland area extends approximately north/south through the region. This elevated ridge is composed of Stony Mountain Formation rocks which were more resistant to weathering and erosion and form a topographical high. As a result of the bedrock ridge, the overburden cover in the area is generally very thin and even absent in some locations.

The surficial geology of the region consists of calcareous grey clay till that composes a layer of varying thicknesses. Surficial mapping in the area indicates less than 20 feet of overburden across the project site (Betcher, 1985). Underlying the till is a highly fractured carbonate (limestone and dolostone) rubble zone. The thickness of the rubble zone varies across the area. The rubble zone grades into more competent, fractured and bedded carbonate and shale rock. The Penitentiary and Gunn Members of the Stony Mountain Formation compose the main sub crop and overlie the Fort Garry Member of the Red River Formation. The Stony Mountain/Red River Formation contact lies at a depth of 120 to 140 feet below grade in the Stonewall area. The Red River Formation consists mainly of alternating layers of limestone and dolostone with basal shale layers. The Red River Formation is in turn underlain by the Winnipeg Formation clastic (sandstone and shale) unit, followed by Precambrian bedrock. The Winnipeg Formation is typically intersected at a depth of between 590 to 610 feet below grade (Betcher, 1985). A geological cross section is shown below as Figure 2.

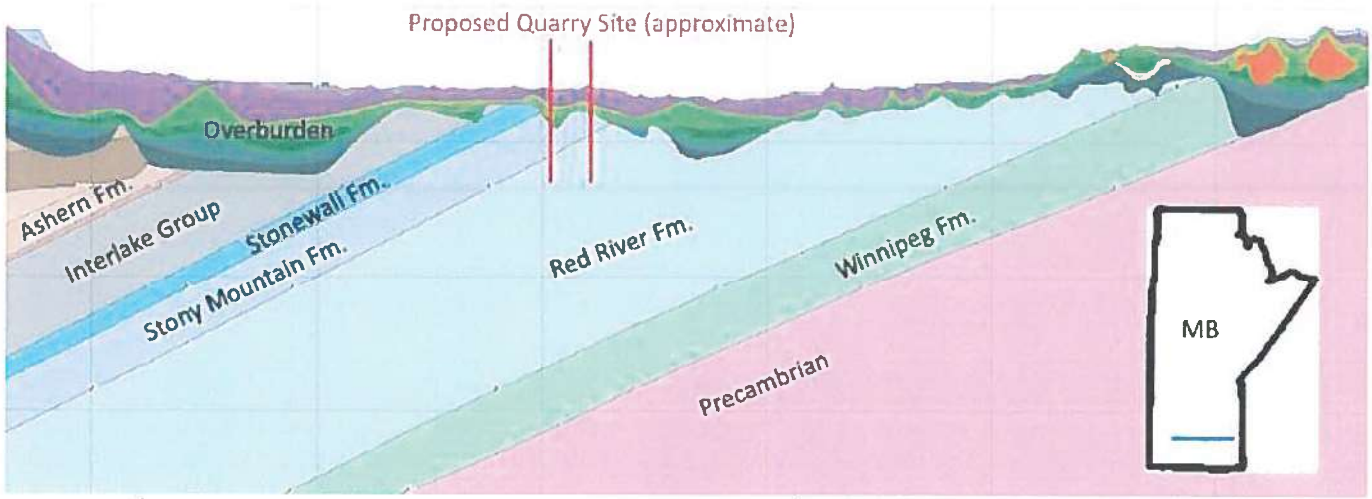


Figure 2 – Regional bedrock geology of southeastern Manitoba. (source - Manitoba Geological Survey, 2009)

With the exception of the carbonate rock surface, which is irregular due to weathering, fracturing and karstic features, the stratigraphy of the study area is relatively consistent.

Hydrogeology

The assessment of hydrogeological conditions in the area was based upon background reports and data available from Manitoba Sustainable Development (MSD). The location of the provincial observation wells closest to the project site are shown below in Figure 3. Groundwater aquifers at the site are found in the carbonate bedrock (Stony Mountain and Red River Formations) and in the deeper sandstone unit (Winnipeg Formation). In addition, overburden sand and gravel deposits form scattered aquifers of limited extent.

As the carbonate bedrock generally has very low porosity, groundwater flow in the carbonate bedrock predominantly occurs in the fracture and joint sets of the rock. The size, extent, and interconnectivity of the fracture systems controls the horizontal and vertical movement of groundwater through the bedrock. Due to this geologic condition, aquifer transmissivity and storativity can vary significantly over relatively short distances. This variability also results in substantial variations in well yields. The carbonate bedrock aquifer is a significant groundwater resource throughout Manitoba and has been developed for municipal, commercial, and domestic water supplies.

The transmissivity of the carbonate aquifer in the Winnipeg region was mapped by Baracos et al. (1983). The maps indicate that transmissivity within the northern regions of Winnipeg range from less than 10,000 to more than 100,000 USGPD/ft. The large range is typical for fractured limestone aquifers and reflects the highly variable bedrock conditions (Freeze and Cherry, 1979). Site specific aquifer testing has been conducted at the proposed quarry site (Wardrop, 2005; Friesen Drillers, 2009). These tests indicated a similarly wide range for aquifer transmissivity with values between 20,000 and 96,000 USGPD/ft. The aquifer tests also revealed that transmissive conditions at the site fluctuate seasonally with changing static water levels. Higher transmissive conditions were noted to correspond with higher static water levels.

Figure 3 – Provincial monitoring wells surrounding the proposed Quarry site.

Several groundwater recharge and discharge areas have been identified in the area. Recharge areas have been mapped west of Stonewall, within the East and West Shoal Lakes area, and northerly through the Stonewall upland area. These recharge areas contribute to local and regional flow systems, and the resultant groundwater flow is directed easterly towards the Red River. Groundwater discharge occurs near Oak Hammock Marsh, located several miles west of the City of Selkirk. The City of Selkirk water supply is also a major source of discharge for the aquifer. It is thought that a certain amount of groundwater also discharges to the Red River in the Lister Rapids area. The general direction of groundwater flow through the region is shown on the following page in Figure 4. The natural groundwater flow under the site is inferred to be easterly-southeasterly.

Hydrogeology (cont'd)

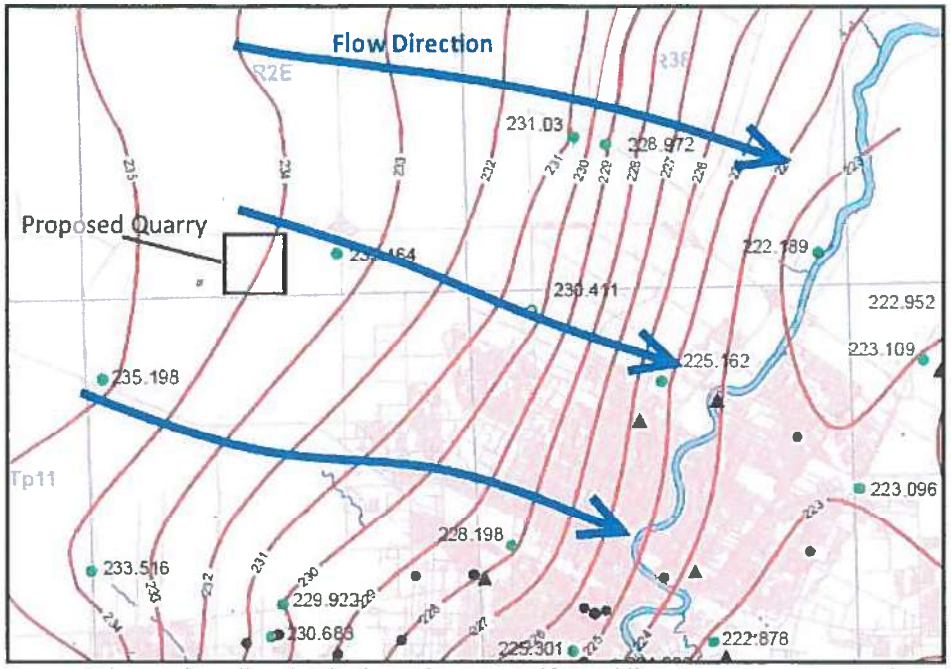


Figure 4 – Approximate groundwater flow direction in the carbonate aquifer; red lines represent the potentiometric surface; blue lines indicate flow direction. (Modified source – MSD, 2006)

The period of observation available for the regional hydrograph record is variable. Some monitoring stations date back to the mid 1960s, although most were installed after 1995. A composite plot of nine nearby hydrograph stations is shown below in Figure 5. Total annual precipitation data, shown on the following page as Figure 6, is included to supplement the analysis.

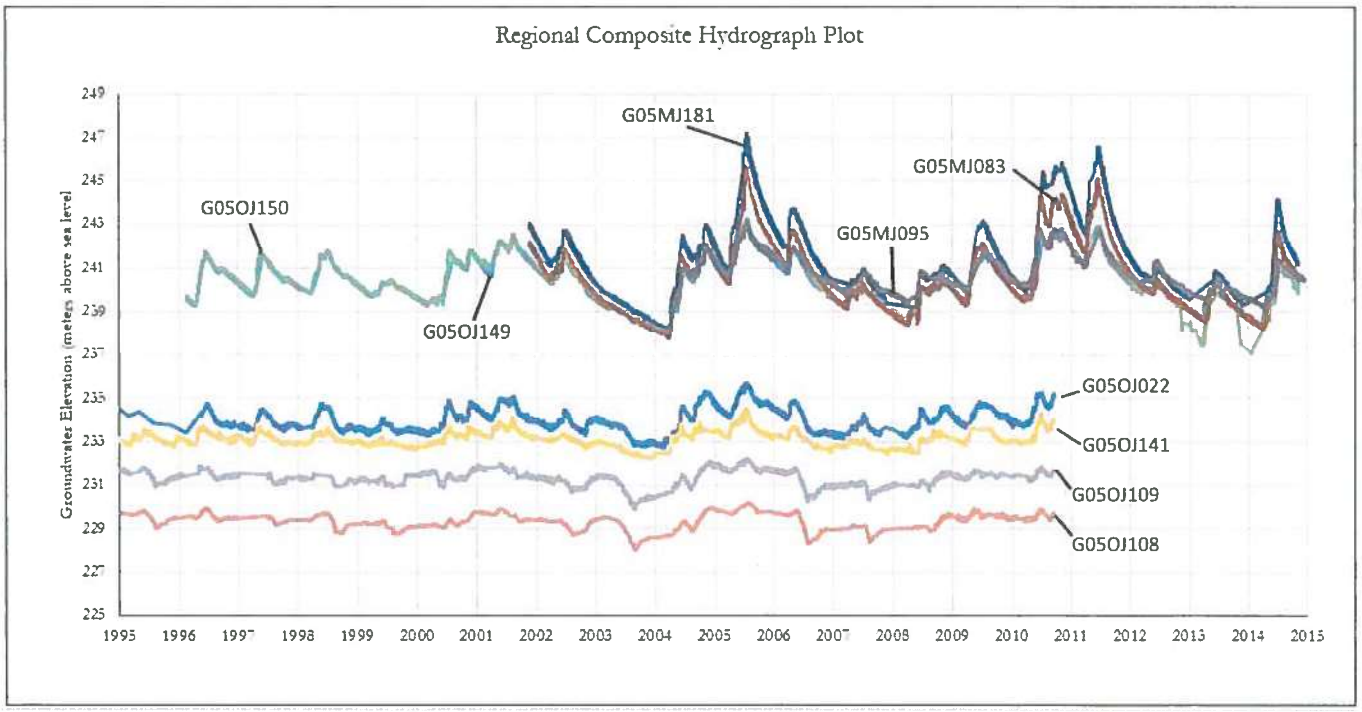


Figure 5 – composite hydrograph plot of data from regional monitoring stations. (MSD, 2016)

Hydrogeology (cont'd)

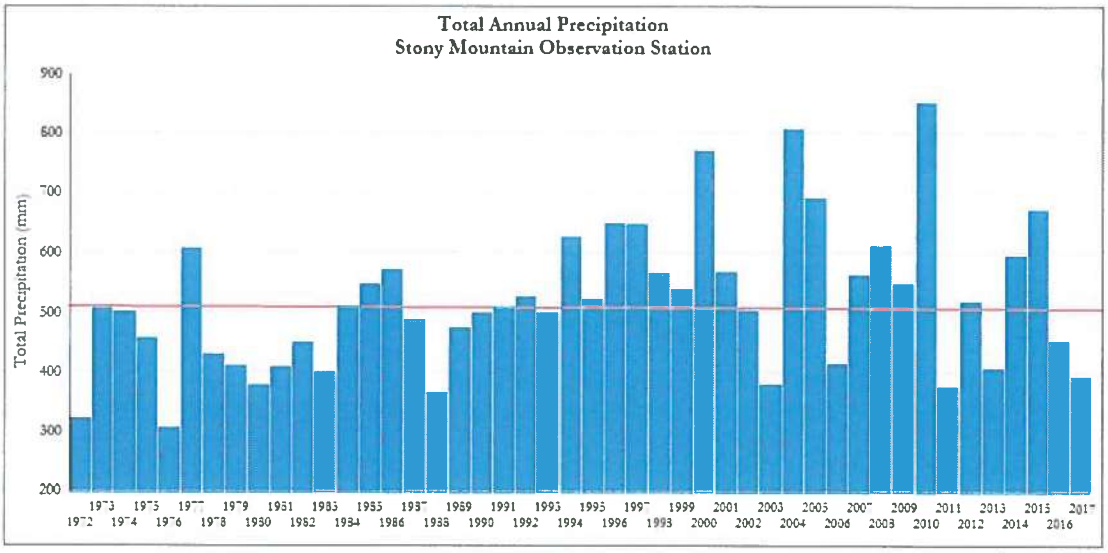


Figure 6 – Total precipitation – Stony Mountain Station, 1972 to 2017; average for the period is 518 mm/year (orange line). (data source – Environment Canada, 2018)

It is apparent from the hydrographs that static water levels in the carbonate aquifer follow seasonal and climatic trends. For example, in the years 2004 and 2005, when the total annual precipitation was well above average, groundwater levels rose significantly, reaching the highest levels recorded on the chart. The response to precipitation events is more pronounced in wells proximal to the recharge zone and appears to be dampened with increasing distance from the recharge zone. Long term trends indicate a relatively stable average groundwater elevation, and no long term drawdown was apparent from the hydrograph records.

