FEBRUARY 9, 2022

PLANNING ADVISORY COMMITTEE REPORT

REPORT NO. PAC-001-2022

ADDITIONAL COMMENTS RECEIVED ON PROPOSED AMENDMENT NO. 3 TO THE COUNTIES OFFICIAL PLAN – AGGREGATE RESOURCES

CHERIE MILLS
MANAGER OF PLANNING SERVICES

RECOMMENDATIONS

THAT the Planning Advisory Committee recommends that the Aggregate Resources Master Plan, as updated to January 19, 2022, be accepted; and

THAT the Planning Advisory Committee recommends that Official Plan Amendment No. 3 to the Official Plan for the United Counties of Leeds and Grenville be adopted, as revised to reflect the consultant's recommendations on additional comments received; and

THAT the necessary by-law be prepared and that Planning staff be requested to send out the required notice of adoption as specified in the Planning Act.

FINANCIAL IMPLICATIONS

There are no financial implications regarding the review of additional comments received. However, if the Official Plan Amendment is approved and appealed then there will be legal and planning consulting costs associated with the Counties participating in any Ontario Land Tribunal process.

CLIMATE CHANGE IMPLICATIONS

The implications of climate change and long term sustainability were taken into account in the preparation of the Aggregate Resources Master Plan and the Official Plan policies

by ensuring the development of aggregate resources considers minimizing environmental impacts on, for example, natural heritage (species at risk, fish habitat), air quality, stormwater flows, sourcewater protection and natural heritage features (wetlands, woodlands). By protecting aggregate resources close to market, transportation distances are minimized potentially reducing greenhouse gas emissions.

ACCESSIBILITY CONSIDERATIONS

This report, the supporting Aggregate Resources Master Plan and Official Plan Amendment can be provided in alternative accessible formats on request. Under the Planning Act, accessibility is a provincial interest that the Counties shall have regard to for all facilities, services and matters to which the Act applies.

COMMUNICATION CONSIDERATIONS

An extensive consultation program was undertaken as part of the preparation of the Aggregate Resources Master Plan and the implementing Official Plan Amendment. The Public Meeting for the Official Plan Amendment was advertised as per the Planning Act and described in Report No. PAC-003-2021. This report has been posted on-line as part of the Planning Advisory Committee agenda. If the Official Plan Amendment is approved by Counties Council, all local municipalities, agencies and interested members of the public who have made written submissions or made comments at the December 14th public meeting will receive a notice of adoption as per the provisions of the Planning Act.

BACKGROUND

At the December 14, 2021 statutory Public Meeting on Counties Official Plan Amendment No. 3 (OPA No. 3) implementing the Aggregate Resources Master Plan (ARMP), there were three public and municipal written comments that were received after the deadline to be included in the Planning Advisory Committee (PAC) agenda and addendum.

Several Planning Advisory Committee members were concerned that the comments had not received appropriate review and consideration. As a result, PAC deferred their decision on the ARMP and OPA No. 3 and requested staff review, consider and prepare

a response to the three written comments. There was a fourth written comment received on December 31, 2021 that has also been considered in the review. The purpose of this report is to provide the comments and responses to the comments from the consulting team, Meridian Planning Consultants.

DISCUSSION/ALTERNATIVES

The four sets of comments received from the Municipality of North Grenville, the Township of Augusta, Mr. Tom Graham, and Mr. Tony Sevelka from December 31, 2021 are attached to this report for PAC's information. A detailed memorandum outlining the review and responses from Meridian Planning Consultants to each comment is also attached. Planning staff are in agreement with the responses and the minimal revisions recommended to Official Plan Amendment No. 3. A copy of revised OPA No. 3 has been attached to this report.

A final draft of the Aggregate Resources Master Plan is appended to the report and has been updated to include recent consultation including summaries of every meeting and comments received. The policy section also includes the latest OPA No. 3 policies.

It is the still the opinion of Counties planning staff, that the draft ARMP and implementing draft OPA mapping and policies strike a balance between preserving the valuable aggregate resources prioritized in the PPS and continuing to enable locally appropriate rural residential development. Staff and the consulting team are satisfied the draft Official Plan Amendment, as revised, is consistent with the applicable policies of the Planning Act, the 2020 Provincial Policy