Groundwater levels at the proposed quarry site are also expected to fluctuate based on seasonal and climatic variations. The chart of G05OJ022 is considered to closely reflect groundwater conditions in the area. Groundwater fluctuations on the order of 10 ft. are observed for the area. Given the recent years of below average precipitation, groundwater levels are expected to be at the low end of the range. However, the record also indicates that recovery occurs quick with wet conditions. The typical groundwater elevation at the site is expected to be around 237-233 m geodetic.

Groundwater Geochemistry

The available chemistry data from nearby MSD hydrograph stations was reviewed. The results are detailed below in Table 1 and plotted on the following page in Figure 7. The geochemistry of groundwater appears to be variable throughout the region. The samples plot as calcium/magnesium/bicarbonate type groundwater, which is typical for the area.

Groundwater quality appears to be controlled largely by the distance from recharge zones and the depth below grade. The freshest quality groundwater was collected from wells which are all relatively close to the Stonewall recharge area. The poorest quality samples were collected from wells which are farthest down gradient in the sample set. The sample from G05OJ149, a deep observation well, contained markedly higher concentrations of sodium and chloride than the shallower wells installed at similar locations. These results suggest that groundwater quality within the aquifers ranges with depth below grade.

Table 1
Regional Groundwater Geochemistry

Station	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	TDS	Nitrate
G05OJ022	89.1	89	107	12.9	0.5	510	87.4	186	864	0.08
G05OJ150	62.1	60.1	31.5	11.7	0.5	488	26.3	39	474	1.05
G05OJ149	94.5	63.6	84.7	13.1	0.5	522	116	82.4	700	0.01

Table 1 – Geochemistry results from the regional provincial observation wells (source – MSD, 2016).

Groundwater Geochemistry (cont'd)

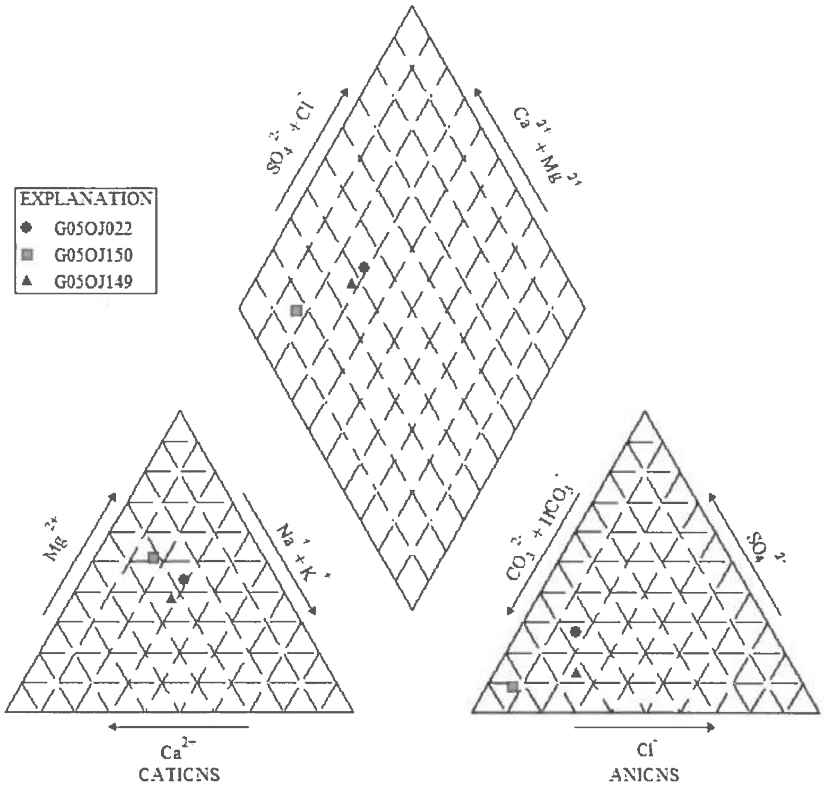


Figure 7 – Trilinear plot of regional groundwater quality. (source - MSD hydrograph network)

Significant water quality differences have been noted between the carbonate formations, in some locations. MSD has noted several instances where bacterial and organic compounds have impacted the upper aquifer, mainly due the shallow burial of the aquifer in the Stonewall and Stony Mountain areas. Leaking septic tanks, agricultural operations, and other land uses have also impacted the water quality in the upper Stony Mountain Formation, especially in the Stonewall area. In general, water quality in the underlying Red River Formation has been considered to be more suitable for domestic and municipal water supply.

Station, G05OJ022, is nearest to the proposed quarry site and is completed into the deeper carbonate aquifer formations. The total dissolved solids are expected to be in the range of 400 to 600 mg/L, with relatively low concentrations of sodium and chloride. It should be noted that these samples were collected by MSD from provincial monitoring wells, shown in Figure 3. Friesen Drillers has not verified the sample results and has assumed them to be correct and representative of actual groundwater conditions.

Nitrate, a common contaminant in groundwater, has been detected in groundwater samples from the region with somewhat alarming concentrations. Nitrate concentrations were above detection limits in four of the nine provincial observation wells reviewed. The sample with the highest concentration was collected from G05MJ081, which reported a value of 5.44 mg/L. It is interesting to note that the samples with the highest nitrate concentrations come from the shallow wells installed near the recharge area. This is to be expected, as the thin overburden in these areas reduces the protection to the aquifer from surface activities.

Sources of nitrate include leaching or runoff from agricultural and fertilizer use, sewage and manure, or as a product of excess ammonia or nitrification (Freeze and Cherry, 1979). The recommended maximum limit for nitrate in drinking water from the Canadian Drinking Water Quality Guidelines is 10 mg/L (Health Canada, 2014). Bottle fed babies subjected to nitrate in groundwater above the recommended maximum limit have higher risks of developing methaemoglobinaemia (blue baby syndrome) and thyroid gland problems (Health Canada, 2014). An elevated nitrate concentration in groundwater is a serious issue if the groundwater is regularly consumed in an untreated manner (Health Canada, 2014). The underlying issue with nitrate is that the mere presence indicates that groundwater in the area is negatively interacting with surface activities.

Previous investigations in the region have suggested that groundwater in the area has already been heavily influenced by surface activities which generate nitrates. This is an item of concern, and one that requires attention. Although it is common to have individual private septic facilities in the area, the presence of these systems in a groundwater recharge area is also a source of concern.

Well Inventory Review and Update

Previous work conducted in the area has revealed that a high percentage of private domestic wells are in relatively poor condition based on the parameters of well age, construction type, materials, and hookup type. Modern wells are constructed with PVC casing and include a modern brass hook up, complete with a manufactured pitless unit. Wells constructed prior to 1990 often have galvanized products used in the plumbing connection which can corrode over time and can allow for contaminated surface water to enter a well. This is especially an issue for the older galvanized well casings in the area.

Wells constructed in well pits were common prior to the 1960's/1970's, and have not been an accepted well hook up method for many years. Well pits were used to protect water line connections from freezing and to provide access to underground water line connections below the frost line. Well casings were cut off below the frost line and a large cribbing, usually made of either wood or concrete was placed over the top of the well. Professional well hook up contractors have not typically completed wells in pits for nearly 50 years.

New regulations, currently in discussion with government, will require new wells be installed with a pit less configuration. Well pits pose a serious risk of groundwater contamination by allowing for surface run-off to easily enter the aquifer. In addition, septic lines and waste lines are also buried in a similar manner, which can lead to interconnection under the backfill of a house basement/weeping tile/sump pits/etc. Well pits are a serious issue and need to be addressed immediately. When the well pit becomes flooded, contaminated surface water carrying debris, bacteria, pesticides, fertilizers and oil products can enter and contaminate the aquifer. Vermin and other animals can enter the well pit which can cause further contamination.

A review of the GWDRILL (2016) database identified 75 groundwater wells present within two miles from the study site perimeter. A summary of the results is shown as Table 2, attached. From the available records, 45 of the 75 wells (~60 %) have a construction date prior to 1990. The total well depths ranged from 35 to 325 feet below grade, with an average depth of 136 feet below grade. The depth of casing ranged from 10 to 134 feet below grade, with an average casing depth of 55 feet below grade. The average static water level was reported to be 17.5 feet below grade. The vast majority of the wells were noted to be used for domestic purposed, however, a few wells were noted to be used for air conditioning, recharge and livestock purposes.

The results from the desktop well inventory suggest that many of the wells in the area surrounding the proposed quarry site are expected to be in relatively poor condition. It is recommended that a field inventory be conducted to inspect the well conditions and collect raw water samples from the wells. In addition, the results indicate that a majority of the wells are constructed into the deeper Red River Formation aquifer. The completion of wells into the RRF reduces the potential for negative impacts to the wells as some degree of hydraulic separation (Gunn member) is shown to exist between the shallower rocks and the RRF.

It is important to note that the GWDRILL database was initiated in 1964. Consequently, wells constructed earlier to this date are unlikely to be included in the database. In addition, it is generally understood that the database includes a record for approximately half of the wells in the field. A field inventory would confirm the location, condition and current state of use for each well and establish a baseline for regional groundwater quality prior to quarry operation.

Assessment of Potential Dewatering Requirements

Previous investigations indicated the approximate maximum quarry depth would be up to 25 feet (~7.6 m) below an assumed grade elevation of 240 m. In addition, the approximate top of the limestone bedrock is considered to be at 235 m. This results in a quarry base elevation of approximately 232.4 m geodetic. Based on hydrograph data (G05OJ022), static groundwater levels at the site are expected to fluctuate between about 233 and 235 m geodetic elevation. Based on these assumptions, the water level would need to be lowered 3-5 m (9.8-16.4 ft.) to dewater the bedrock to the lowest excavation levels. Figure 8, shown on the following page, illustrates the relative elevations in relation to the regional groundwater fluctuations at the quarry site. It is important to note that this assessment is based off on the available regional data and that conditions in the aquifer are shown to be dynamic. Ongoing monitoring is recommended to confirm site specific hydrogeological conditions.

In the event that dewatering would be required, site specific testing at the time of implementation would be necessary to assess the potential response of the local aquifer to pumping stresses based on current conditions. Based on the aquifer parameters inferred from previous studies, to lower the groundwater level at the site by 12 feet would require sustained pumping at rates of 250 - 1,000 U.S.G.P.M. or more. The range is based on largely on the transmissive conditions encountered at the time of dewatering. The calculations were based on the Theis (1935) equation and assumption with the following parameters:

- Transmissivity: 20,000 - 98,000 US.G.P.D./ft.
- Storage coefficient: 1.0×10^{-4}

Assessment of Potential Dewatering Requirements (cont'd)

- Pumping duration: 90 days.
- Radial distance: 750 feet.

It is assumed that a water supply will be required for quarry operation. Depending on the water demand, it is possible that a groundwater supply could be designed to satisfy dewatering requirements as well. Siting the supply well locations would require additional information, including the proposed water demand, site specific geology/hydrogeology, and quarry development plans. Any implemented system should be designed and monitored by a professional hydrogeologist or engineer licensed to practice in Manitoba.

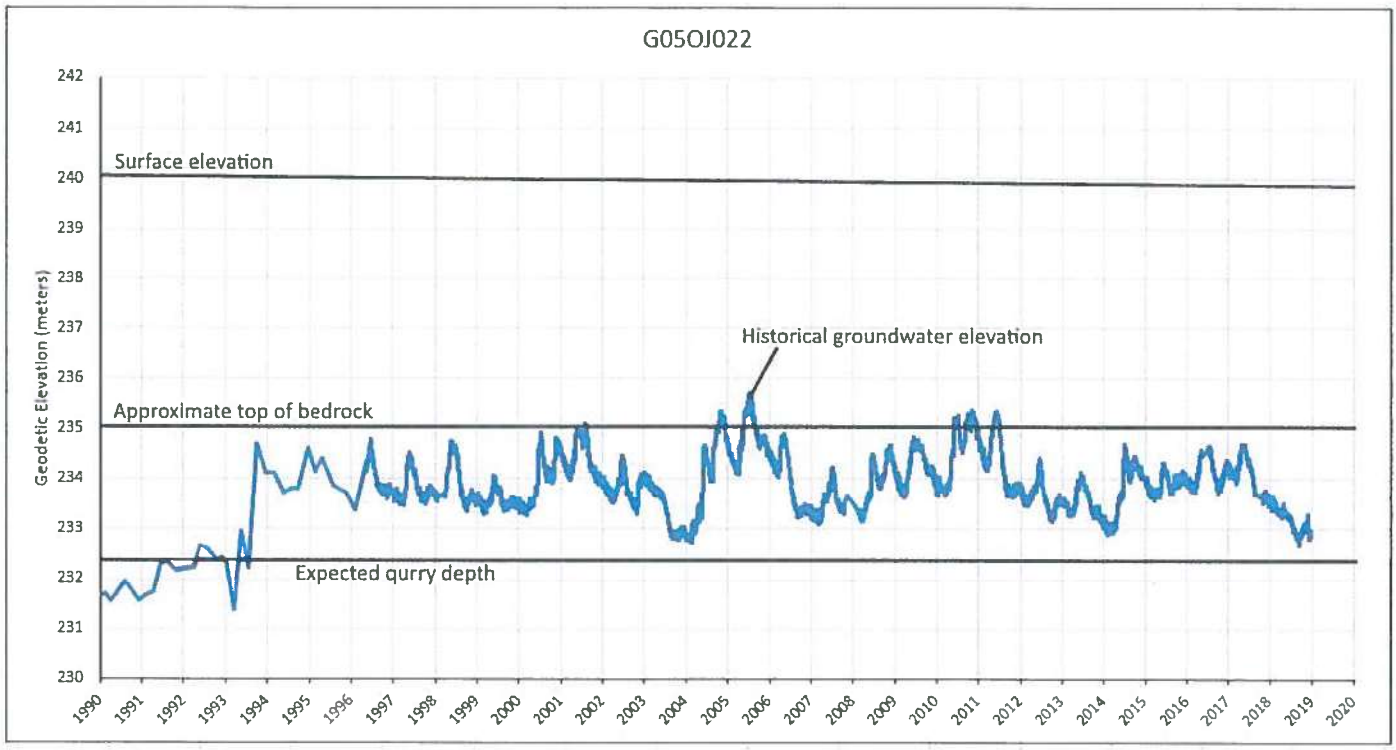


Figure 8 – Quarry elevations in relation to historical regional groundwater fluctuations. (data source - MSD, 2019)

Discussions and Recommendations

To date, MSD has not noted any water quality changes or impacts from the long standing quarry operations in the region. The bedrock aquifers in the area have a naturally shallow burial depth and have the potential to be impacted from surface activities such as landfills, lagoons, or leaking septic tanks. It is highly likely that the elevated nitrates in the region are a result of the shallow burial of the carbonate aquifer.

The Stonewall upland area serves as a major source of recharge to the carbonate aquifer and all activities in the area should take this into account. The storage of fuels and oils, etc. should be done in an environmentally friendly manner, along with the collection of on-site wastewater and wash water. Refueling should not take place on the quarry floor.

To minimize potential impacts to deeper aquifer formations, it is recommended that excavation does not penetrate the Gunn Member of the Stony Mountain Formation.

Regional hydrograph data indicates the target rocks are saturated to various levels depending on seasonal and climactic conditions. If dry rock conditions are required to quarry, dewatering will likely be required.

A dewatering system at the proposed quarry site may encounter challenges dealing with the seepage inflows into the excavations under higher static water level conditions in the Stony Mountain Formation, especially when mining the deeper portions of the bedrock.

Discussions and Recommendations (Cont'd)

Additional testing would be needed to quantify the required pumping rates and the potential aquifer responses. Preliminary estimates indicate pumping rates in the range of 250-1,000 U.S.G.P.M. or more may be required.

In our view, dewatering operations constitute groundwater use and would require a Water Rights diversion License from MSD, although this opinion should be confirmed.

Based on the available information, the potential dewatering level is above the lowest historic levels on nearby hydrograph charts. Consequently, the overall risk of negative impacts to a significant number of off site wells is considered to be low. However, we suggest the quarry development plan have procedures to deal with potential issues relating to third party groundwater users. An inspection of nearby private wells near the proposed quarrying operation is recommended prior to undertaking aggregate mining. Wells with short casing sections, or open hole through both aquifers should be monitored closely for water quality changes.

We recommend that the individual private well inventory conducted previously be reviewed and that any new wells be inspected. This should be undertaken to determine a baseline condition of the existing wells and to review the well hook ups and well completions. Baseline groundwater quality samples should also be collected. This work should be undertaken by qualified personnel that are familiar with domestic water wells and well hook ups. A licensed driller in the Province of Manitoba should undertake this work. The work should also be supervised and documented by a professional hydrogeologist or engineer.

It should be noted that a significant nitrate problem exists in the area up gradient from the proposed quarry. Site specific monitoring should be conducted to confirm local conditions in the quarry area prior to any development activity. Some of the practices in this area should be reviewed, as there are strong indicators that these practices are having a significant impact on this aquifer system.

We thank you for the opportunity to be of continued service to Broda Properties.

Should you require anything further, please call us at 204-326-2485.

Sincerely

Friesen Drillers Limited

Justin E. Neufeld, GIT
Groundwater Geologist

PROVINCE OF MANITOBA
March 14/19
J. J.
BELL
Member
22621
REGISTERED PROFESSIONAL ENGINEER

Reviewed by

Friesen Drillers Limited

(J. Jeff) Bell, B.Sc.(G.E.), P.Eng.
Hydrogeological Engineer

APEGM
Certificate of Authorization
Friesen Drillers Limited
No. 4016 Date: March 14/2019

Attachments Table 2 – Well inventory update

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Limitations

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Friesen Drillers Limited makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness to a particular use. The assessment was conducted using standard engineering and scientific judgment, principles, and practices, within a practical scope and budget. It is based partially on the observations of the assessor during the site visit in conjunction with archival information obtained from a number of sources, which is assumed to be correct. Except as provided, Friesen Drillers Limited has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g. number of boreholes drilled or water quality samples submitted for laboratory analysis) interpolated between sampling points and the actual conditions on the site may vary from that described above. Any findings regarding the site conditions different from those described above upon which this report was based will consequently change Friesen Drillers Limited's conclusions and recommendations.

Disclaimer

This Friesen Drillers Limited report has been prepared in response to the specific requests for services from the client to whom it is addressed. The content of this document is not intended to be relied upon by any person, firm, or corporation, other than the client of Friesen Drillers Limited, to who it is addressed. Friesen Drillers Limited denies any liability whatsoever to other parties who may obtain access to this document by them, without express prior written authority of Friesen Drillers Limited and the client who has commissioned this document.

Table 2
Well Inventory – 3,200 Meter (2.0 mile radius)
Proposed Quarry Site - Section 4-12-2 EPM – RM of Rosser

No.	Location	Owner	Driller	Well Use	Date	Depth (ft.)	S.W.L. (ft.)	P.W.L. (ft.)	Rate igpm
1	SE4-12-2E	BRODA CONSTRUCTION LIMITED	Friesen Drillers Ltd.	P	2006	39	11.1	17.5	165
2	SW-4-12-2E	L LAWRENCE	Friesen Drillers Ltd.	P	1978	149.9	16	25	24.9
3	SW-4-12-2E	N MARTIN	Stonewall Drilling	P	1993	135.9	18	N/A	299.8
4	NE-4-12-2E	D RITCHIE	Echo Drilling Ltd.	P	1987	139.9	15	17	19.9
5	SW4-12-2E	CRYSTAL CHARTRAND	UNKNOWN	P	1900	N/A	N/A	N/A	N/A
6	SW3-12-2E	ERNIE FUTROS	Perimeter Drilling Ltd.	R	1992	200	45	45	25
7	SW3-12-2E	ERNIE FUTROS JR.	Perimeter Drilling Ltd.	P	1992	270	47	49	35
8	NW33-11-2E	LACH BROS	Friesen Drillers Ltd.	P	1980	209.9	21	60	99.9
9	NW33-11-2E	G LACH	R. MUELLER DRILLING	P	1976	142.9	25	N/A	10
10	SE9-12-2E	DON MOURANT	Perimeter Drilling Ltd.	P	2003	110	20	21	80
11	SE-9-12-2E	R VAGER	PRUDEN DRILLING CO. LTD.	P	1964	148.9	14	N/A	19.9
12	SE-9-12-2E	D DOROSCHUK	Stonewall Drilling	P	1982	111.9	21	N/A	15
13	SE-9-12-2E	G MOHR	Stonewall Drilling	P	1979	149.9	11	19	11.9
14	NE-5-12-2E	VAGER BUILDERS	PRUDEN DRILLING CO. LTD.	P	1968	50	5	N/A	10
15	NE33-11-2E	SENECA KENNALS	Perimeter Drilling Ltd.	P	2012	220	6	N/A	120
16	9-12-2E	D DOROSHUK	Ford Drilling Ltd.	P	1973	104.9	20	N/A	6.9
17	9-12-2E	D RIEKE	Perimeter Drilling Ltd.	P	1990	124.9	15	N/A	99.9
18	NE32-11-2E	J OATWAY	Stonewall Drilling	P	1985	143.9	20	28	24.9
19	SW-10-12-2E	C KLIMPKE	Stonewall Drilling	P	1983	77.9	14	20	44.9
20	SW-10-12-2E	FUL-FLOW INDUSTRIES	Ford Drilling Ltd.	P	1980	119.9	0	22	19.9
21	SW10-12-2E	MARGARET MCKEWEN	Perimeter Drilling Ltd.	P	1996	100	25	N/A	100
22	SW-10-12-2E	FUL-FLO INDUSTRIES	Perimeter Drilling Ltd.	P	1988	141.9	20	17	109.9
23	SE-8-12-2E	N PERIMITER CONST	Stonewall Drilling	P	1989	179.9	19	N/A	39.9
24	SE8-12-2E	MARGIN OATWAY	Interlake Water Supply	P	1981	35	17	N/A	15
25	NW34-11-2E	D KROLL	Paul Slusarchuk Well Drilling LTd.	P	1983	185.9	27	N/A	24.9
26	NW9-12-2E	TOM JOUBERT	UNKNOWN	P	1974	N/A	N/A	N/A	N/A
27	NW9-12-2E	TOM JOUBERT	UNKNOWN	P	1997	N/A	N/A	N/A	N/A
28	SW-5-12-2E	J OATWAY	Stonewall Drilling	P	1978	76	7	10	10
29	NE9-12-2E	DENISE RIEHL	Perimeter Drilling Ltd.	P	1996	160	20	N/A	15
30	NE-9-12-2E	H MCDONALD CONST	PRUDEN DRILLING CO. LTD.	P	1964	97.9	10	N/A	19.9
31	NW-9-12-2E	R MUELLER	R. MUELLER DRILLING	P	1976	N/A	0	N/A	10
32	NW-9-12-2E	M CHATFIELD	Perimeter Drilling Ltd.	P	1989	104.9	15	15	79.9

33	32-11-2E	P HUDSON	MIKE FUTROS & SONS	P	1970	210.9	5	18	45.9
34	SW-34-11-2E	N FINKEL	SONIC DRILLING CO. LTD	P	1966	149.9	29	47	49.9
35	10-12-2E	C KLIMPKE	Stonewall Drilling	P	1981	134.9	14	25	15
36	10-12-2E	E KLIMPKE	Friesen Drillers Ltd.	P	1979	104.9	14	34	10
37	SE-10-12-2E	W KLIMPKE	PRUDEN DRILLING CO. LTD.	P	1966	100.9	7	9	19.9
38	SE-10-12-2E	BUILDING PRODUCTS	Paul Slusarchuk Well Drilling LTd.	P	1991	325.8	17	N/A	99.9
39	NW32-11-2E	D PEDERSEN	Stonewall Drilling	P	1981	102.9	12	20	39.9
40	NW-10-12-2E	W PETLOCK	WALKER, LORNE	P	1969	99.9	25	35	19.9
41	NW10-12-2E	CHALDEM PASAK	Stonewall Drilling	P	2000	122	20	N/A	50
42	NE-8-12-2E	N SMITH	Paul Slusarchuk Well Drilling LTd.	P	1971	138.9	17	25	29.9
43	NE-8-12-2E	S FUTROS	MANITOBA DIAMOND DRILLERS LTD.	P	1985	84.9	5	5	7.9
44	NE34-11-2E	MANITOBA HYDRO	UNKNOWN	P	2012	N/A	N/A	N/A	N/A
45	10-12-2E	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	UNKNOWN	P	1900	N/A	N/A	N/A	N/A
46	NE8-12-2E	RM OF ROSSER	Perimeter Drilling Ltd.	P	1994	221.9	6	79.9	261.8
47	NW10-12-2E	CHALOEM PASAK	Stonewall Drilling	P	1981	122.9	18	26	24.9
48	NE10-12-2E	ROB SIMIACO	Perimeter Drilling Ltd.	P	1998	240	45	N/A	13.9
49	NE10-12-2E	ADESA CAR AUCTION	Maple Leaf Enterprises Ltd.	P	2004	120	4	N/A	N/A

Notes

All information sourced from Manitoba Sustainable Development – GWDRILL, (2016 edition)

Friesen Drillers Limited has not verified or field confirmed any data present in this table. All yields and static water levels are as reported and have not been verified by Friesen Drillers Limited. Current well use or operations are unknown for all wells listed.

S.W.L. – Static water level; P.W.L. – Pumping water level; N/A – Not Available; P – Production; R – Recharge.

WATER and NATURAL RESOURCES MANAGEMENT PLAN
in SATISFACTION of RURAL MUNICIPALITY OF ROSSER
QUARRY OPERATION BY-LAW NO. 8-15

SUBMITTED TO:

North Perimeter Aggregates Inc.
Broda Properties Inc.

PREPARED BY:

MLi3 Inc.

March 1, 2019

ACKNOWLEDGEMENTS

MLi3 Inc. acknowledges with gratitude the guidance and suggestions received from government representatives who offered input into the development of this Water and Natural Resources Plan (WNPMP). Further, gratitude is expressed for the guidance and suggestions offered by neighbouring landowners who voluntarily participated in the 2008-2009 Citizens Advisory Committee process to constructively critique (i) Broda's design of the evolving project, and (ii) Tetr*ES* Consultants Inc.'s 2010 Environmental Impact Assessment of the then-current project. The contributions to the WNRMP of the former Tetr*ES* team that now are part of and support Broda through MLi3 Inc. are acknowledged with particular appreciation. Third-Party Peer Review by and suggestions from Mr. Geoff Reimer, P.Eng. of GPR Project Management and Consulting Inc. were especially helpful. They are also acknowledged with particular gratitude. Third-Party Peer Reviews by Mr. David Capelle, Ph.D. and a highly respected and experienced Water Resources Engineer in Manitoba are also acknowledged with gratitude. Relevant information prepared by DST Consulting Engineers Inc., WSP Engineering and HCG Engineering is acknowledged with appreciation.

STUDY TEAM

J. Michael McKernan	Environmental Scientist; Principal in Charge
Mike J. Sweet	Environmental Scientist
Sandy Gorrie	Survey Botanist and Plant Taxonomist
Richard Bruneau	Researcher; Information Management Specialist
Anna Morrison	Researcher, Document Production, and QA

DISCLAIMER

MLi3 Inc. accepts no responsibility for damages of any kind, if any, suffered by any third party as a result of decisions made or actions based on this Water and Natural Resources Management Plan ("WNRMP; this report"). All conclusions, views, and opinions expressed in this report are those of MLi3 Inc.

USE OF THIS REPORT:

This report has been prepared for the sole benefit of Broda Properties Inc. ("Broda", or "the Client" or its agent) and may not be used by any third party without the express written consent of MLi3 Inc. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT:

The information, opinions, and/or recommendations made in this report are in accordance with MLi3 Inc.'s present understanding of the Client's site(s) and/or the project(s) and/or actions referenced herein. If the proposed site-specific locations, site uses, actions and/or project(s) differ(s) or is/are modified from what is described in this report, or if the site conditions as described herein are altered, this report is no longer valid unless MLi3 Inc. is requested by the Client to review and revise the report to reflect the differing or modified location, land use and/or project specifics and/or the altered site condition(s).

STANDARD OF CARE:

Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in Manitoba for the specific professional service provided for the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS:

All site-specific descriptions, and statements regarding their influence on the findings and recommendations made in this report, are based on site conditions encountered by MLi3 Inc. at the time of its site-specific work and at the specific testing and/or sampling locations on the Client's property(s) examined by either Tetr*ES* Consultants Inc. or Stantec Consulting Ltd. by whom the author was employed over the periods, respectively, of 1990-2010 and 2010-2015. Environmental descriptions and other classifications and/or statements of site condition(s) have been made in accordance with normally accepted professional practices which are judgmental in nature; no specific description in this report should be considered exact, but rather to be reflective of the anticipated behaviour of the material or matrix in question. Extrapolation of in situ conditions can be made only to some limited extent beyond the understandings set out herein, being in turn based on specific localized sampling or test points. The extent depends on variability of the soil, rock, groundwater conditions, species composition, habitat types, habitat uses, etc., as influenced by geological processes, time, seasons, planned construction activity, and intended site use(s).

VARYING OR UNEXPECTED CONDITIONS:

Should any site or subsurface condition(s) be encountered in the future, if the proposed land use or project proceeds, that are different from those described in this report or encountered at the test locations referenced herein, MLi3 Inc. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. MLi3 Inc. will not be responsible to any party for damages incurred as a result of that party failing to notify MLi3 that differing site or subsurface condition(s) are present upon becoming aware of such conditions.

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STUDY TEAM

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1.0 INTRODUCTION

1.1 INTENT TO DEVELOP HIGH-QUALITY AGGREGATE QUARRY

Broda Properties Inc. (operating in Manitoba as "North Perimeter Aggregates Inc.") has been working to develop a high-quality aggregate-supply business on the property it owns in the Rural Municipality (RM) of Rosser. The site is approximately 589 acres on lands in Section 4, Township 12, Range 2, EPM, and Section 33, Township 11, Range 2 EPM. All land in the proposed project is held by Broda.

The proposed multi-stage development is located close to and west of the intersection of Mollard Road and Metro Route 90, immediately west of Klimpke Road, ~3 km (~2 miles) southeast of the intersection of the Perimeter Highway (Provincial Trunk Highway [PTH] 101) and PTH 7 (Figure 1-1).

Figure 1-1. Development is located 1-2 miles south of Perimeter Highway, west of intersection of Mollard Road and Metro Route 90, between Sturgeon Rd (west), Klimpke Rd. (east). Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010.

The proposed operation is not a use that was permitted under the former land-use planning and administration scheme that applied to the lands before creation of CentrePort in 2008. The property is zoned for agriculture, the prevailing local land use (Figure 1-2). (The prevalence of the agricultural land use is evident in digital imagery routinely captured by satellites [Figure 1-3])

Figure 1-2. The development is planned for land now zoned and used for agriculture south of Perimeter Highway, west of west of Metro Route 90. Source: Google Earth, MLi3 Inc.

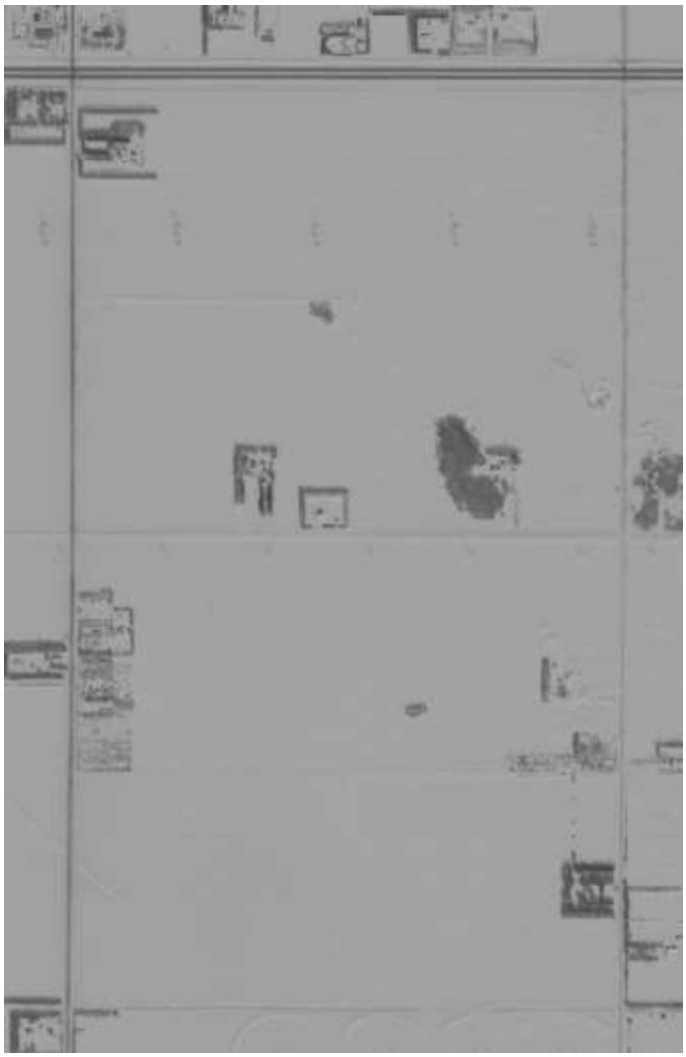

Figure 1-3. Prevalence of agriculture is reflected in unsupervised classification mapping of grey-toned "spectral signature" for cropland in recent satellite image. Darker polygons are shelterbelts, woodlots, houses, machine sheds, etc. Source: Google Earth, MLi3 Inc.

Accordingly, to support applications for Conditional Approval by the RM and South Interlake Planning Board (SIPD) of the proposed new land use, Broda worked for several years with the information and guidance from a Citizens Advisory Committee (CAC) of neighbouring landowners. This Committee collaborated briefly with Broda in 2005-2006 to help plan a project where all possible potential impacts could be identified, assessed and precluded. This was then expected to occur through a combination of careful project development and impact mitigation, ongoing environmental monitoring, and ongoing collaboration with the CAC.

The proactivity of Broda's approach, and the very high level of corporate commitments to the highest standards of possible environmental and socioeconomic care notwithstanding, several applications for the requested change in land-use zoning over many years were rejected by Rosser Council (and, accordingly, SIPD). Broda has, nonetheless, continued to believe in the

intrinsic value of the project. Broda continues to believe that there was, and is, significant growing economic need and opportunity.

Broda has therefore continued to invest in building the knowledge necessary to develop the site in a sensitive fashion, consistent with the state-of-the-art in limestone quarry development and operations.

Recent (2016) changes in the planning processes applying to the lands within the CentrePort Special Planning Area (SPA) acknowledge that the quarries should be a "permitted use". This intent is consistent with the Inland Port SPA Regulation 48/2016, specifically its Aggregate Policy 6.1.2.3. This Policy notes that in "an area designated by the appropriate provincial authority as having 'high' or 'medium' mineral content must have the mineral extracted prior to it being developed for other uses, unless otherwise approved by the authority". The Broda property is located above the last undeveloped provincially-designated 'High Quality" limestone ore body (Figure 1-4; Baracos 1983). Recovering these high-value construction materials can reduce the costs of infrastructure construction in the Winnipeg-centred region, improving construction-project economics.

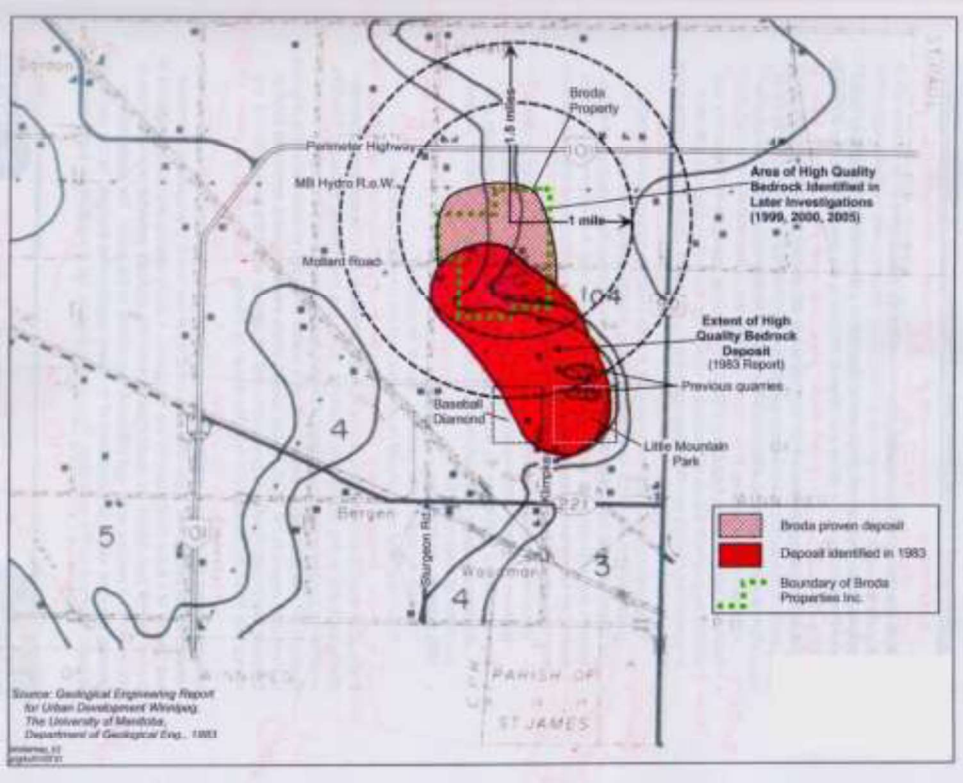

Figure 1-4. Development is located above last undeveloped provincially-designated 'High Quality" limestone-ore body. Deposits under Broda land have variable surficial topography, and are northern continuity of a geological formation trending to southeast. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010.

To be developed in five stages, the highest concentration of the highest-value materials, located generally north of Mollard Rd., will be quarried first (Figure 1-5). This first few stages of the project development are often termed "Stage 1" throughout this report (and in related documents prepared by MLi3 for Broda). A portion of Little Mountain Park immediately southeast of the

property (Figure 1-4) was the land use developed after aggregate materials from the southerly extension of the same geological formation were quarried.

Figure 1-5. Initial development stages will address variable elevations and thicknesses of last undeveloped provincially-designated 'High Quality" limestone-ore body. Shape of complete excavation is nominal; i.e., expected but not certain. Shape will depend on field conditions. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010

1.2 PROVINCIAL REGULATORY GUIDANCE FOR QUARRY DEVELOPMENT

The CentrePort Act, assented to on October 9, 2008, mandates the creation of an "inland port" to encourage transportation, warehousing, trade, manufacturing, and distribution throughout Manitoba, but especially in proximity to the James Armstrong Richardson International Airport. The province initiated a process to create a "Manitoba Development Plan for CentrePort Lands", which included public, multi-stakeholder liaison, and consultations. The resulting planning scheme for the CentrePort land base proposed an enhanced future for the 20,000 acres within the Perimeter Highway considered necessary for the Project (MMM Group 2009). About 54% of the CentrePort lands fall within the RM of Rosser.

The Province has authority to ensure that quarries developed on Crown lands satisfy the stringent requirements for Environmental and Community Interests Protection under the *Mines and Minerals Act*. The planning, operations-related monitoring, and decommissioning requirements set out under The *Quarry Minerals Regulation* (QMR; MR 65/92) amplify these protections. They do so in the form of specific prescriptions for beneficial action, and against specific unwanted action. These prescriptions apply strictly to projects proposed on Crown lands. Their

protective value, however, means that they are often applied to various processes for permitting, or to approvals, for private-land development. Clause 43(1)(b)(ii) of the QMR requires minimum separation/setback distance of 400 m between any rural residence and the aggregate-mining boundary. Most rural municipalities regulating aggregate operations use this setback distance as a condition in a CUA decision to create a "buffer zone". Another example would be decisions by Manitoba Sustainable Development to include several of these QMR prescriptions as conditions if a license were to be issued under *The Environment Act*.

1.3 GUIDANCE FOR QUARRY DEVELOPMENT ON CENTREPORT LANDS

The *Inland Port SPA Planning Regulation* MR 48/2016 allow a quarry as permitted land use within the Heavy Industrial Zone (Class 3; "I3"), on the CentrePort lands within the RM of Rosser. Taken together, they create another set of protections for environmental and community interests. Approval of a proposed quarry, pursuant to rezoning recommendations of the Inland Port SPA Planning Authority Board which has jurisdiction over these lands, must be made by the Minister of Indigenous and Municipal Relations. The Minister's decision can occur only after a public review of the proposal, including a public hearing administered by the Planning Authority Board.

1.4 R.M. OF ROSSER QUARRY OPERATIONS BY-LAW

In addition to these levels of environmental and community protection, including the requirements for a public hearing, and a review and issuance of approval conditions by an independent Planning Board that it co-chairs, Rosser has created a special By-law ("Quarry Operations By-Law"; Rosser By-law No. 8-15; a.k.a. the "Aggregate By-law") to create further control over such aggregate operations.

1.4.1 Assessment and Plans Required by Quarry-Operations By-law

As one type of control measure included in the Aggregate By-law, the By-law sets out requirements for several formal Assessments and Plans that must be reviewed and approved by Rosser. As prescribed in the By-law, set out in Clause 13 and Schedule A, and along with other Plans that Broda will prepare to satisfy various other requirements (e.g., MLi3 2019f), these specific Plans include the following:

- "Adaptive Management Plan" (submitted as the "Adaptive Management and Progressive Rehabilitation Plan"; ["AMPRP"]; MLi3 2019a)
- "Progressive Rehabilitation Plan" (subsumed within the AMPRP; MLi3 2019a)
- "Sound Impact Assessment" (submitted as the "Sound Impact Management Plan and Sound Impact Assessment"; ["SIMPSIA"]; MLi3 2019b)
- "Transportation Plan" (MLi3 2019c)
- "Visual Impact Assessment (submitted as the "Visual Impact Management Plan and Visual Impact Assessment"; ["VIMPVIA"]; MLi3 2019d)
- "Water and Natural Resources Management Plan" (MLi3 2019e); this plan

- Preliminary Confidential Conceptual Environmental Monitoring Plan (EMP) (MLi3 2019f; confidential; in prep.)
- Rosser Quarry Preliminary Confidential Conceptual Operating Plan. WSP Engineering (WSP Canada Group Limited). 2019 (confidential; in prep.).
- Proposed Limestone Quarry in The RM of Rosser Traffic Impact Study. WSP Engineering (WSP Canada Group Limited). 2018
- Blast Impact Assessment – Proposed North Perimeter Aggregates Quarry, Rural Municipality of Rosser, Province of Manitoba. DST Consulting Engineers Inc. 2018
- Noise Impact Assessment, Lilyfield Quarry, Rosser, Manitoba. HGC Engineering. 2018.

Broda has instructed MLi3 Inc. of Winnipeg to develop these (and other) documents (and review those prepared by others) to support its application for rezoning of its property within the RM of Rosser. The MLi3 documents have been considered, adopted and committed to by Broda (Broda *pers comm.* 2018). All the documents will be formally filed in support of Broda's request for rezoning of its property (MLi3 2019 a, b, c, d, e, f). This WNRMP will be supported by Broda's execution of the AMPRP.

This WNRMP was developed in relation to the same Project Description considered in: (i) the draft Conceptual Operating Plan; (ii) the required "Sound Impact Assessment" (SIA) component of an integrated "Sound Impact Management Plan and Sound Impact Assessment" (SIMPVIA) document; (iii) the required "Visual Impact Assessment" (VIA) component of an integrated "Visual Impact Management Plan and Visual Impact Assessment" (VIMPVIA) document; (iv) Broda's Preliminary Environmental Monitoring Plan (EMP); and (v) the AMPRP.

This document is proactive. While its preparation is intended to satisfy a formal requirement of the RM of Rosser, it is not formally required by any other regulatory body. It has been prepared at Broda's instruction to support compliance with corporate environmental due diligence policies, satisfaction of a By-law 8-15 requirement and, most importantly, to honour previous corporate commitments to Broda's neighbours and to provincial water-resources regulators.

The elements and organization of the activities outlined in this corporate WNRMP rely on published non-peer-reviewed research reports and data, published peer-reviewed reports and data, common sense, regulatory practice and precedent in Manitoba, extensive relevant professional multidisciplinary experience, academic research, and communications with and guidance from provincial regulators.

2.0 PURPOSE

The development and operation of an aggregate quarry will create impacts on the closely proximate groundwater and surface water. Landowners living beside quarries, especially those operations that are older and poorly capitalized, can and do complain of nuisance, even health impacts, because of perceived and measured they rely on (e.g. OSSGA 2010, USGS undated,

Green *et al* 2005). For parties living beside such industrial activity, the implications for their well-being can be significantly negative unless the proponent takes suitable effective steps to prevent and minimize unavoidable impacts.

Accordingly, Broda commissioned MLi3 to develop (i) the Sound Impact Management Plan component of its Sound Impact Management Plan and Impact Assessment (SIMPSIA); (ii) the Visual Impact Management Plan component of its Visual Impact Management Plant and Impact assessment (VIMPVIA); (iii) the preliminary Conceptual Environmental Monitoring Plan (EMP); (iv) the Transportation Plan (TransPlan); and (v) the Adaptive Management and Progressive Rehabilitation Plan (AMPRP) as fully integrated components of the project. To assist it to understand impact potential further so as to more precisely mitigate the potential for impacts, Broda also commissioned a Blasting Impact Assessment, a Noise Impact assessment and a Traffic Impact assessment, all produced by others. This WNRMP is to provide the data and to better plan the all the actions needed to prevent or mitigate impacts on the groundwater and surface waters of the site and immediate region. Data generated from actions prescribed in this Plan will also support execution of the AMPRP in an evidence-based and timely manner.

Execution of the five plans prepared by MLi3 will be informed and mindful of the insights gained from the other impact assessments and studies. Such execution will contribute to the corporate satisfaction of: (i) provincial requirements for protection of worker health, neighbourhood health and the ambient groundwater and surface water environments (i.e., the specific requirements of the Manitoba Workplace Safety and Health Division and Manitoba Sustainable Development ["MSD", through the former Water Management Branch]); (ii) relevant requirements of RM of Rosser By-law 8-15, (iii) proactive execution of the Development Agreement that Broda advises it will negotiate with the RM, and (iv) various corporate commitments Broda made in prior years to: (a) the reactivated local volunteer Citizens Advisory Committee, (b) participants at public Open Houses from 2004-2010, (c) public hearings administered by the RM of Rosser in 2010 about the proposed project, (d) several landowners adjoining the Broda property; (e) Mines Branch ("MMB"), and; (f) the former Water Management Branch.

The impact-prevention and/or –mitigation components of these plans, assessments and studies embody the 'state of the art' in proactive management of a modern, well-capitalized, and well–operated quarry during its operational phase. They are intended to help develop and maintain strong positive relations with the site's workers, neighbours (through planned ongoing constructive engagement with the CAC), and the project's regulators.

This document is filed in support of Broda's request for a change in the zoning of its lands. Its filing adds to the weight of evidence filed to demonstrate satisfaction of the applicable requirements set out in the *Inland Port SPA Planning Regulation* MR 48/2016 that allows a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") on the CentrePort land base.

3.0 PERFORMANCE OBJECTIVES

3.1 NUISANCE AND IMPACT PREVENTION AND MANAGEMENT

The performance goals and objectives of this WNRMP are consistent with the current state-of-the-art in nuisance and impact prevention and mitigation (e.g., Manitoba Environment Act's 2015 Proposal Report Guidelines, based on the *Licensing Procedures Regulation (Manitoba Regulation No. 163/88*). They have also been informed by the findings and the insights gained from the other impact assessments and studies (WSP 2018, DST 2018, HGC 2018). They were also selected having regard to very similar work done elsewhere in the world where nuisance and impact prevention and mitigation were the purposes of evidence-based quarry planning and management (Manoj and Prasannakumar 2002). They are:

- Complete practical environmental monitoring to create the evidence needed to optimize operations of the proposed project, which will require occasional blasting to loosen rock, (thereby facilitating operations of a Continuous Surface Miner (Appendix E), to prevent or mitigate the adverse effects on the ambient sonic and visual environments having potential to impact the health of site workers, the comfort of neighbours, or habitat use by fauna on-site.
- Use credible public-domain analytical tools and methods best able to support identification and tracking of significant, persistent, post-mitigation effects of the project.
- Use the monitoring data from the Preliminary EMP (and other plan components) in optimizing and executing the five impact-prevention and/or -mitigation plans.
- Render the potential for project nuisance or impact effects for workers or neighbours to "non-significance" in the judgement of professional national and provincial regulators, including through evolution of Broda's current conceptual Blasting Plan (allowed by the QMR and the Rosser By-law) or improvements in aggregate-processing methods.
- Use the monitoring data, and public responses to these data, to evolve and refine the WNRMP over the operating years, especially for issues of consistent public and neighbour concern (e.g., insufficient springtime capacity in municipal ditches to accommodate runoff), in conjunction with inputs from MSD staff, and through dialogue with the CAC, responding proactively and thoroughly to any expressions of environmental concern or suggestions for improved surveillance methods, data interpretations and public and regulatory accountability.

3.2 PUBLIC AND REGULATORY ACCOUNTABILITY

In addition to collaboration with regulators, Broda will maintain a collaborative approach with its neighbours to execute and refine its WNRMP. Broda intends to reactivate and maintain collaborative dialogue with the Citizens Advisory Committee that Broda created in 2005. Broda supported several meetings with the CAC through 2006 to explore its needs for information and input to project planning until Committee members declined to participate after the project was rejected by Rosser Council in 2010. New participants in the Committee will be sought to augment the core of members willing to maintain their participation from the earlier years. Attendance at the CAC meetings will remain under an "open-door" policy. The former mechanisms for public accountability will be strengthened with new digital techniques. These

will provide for public input to and surveillance of quarry operations, and new techniques (e.g., interactive website, record logs [n=5]) for public and regulatory accountability.

4.0 WORK DONE TO DATE

4.1 AGGREGATE QUALITY AND QUANTITY

Investigative work to define the quality and quantity of the resources began at the site in November 1999, by the previous site owner, when 12 core holes were drilled for aggregate-assessment purposes on the north half of section 33-11-2E. This work was followed in April and May of 2000 with 14 test holes drilled on the south half of 4-12-2E. During August 2005, 9 test holes were drilled on the south half of 4-12-2E, for assessment purposes. A major and much more sophisticated assessment of surficial strata, structures and limestone quality occurred in 2015 (Stantec Consulting 2015). The new data have greatly expanded understanding of the resource.

4.2 CONFIDENTIAL DRAFT QUARRY CONCEPTUAL OPERATING PLAN

Broda has prepared a conceptual-level multi-stage plan for developing and operating the quarry (WSP Engineering [confidential; in prep.]; Appendix D). The scope of the current draft plan covers five stages of development. Key components of the plan have been influenced by the potential for minimizing nuisance effects of operations on the very few homes or businesses within three kilometres of the approximate centroid of the first three stages of the quarry (Figure 4-1). A conceptual five-stage development process has been rendered (WSP 2018), with the first three stages located north of Mollard Road. The current preliminary confidential Conceptual Operating Plan (see Appendix D) will be further refined through dialogue with MIT, MMB and the CAC, especially after conclusion of a bilateral negotiation of an Benefits Agreement.

SIPD By-law No. 01/02 has designated the area *"…specifically for mineral extraction prior to other types of developments.*" Manitoba Regulation 184/94 (Policy No. 9) sets out numerous requirements for the protection and use of such designated aggregate resources. Broda's conceptual Workplan is consistent with the relevant provisions of the SIPD By-law, MR 184/94 and MR 65/92. The conceptual Workplan sets out the current intended layout and expected quarry operations, involving:

- An evolving subsurface progressive-trench type of quarry created through use of Continuous Surface Miner technology (https://www.wirtgen.de) (see Appendix E).
- Routine monitoring of all blasting activities.
- Two wells for on-site monitoring of groundwater levels and quality. These two wells would be routinely monitored and the results disclosed to the CAC and regulators in Water Resources Branch (WRB) in MSD. Data from adjacent provincial monitoring wells (see Figure 4-5, p. 19) would be routinely gathered at the same time to assist in interpreting the

groundwater-level data generated from the on-site wells. Water-quality data for all the monitored wells would be shared with the CAC and the WRB regulators.

- Selective strategic and substantial lengths of site-perimeter berming and landscaping to create sound-absorbing/altering/reflecting screens of earthen windrows vegetated with native species adapted to the agricultural landscape of the region (Figures 4-2, 1-3).
- An office facility, associated with a scale and Scale House, which may be developed from an existing well-maintained structure on the property.

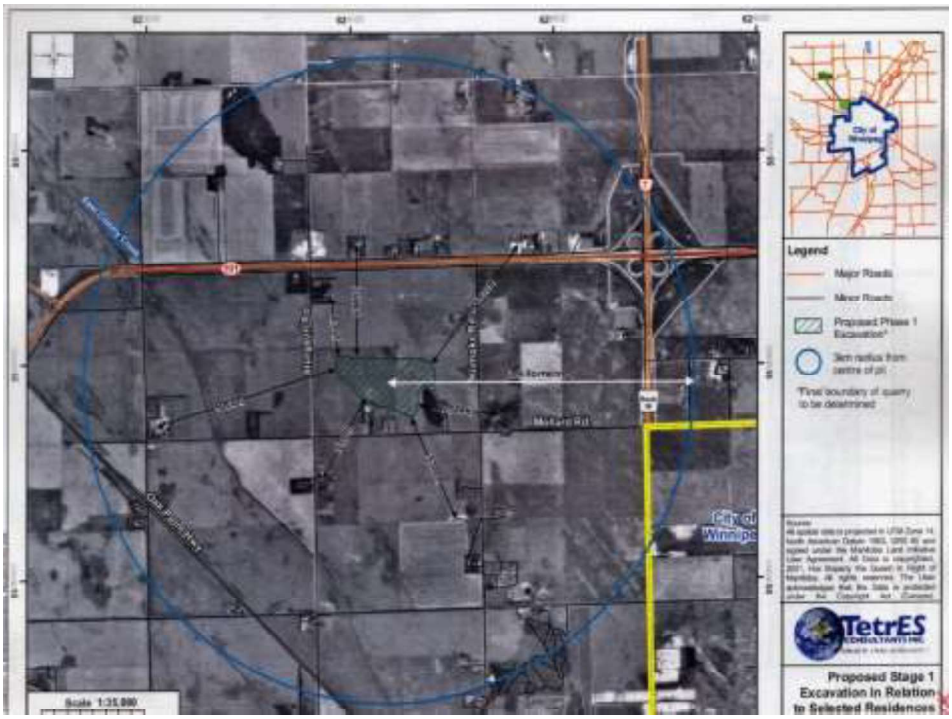

Figure 4-1. Distribution of the few occupied dwellings and businesses north of Mollard Rd. near the initial three stages of the proposed quarry. Sources: Google Earth, Tetr*ES* Consultants Inc., MLi3 Inc.

- A larger structure obscured by sound-absorbing and visual screening plantings of native trees and shrubs for large-vehicle maintenance and repairs.
- A small similarly screened workshop for small-equipment repairs.
- Stockpiles (mostly at grade) of stored aggregate products screened with sound-absorbing earthen materials.
- Protection of existing sound-absorbing/deflecting woodlots and shelterbelts.
- A machinery-parking area, located some distance north of Mollard Road in a current open area (Photo 1) that will be screened by a discontinuous strategically-placed sound-absorbing/deflecting earthen berm planted with native trees and shrubs.

Broda advises that the entire operation will be set back from and north of Mollard Road (Figure 4-2) and generally centred on the northern property (Photo 1) to maximize separation distance from the neighbours. In part, this is intended to maximize separation distance from the open excavation trench and the adjacent water-supply wells on neighbouring lands. The substantial regional background noise in the soundscape emanating consistently from the Perimeter Highway and occasionally from local and regional agricultural, industrial and commercial activities.

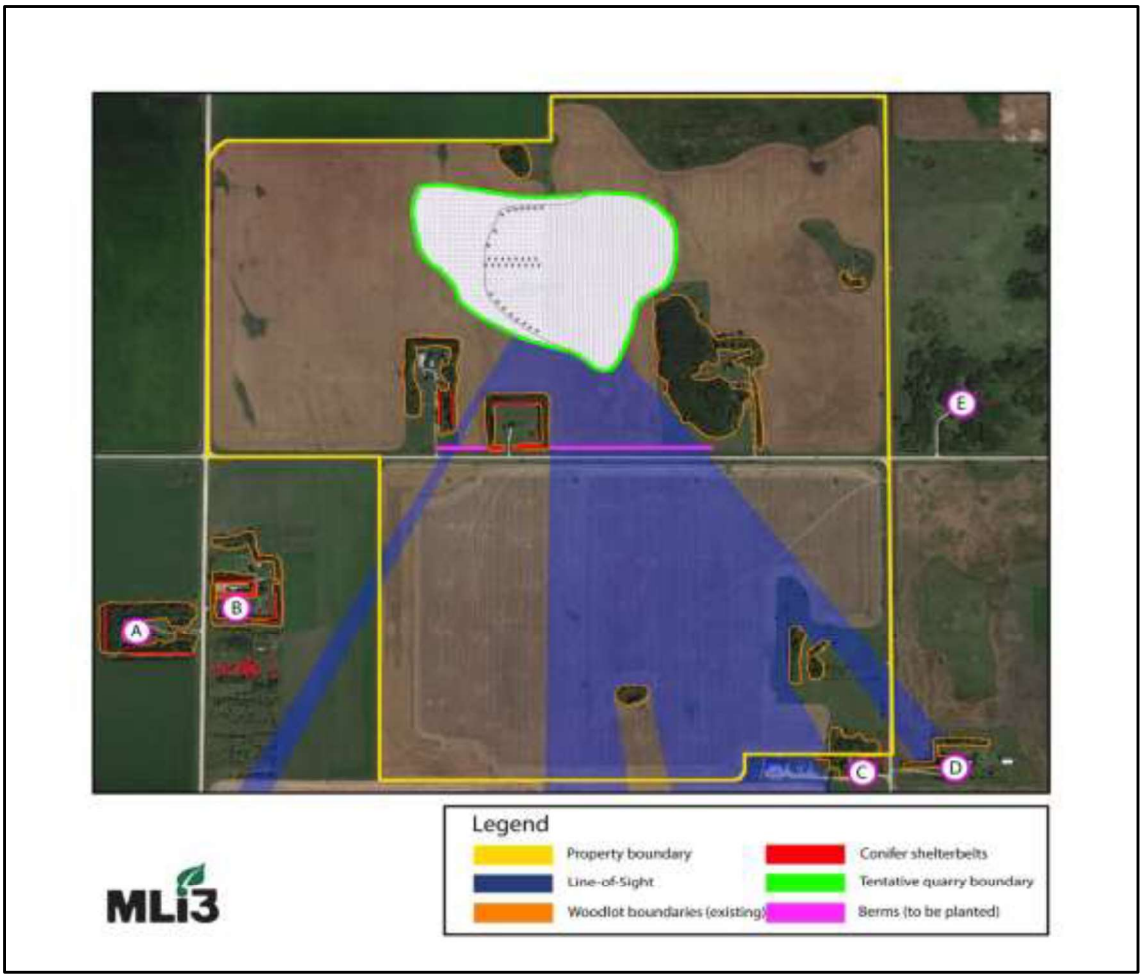

Figure 4-2. Shelterbelts and forest woodlots provide visual and sonic nuisance screening of vectors from the initial operations of the quarry to the southwest, south and southeast. Planted berms will mitigate impacts. Sources: Google Earth, MLi3 Inc.

Photo 1. Placement of the quarry's centroid of the first three stages is intended to maximize separation distance from adjoining water-supply wells from Broda's property. Sources: Google Earth, MLi3 Inc.

The site will be surrounded by discontinuous lengths, and shorter, strategically placed, sections of vegetated perimeter earthen berms. This should reduce and, in some cases and locations, completely prevent, off-site lateral propagation of sound from operating equipment and nuisance views of site operations. Soil and sandy material stockpiles will be screened by additional strategically placed (and higher) berms, to maximize localized absorption of nuisance sound (MLi3 2019b). Distances between quarry and aggregate-producing activities and the associated storage stockpiles will be minimized in the final site layout. This will help reduce on-site transportation noise by shortening the distance between material generation and material stockpiling. Berms will be planted with native fast-growing tree species like hybrid poplars (female cultivars, to prevent release of nuisance seed ['cotton']) and water-transpiring trees and shrubs.

Broda intends to plant fast-growing species on the strategic-screening berms such that summer sound-propagating pathways of most site buildings and viewscapes of most site operations should be minimal after establishment of the plantings. Slower-growing coniferous tree species are also to be planted, in density and in proximity to the faster growing deciduous trees and shrubs (Manitoba Forestry n.d.; University of Minnesota n.d.). This will protect the conifers, promoting their increased survival and growth. Techniques will be identical to those used for planting rural home and farm shelterbelts (PFRA 2015), especially those immediately nearby (Photos 1, 2). The planned species composition and densities are to enhance sound-absorbing and -screening capacity and visual texture and complexity. This will be very important where berms are planned to block the few sound-propagating pathways and sightlines for several landowners adjoining the Stage 1 quarry. The potentially significant pathways (i.e., < 1 km) are

to the south and north, not the east, southeast or west and southwest. These will be the highest priority for immediate placement of vegetated berms (Figure 4-2).

Photo 2. Typical shelterbelt of deciduous trees (e.g., aspen) protecting conifers (e.g., spruce), near intersection of Mollard Rd. and Klimpke Rd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

On average, up to ~80% of the time (DST 2018), Broda intends to use "Continuous Surface Miner" technology to loosen and fragment rock as efficiently as possible. Up to ~20% of the time, on average, (DST 2018), Broda will use judicious blasting techniques to loosen rock that is too hard to be broken up by the Surface Miner. This combination will be superior to the best current practices in the Manitoba quarrying industry. Broda plans to quarry the limestone using the Surface Miner to create a progressive-trenching excavation (Figure 4-3).

This technique will excavate loose rock down to its nominal design depth of ~5-8 m (Figure 4-4) so it can be crushed and conveyed for stockpiling. Final depth of excavation will depend on future varying combinations of excavation conditions, groundwater elevations and markets for the various types of construction materials that can be created from the crushing operation.

As previously noted, most heavy operating equipment will be placed or will operate at the base of the excavation (Figure 4-4). This places the equipment well below the sight- and sound-propagating pathways towards neighbouring homes.

As noted, the limestone would be quarried from an evolving, slowly moving and reconfiguring moving-trench excavation (Figure 4-3), traveling sequentially back-and-forth across the property over the years. Broda intends that non-commercial overburden quarried will be used to sequentially backfill areas behind the moving face. Thus, ongoing daily excavation operations will also, *de facto*, serve as execution of key elements of Broda's Adaptive Management and Progressive Rehabilitation Plan (AMPRP; MLi3 2019a), fulfilling the corporate commitments set out in the AMPRP.

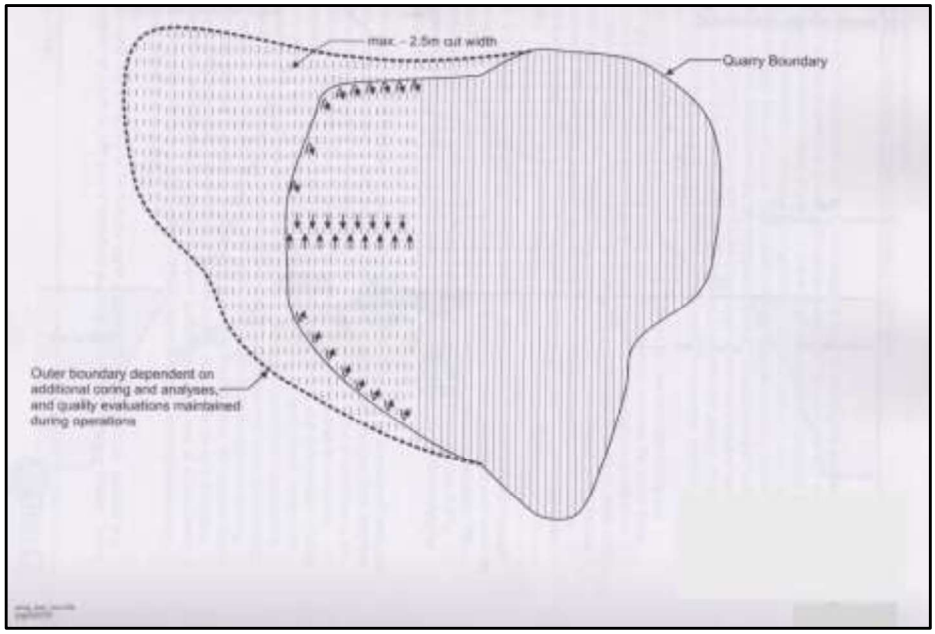

Figure 4-3. Initial quarry-development stages will address variable elevations and thicknesses of limestone-ore body using progressive-trenching excavation method. Final shape of complete excavation is nominal and will depend on field conditions. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010

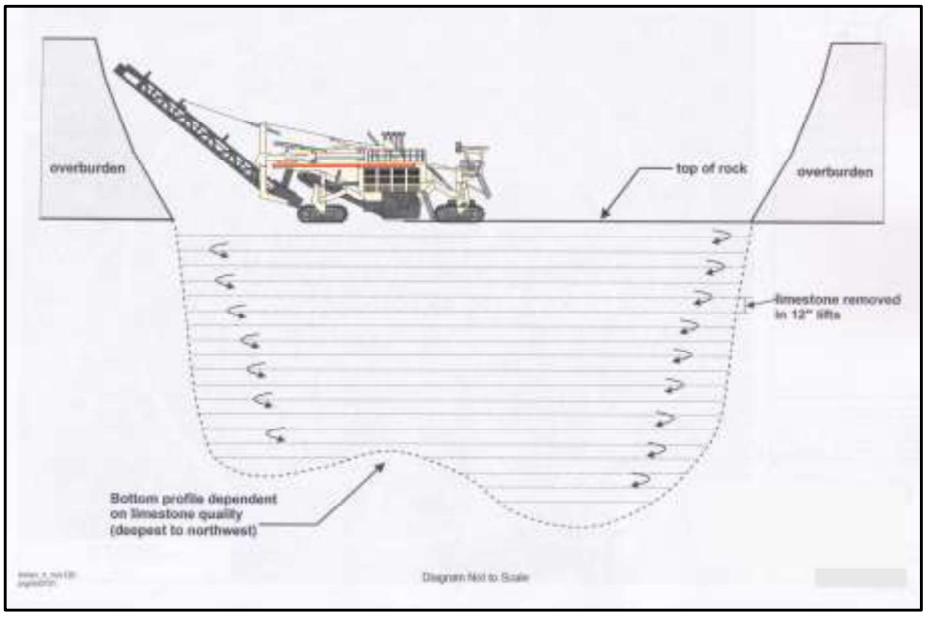

Figure 4-4. Excavators and conveyors delivering aggregate to surface will be well below sight- and sound-propagating pathways of adjoining properties. Final depth is nominal and uncertain; will depend on field conditions. Direct sound dissemination will be vertical, not lateral. Sources: Google Earth, KGS Group 2010, Tetr*ES* Consultants Inc. 2010

The quarry is intended to operate "seasonally" from about April to about November. Broda advises that the production goal is 5,000 to 6,000 tonnes/day of limestone, to be achieved during a Monday to Friday work week, 7 a.m. until 6 p.m., and on Saturdays 9 a.m. until noon. Broda estimates 15 to 20 seasonal workers will be hired during the operation phase, for a period up to a nominal 20+ years. When the "Phase 2" lands (south of Mollard Rd.) are developed, the staff size could grow.

Stockpiled finished limestone products are intended to be purchased and hauled by trucks to client. The proximity of the Broda quarry to Winnipeg and the Capital Region means that haul costs to construction sites should be substantially reduced over trucking from Stony Mountain and Stonewall. This would also mean fewer GHG emissions from haulage. Broda expects 150–200 trucks/day at peak production, and 50–75 trucks/day when aggregate demand is lower.

During collaborative consultations with Manitoba Infrastructure (formerly Manitoba Infrastructure and Transportation; MIT) in February 2010, MIT advised that it would not likely allow direct access to the Perimeter Highway (No. 101) by quarry vehicles. This was despite Broda's request for such access to reduce the sound impact of haulage past the sole resident close to the site on Mollard Road. Consistent with this dialogue, and guidance from MI (Magnusson *pers comm* 2017, Coleman *pers comm.* 2017), Broda's planned access to the site is still from Brookside Boulevard, along a short (~1-mile) section of Mollard Road (Photo 3, 4; MLi3 2019c).

Photo 3. Recently upgraded intersection of Mollard Road and Brookside Blvd, looking north from Mollard. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Broda has advised that it intends to enforce proper site access and egress. It will also ensure no chronic local road-dust nuisance is created by truck traffic. It plans to pave and maintain the portion of Mollard Road between its site and Brookside Blvd. (Photo 4), and to integrate that upgraded road section with the recently upgraded intersection with Brookside Blvd. (Photos 3, 4; MLi3 2019c), pending final review of results from the confidential WSP Traffic Impact Study (WSP Engineering 2018).

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Photo 4. West-facing view of Mollard Road taken from east side of upgraded intersection with Brookside Blvd. Photo taken Oct 28, 2017. Source: MLi3 Inc.

Broda also intends to maintain this upgraded access route (e.g., removing these costs from the RM's annual road-maintenance budget, a very significant benefit to the RM). In response to complaints, which it will monitor, document and disclose (section 6 herein), Broda has committed to check and take immediate corrective action (Tetr*ES* Consultants 2010). The quarry is planned to satisfy regulatory requirements and be subject to public regulatory reviews. Quarry operations will be the subject of a benefits-sharing Agreement "Development Agreement" measures that Broda intends to negotiate with the RM of Rosser.

4.3 REVIEW AND RECONSIDERATION OF ISSUES AFFECTING BRODA'S PROJECT PLANNING, LAYOUT AND OPERATIONS

Broda has reviewed the records for meetings with the CAC from 2005-2006 for issues it expressed. Broda's review has guided the data-gathering and impact-prevention activities that have been completed to date, including the confidential draft Conceptual Operating Plan (WSP 2019 in prep.; see Appendix D). In developing this Plan, Broda has reconsidered all past guidance received through collaborative dialogue with government departments and officials (especially Manitoba Conservation, Manitoba Mines Branch and Manitoba Infrastructure).

4.4 WATER MANAGEMENT

Broda's most intensive and sustained investment in the past decade has been in building understanding of the surface and groundwater environments at the site and in the region. The product was a Water Management Plan (WMP) created by KGS Group for Tetr*ES* Consultants in 2010. The KGS 2010 WMP was filed in support of Broda's last unsuccessful application for a conditional use approval in 2010. Among other things, the WMP examined the potential for dewatering (or other) effects on drinking-water wells on adjoining lands and defined initial conceptual impact-prevention and mitigation measures. This WNRMP builds upon and amplifies the 2010 KGS WMP. In due course, this WNRMP will likely evolve as data accumulate.

4.4.1 Groundwater Yields, Levels and Chemistry Patterns

Because surface runoff accumulations are not likely to affect operations or neighbours, Broda has investigated the potential for quarry-dewatering operations to create impacts. Broda has completed substantial hydrogeological work at the site over the recent ~15-year period.

4.4.1.1 Baseline Groundwater Yields

Previous hydrogeological work included test drilling of the shallow bedrock and installation of two monitoring wells in the shallow (Stony Mountain formation) and deep (Red River formation) bedrock aquifers (Friesen Drillers 2006a). In November 2002, two test holes were drilled on southeast 4-12-2E and completed as monitoring wells in the shallow (7.6 m) and deep (45.7 m) bedrock aquifers. During August 2005, nine test holes were drilled on the south half of 4-12-2E, for aggregate quantity and quality-assessment purposes, with four test holes completed as monitoring wells. Short-term, low-capacity hydrogeological pumping tests were completed in September 2005, January 2006, November 2006 and March 2007 (Friesen Drillers 2009) to determine baseline groundwater yields.

4.4.1.2 Baseline Groundwater Levels

Using two of several monitoring wells that survived farming practices on the site over the years, a record of water levels from both the Stony Mountain and Red River aquifers was collected from July 2006 through April 2009 data collected by Tetr*ES* Consultants (KGS 2010; Figure 4-5). These data are contrasted with the long-term water-level record for the Red River Formation from 1965 to 2010 in a Provincial government monitoring well located 1.6 km to the northeast.

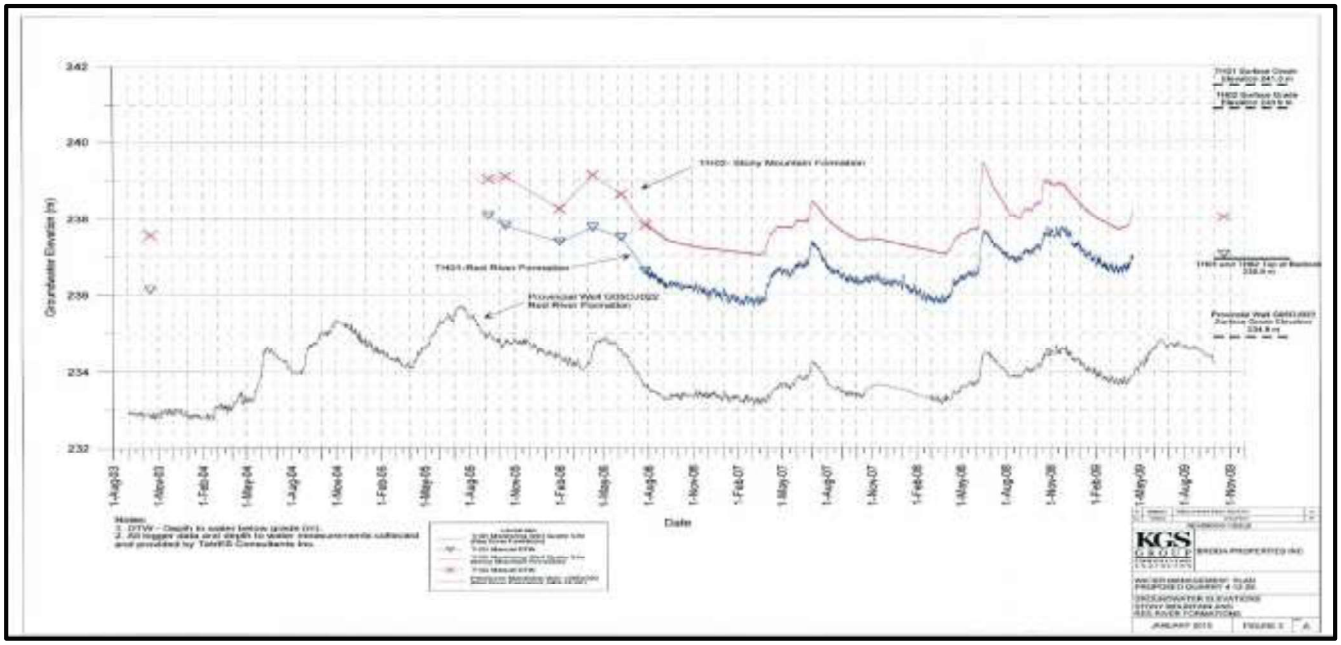

Figure. 4-5. Continuous Groundwater-Level Data for On-Site Wells (2006-09) and for Adjacent Provincial Groundwater-Monitoring Well (2003-09).

No well monitoring occurred for some years but data were retrieved from the two on-site monitoring well dataloggers in late 2016 by Stantec Consulting for MLi3 Inc. (Figure 4-6).

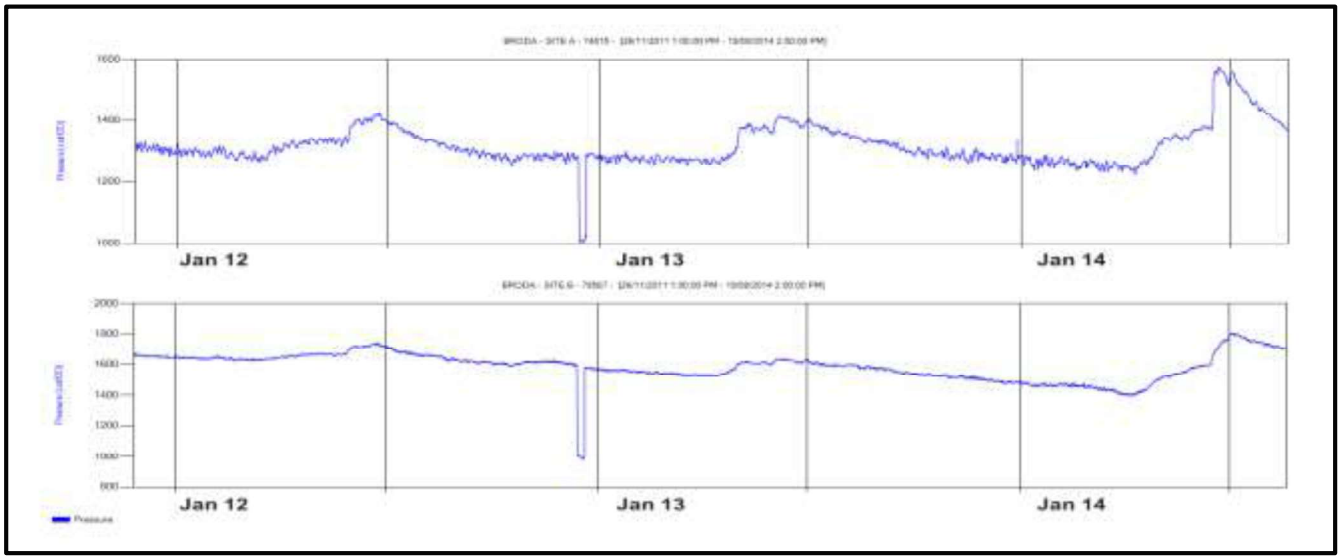

Figure 4-6. Recent (2016) Groundwater-Level Data for On-Site Wells.

These data are not straightforward to interpret. The seasonal trends correspond well with the trends in the other data, from prior monitoring over the past decade, but because these data were recorded in units of *pressure*, while the prior data are expressed as *elevations* above sea level, the datasets and trends are not strictly compatible. They have therefore have not yet been entered into the longer-term dataset. They will be if the pressure data can be translated into elevations.

Attempts to gain additional data from the wells before freeze-up were made in November 2017 in hopes that the additional data would corroborate the earlier data and that both additional datasets could be included in the longer-term dataset. Unfortunately, the wells had been vandalized and the dataloggers were missing (Mathers *pers com* 2018).

4.4.1.3 Baseline Regional Water-Supply Well Conditions

During July 2006, an inventory of 55 water-supply wells was carried out on lands within a radius of ~3 km (~2 miles) from the site (Friesen Drillers 2006b). This survey established the "baseline" number, proximity and apparent condition of neighbouring wells before the project began. Broda has just commissioned Friesen Drillers to update this information such in hopes that it can be available to support the filing for rezoning (Broda *pers comm.* 2019).

4.4.1.4 Baseline Groundwater Quality

Analytical chemistry data created a dataset on the benchmark quality of the groundwater.

4.4.2 Water-Management Planning

Broda intends to operate the quarry and manage discharges within protocols that adhere to regulatory requirements while preventing or mitigating unexpected adverse effects to the drainage network, adjacent lands, and stakeholders. Substantial studies have been completed to

support this intent. A key task has been defining an operations plan that will minimize impacts on adjoining landowners' wells.

4.4.2.1 Considering Potential Effects on Neighbouring Water Wells

The 2010 KGS WMP examined the potential for dewatering (or other) effects on drinking water wells on adjoining lands. The 2010 Plan concluded that the largest volumes of groundwater in the Stony Mountain formation are present in shallow bedrock fractures within a nominal depth of 2-3 m below the top of the bedrock, mainly in the central part of the quarry centered on the shallowest bedrock. Below 2-3 m, the data suggested that much less water may be in storage in the bedrock. Therefore, the greatest pumping effects on the groundwater regime in the local area were then expected to occur within the upper few metres of the bedrock. This was then expected to occur mainly in the spring when higher water levels and associated higher volume dewatering pumping would logically take place. Less extensive dewatering effects were then (and continue now) to be expected during summer "maintenance" pumping.

As the quarry is deepened into more competent bedrock, much less pumping is anticipated to be needed to maintain groundwater levels below the base of the quarry.

This second phase of (deeper) pumping could have some local effect on water levels in the Stony Mountain Formation. Because KGS judged the deeper rock to be less transmissive, it concluded that the drawdown effects on nearby shallow wells would likely be relatively minor. Also, because Broda's initial quarry excavations trenching will occur in the shallowest, most fractured and permeable bedrock, longer-term dewatering pumping is expected to be minimized.

4.4.3 Regulatory Consultations to Establish Management Approach and Goals

Broda and its consultants (Tetr*ES*, KGS, Stantec, MLi3) have now had almost 15 years of meetings with provincial officials to discuss local and regional water-management needs for the project. Discussions have focused on ensuring it creates no new pressure on the water-management systems. Discussion has also focused on how the proposed quarry can help the province create new solutions to historic regional drainage challenges. The key officials have been those in the departments of managing water storage or conveyance infrastructure.

On January 24, 2017, representatives of Water Resources Branch in MSD and Manitoba Infrastructure reiterated previous advice that Broda should commit to site-operation rules (as Broda proposed in 2009), to prevent pumping of excess groundwater from the site to drains in spring seasons when watertables and field runoff were both high, or in periods of high rainfall events. MI and WRB further advised that, in any event, Broda would likely be compelled to abide by licensed site-operation rules insofar as licensed discharges were concerned. While most of the discussion focused on the East Colony Creek (ECC) receiving-channel option, continuing the focus of previous discussions, MI and WRB requested Broda's willingness to be flexible, depending on circumstances, to use either the ECC or the City Protection Drain (CPD), as directed by the province, to receive discharges of seasonal excess groundwater from its site. This would allow valuable flexibility for the Province in responding to requests from other parties for discharge of seasonal runoff.

4.4.4 Drainage Surveys, Flow Modeling and Channel-Capacity Determinations

Broda's quarry-dewatering activity must be authorized by the provincial regulatory authority under the auspice of *The Water Rights Act*. Authorization is in the form of a licence. Typically, a license contains specific conditions and prescribed operating protocols to ensure that 'diversion of water resources' (which quarry dewatering would be) does not negatively affect others. Because on-site runoff accumulations are not likely to affect operations or neighbours, Broda has investigated and developed management-performance objectives accordingly, to preclude potential impacts to local drainage capacity. Broda will operate the quarry and manage occasional discharges within protocols that adhere to (or frequently exceed) regulatory requirements while preventing or mitigating unexpected adverse effects to the local and regional drainage network, adjacent lands, and stakeholders.

In the prior rezoning CUA-hearing process, to prevent operations-related impacts on neighbours' abilities to drain their lands each spring, Broda committed that quarry-dewatering activities would cease if substantial rainfall events occurred that would greatly utilize the capacity of the local drainage system if Broda had to dewater its quarry in spring. Presently the land base is drained naturally by gravity via surface drains to the municipal drainage system. Dewatering activities would cease if flows in the local municipal drains to which the province allowed Broda to discharge water from its quarry exceeded flow rates considered the maximum available in either ECC (delivering runoff south, to the Assiniboine River), or in the City Protection Drain (delivering runoff east, to the Red River). Broda commissioned work in 2011 to establish these maximum channel-capacity (i.e. threshold-limit) rates so they could be included in an updated WMP.

These rates were established for discharges to East Colony Creek but have yet to be determined for the CPD. The ECC capacity-rate limits were established through dialogue with Water Resources Branch in ~2011-12, after Broda's consultants surveyed the southern drainage pathway. Using the data from these surveys, Stantec constructed a finite-element model of ECC from about a half-mile upstream of Mollard Road to Omand's Creek, and thence to the Assiniboine River (Figure 4-7).

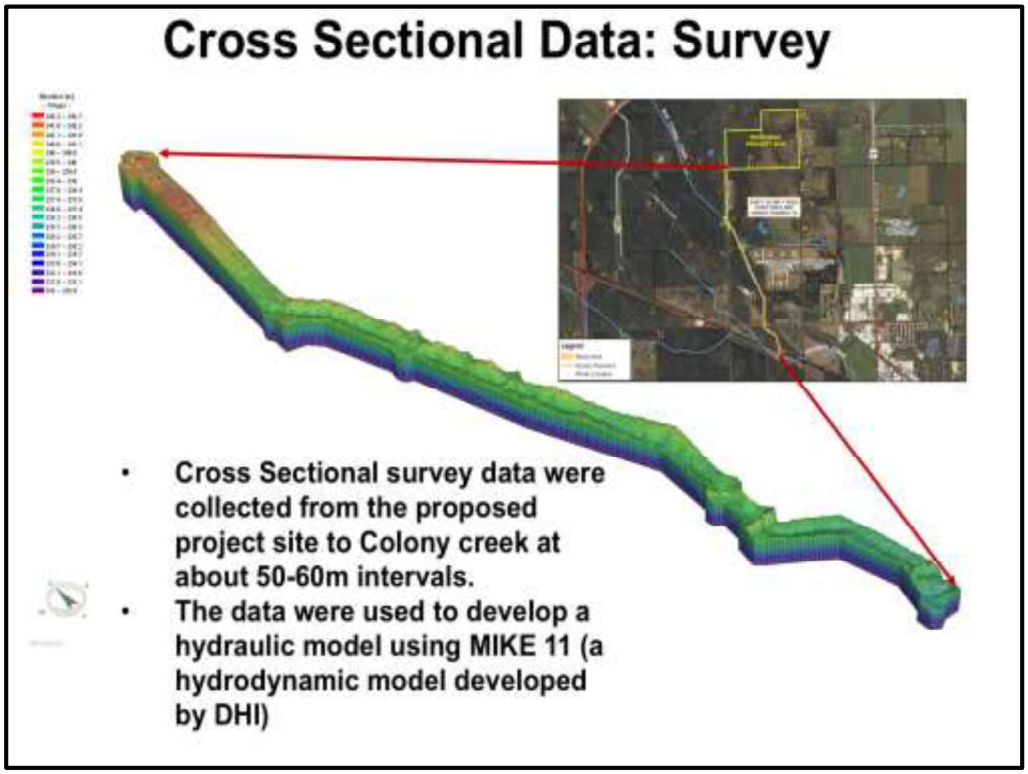

Figure 4-7. East Colony Creek Modelling and Flow-path Analysis.

Cross-sectional and invert (ditch- or channel-bottom) data were used in the Stantec 2011 model (and are now used in this WNRMP) to:

- Establish continuous invert elevations along the flow paths for identifying obstructions to flow (e.g., collapsing banks, culvert inverts higher than the upstream channel invert, undersized culverts, aquatic plant growth) within the channels (which the RM has since considered in its planning for annual channel-maintenance activities).

- Help establish how monitoring data for water levels at staff gauges or other immovable features (e.g., culvert tops) could be used to determine the extent of remaining conveyance capacity in either receiving watercourse, and the extent of need for any additional channel maintenance by the RM (or the province).

- Suggested the basis of a voluntary operational regime for managing discharge rates such that agreed-upon water levels at key locations along the watercourse would not be exceeded. Broda would commit to discharging to whatever watercourse that WRB officials approved for receiving the discharge when quarry dewatering was needed.

- Determine the maximum conveyance capacity of the expected receiving watercourses (i.e. East Colony Creek). The rates would be determined by the condition of the receiving watercourse (i.e., its observed flow in relation to the apparent amount of conveyance capacity remaining in the channel). The ECC maximum flow rate was established through dialogue

with Water Resources Branch (WRB) in ~2011-12. Conceptually, Discharges to the ECC would occur under a 3-tiered system of remaining channel capacity, allowing:

- **"unconstrained discharge**" (e.g., flows of 2.0 – 3.5 cubic metres per second [cms or m^3/s] to ECC),
- "**moderately constrained discharge**" (e.g., 1.0 – 2.0 m^3/s to ECC), and
- "**highly (i.e. nearly zero) to completely constrained discharge**" (e.g., 0.0 – 0.5 m^3/s to ECC).

The maximum nominal capacity of ECC capable of avoiding spring flooding has been established from interpretation of the modeling output (Stantec 2011) as 4 m^3/s (140 cfs). While discharge rates have been established for releases to East Colony Creek, they have yet to be determined for the CPD. Interim CPD drain profiling (Fig. 4-8(b) will assist this).

In January 2017, MLi3 completed additional drainage-channel invert studies and determinations of cross-section at apparent flow-obstruction points along the CPD, using satellite data (Figure 4-8). That same month, Broda renewed its commitment to WRB officials to establish new staff gauges on sites preferred by the province upstream and downstream of Broda's lands. Data from Broda's real-time monitoring of water levels at these gauges (and at other key locations [e.g., road-underpass culverts]) will be shared with the province to improve and expand real-time hydrological monitoring for the local area. This might assist provincial drainage management and, perhaps, even flood forecasting.

Based on the Stantec work done to date, (greatly more than what proposed quarries have filed in support or applications in the past), MLi3 Inc. has concluded that intermittent planned discharges from the Broda quarry pursuant to the scheme proposed by the WRB, when combined with natural flow, will not exceed the receiving system's capacity. Waterway capacity should therefore be fully protected for all users during key seasons.

MLi3's 2017 field surveys have verified that WRB indications (in dialogue years ago), that flow obstructions along the ECC pathway would be removed, have been acted on. One key obstruction identified by the modeling has been removed. As part of the CentrePort Canada development (especially drainage planning associated with CentrePort Canada Way), the key flow constraint at Inkster Boulevard has been replaced by installation of modern new large-capacity culverts (Photo 5). Adherence to the maximum theoretical (i.e. modelled) receiving-channel rate of ~4 m^3/s in ECC should thus be fully protective. This requires confirmation.

Ongoing CentrePort Development can significantly affect Broda's season-specific access to the drainage capacity of the ECC. As noted herein, Broda will track developments that affect the downstream conveyance capacity and will adjust its Water Management Plan and, if needed, its Monitoring Plan, to address such evolution in downstream capacity.

Photo 5. New High-Flow Culverts under Inkster Blvd. to Enhance Capacity.

Such confirmation is intended by Broda. Through dialogue with the WRB, Stantec Consulting and MLi3, Broda will verify WRB's confidence in the model and its underlying data and assumptions. Broda and Stantec will review with WRB how the 2011 model output can be interpolated to identify "safe" flow rates that are higher than the existing computed capacities predicted to cause no localized flooding.

Using the output, Broda, Stantec and WRB will explore the probable effect of the recent improvement to the ECC crossing beneath Inkster Blvd. The mathematical improvement in channel conveyance will be extrapolated from the model output. It will very likely be determined that the new high-capacity culverts have increased the allowable flow capacity of the drain to rates perhaps somewhere between ~4 and ~7 m^3/s. These higher threshold (or "trigger") water levels at which pumping could safely begin could then be permitted by the WRB.

In all likelihood, the permitted pumping regime will be substantially higher than the flow scenarios of 4.0 and 6.5 m^3/s at Inkster Blvd. modelled in 2011 that then predicted "minor" and "significant" flooding, respectively. The same flow regime today would very likely be allowed with zero flooding. Other opportunities to improve conveyance will also be explored using the data displayed in Figure 4-8(a). This could result in even higher permitted flow rates once the localized additional improvements are completed and verified by WRB.

This important process is committed in S. 10 ("Next Steps").

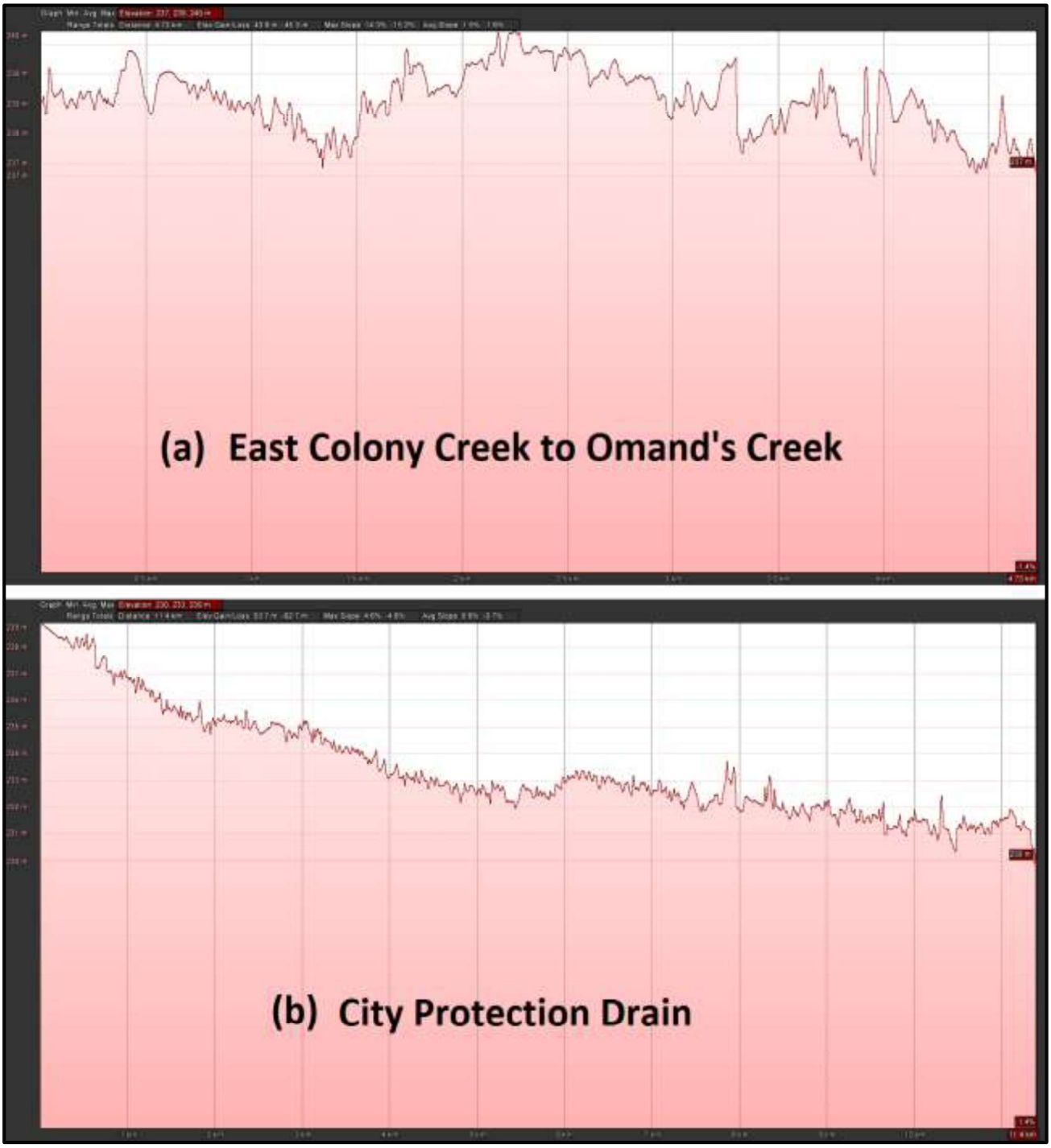

Figure 4-8. Descending channel-invert profiling for optional discharge pathways, illustrating flow constrictions (i.e., low points in profiles) needing attention (i.e., removal of restrictions) to improve conveyance capacities. Poorly-sized culverts smaller than the necessary flow capacity, and culverts installed at elevations inhibiting flow, account for some of the "spikes" in the profiles.

4.5 NATURAL RESOURCES MANAGEMENT

4.5.1 Ecosystem Classification

The Broda site occurs in the Winnipeg Ecodistrict of the Lake Manitoba Plain Ecoregion at the southeastern portion of the Lake Manitoba Plain. The Lake Manitoba Plain Ecoregion is divided into 12 ecodistricts. This area coincides with the central lowland area of the Red River Plain where the ecoregion's largest community ecodistrict, Winnipeg, is located (Smith et al. 1998).

The Winnipeg Ecodistrict is part of a transitional zone between boreal forest to the north and the aspen parkland to the southwest. The vegetation in the ecodistrict ranges from trembling aspen/oak groves (often found along stream channels and in better-drained sites, and found on the Broda land) to white elm, basswood, cottonwood, Manitoba maple and green ash on alluvial floodplain deposits and lower river terraces. Pockets of prairie grassland occur in poorly drained and/or remote sites, or those unfit for mechanized agriculture throughout the ecodistrict. Open wetlands with grasses and sedges are common where standing water is present for all or part of the year. A small wetland occurs on the site. Trembling aspen, willows and shrubs occur where soils are poorly drained, while bur oak and native grass species occupy drier sites on loamy to clay soils (Environment Canada 2006), such as found at the site.

The ecodistrict is flat and underlain by limestone bedrock covered with varying depths of clay, glacial till and topsoil. Depending on overburden composition, cereal crop production is the prevalent land use. Where soils are rocky, livestock and livestock-feed production are common. Crop production occurs on part of the Broda property. Dairy farming occurs nearby.

4.5.2 Vegetation Species Composition

Historically, the native vegetation found within the Winnipeg Ecodistrict consisted of tall prairie grass and meadow prairie-grass communities (Smith et al. 1998). Due to cultivation and the development of drainage ditches, the native vegetation has largely disappeared.

Much of the site is currently cultivated for crop production. In September 2004, site surveys created an inventory of vegetation and terrestrial habitats. Three sites were visited, a species list was compiled and a subjective estimate of dominance was determined (using the DAFORS scale where D >50%, A = 25-50%, F = 5-25%, O = 1-5%, R <1%; Appendix A, Table 1).

Site 1 was located on the east side of the site where a dugout located in the center of Site 1 had created a small wetland. The pond appeared to be about 0.5-0.75 m higher than normal, likely due to the excessive rainfall during autumn of 2004. The wetland was surrounded by previously excavated spoil and limestone boulders. Upland areas were predominantly grassland with a few trees and shrubs. Most locations had 100% vegetative cover. Smooth brome, bluegrass, Canada thistle, and several species of goldenrod dominated this site (Appendix A, Table 1). Other species were less common. None were considered provincially 'rare' or 'endangered'.

Site 2 was an area of drier prairie immediately northwest of, and connected to, Site 1. This area contained a variety of surviving native prairie plants such as bergamot, purple prairie clover, cut-

leaved anemone, blazing star, goldenrod and asters. There were also patches of smooth brome and thistle (not as frequently found as at Site 1). The site also supported several small shrub thickets, which consisted of Saskatoon, silverberry, shrub rose, willow and trembling aspen. There were no provincially 'rare' or 'endangered' plant species encountered at this site.

A small patch of undisturbed prairie grassland may yet survive at this site. Many native prairie species were present. While the site has not yet been greatly compromised by invasion of smooth brome and Canada thistle, shrubs and weedy species are invading.

Site 3 was a wooded area ~200 m west of the two prairie grassland sites. This site contained a farmyard surrounded by a 2.5-ha mature bur oak forest. Although the canopy cover was 80 to 90% (Appendix A, Table 2), both the under-story and herbaceous layer were well developed, supporting a diversity of plant species (Appendix A, Table 2).

The oak forest was bordered to the west by a woodlot containing aspen, Manitoba maple, hawthorn, chokecherry and poplar. A small shallow dugout had then-recently been excavated at the western edge of this woodlot. To the east, the oak forest was bordered by a stand of large poplar trees. To the south, trembling aspen was encroaching on what once seemed to be oak savannah. A small dugout bordered by grasses and shrubs was surrounded on three sides by barbed-wire fence to the north.

Due to the predominance of trees at Site 3, vegetation surveys were conducted to gather information relating to average tree height, density and age. The trees were sampled using a point-quarter method. The understory was examined using a point-frequency intercept method (Smith 1996). For the former, two 100-m transects were established in representative areas of the oak forest. Points were then sampled at 10-m intervals along these transects. For each point, the following parameters were measured; the canopy cover, distance from the point to the nearest tree in each of four quadrants, species of each tree measured, and tree diameter at chest height. Tree height was measured for one tree at each point using a clinometer. Tree age was determined using an increment borer for one tree at each point for the first transect only. For the point-frequency intercept, the understory species closest to the tape at each 1-m interval was recorded. Cover estimates for the shrub layer were impossible to obtain (due to season lateness). The same transect was used for both tree and understory characterization.

The average height of the oak was ~14 m with a mean diameter at chest height of 21 cm. The average age of the sampled oak trees was 57 years, though there were also numerous small oak shrubs and oak seedlings (Appendix A, Table 2). There were ~1,100 oak trees per hectare. All but four of the trees were single-stem trees (Appendix A, Table 2). Few of the oaks had well-developed side branches. The understory contained a well-developed sparse shrub layer, dominated by bur oak in various sizes, prickly rose, and Saskatoon (Appendix A, Table 2).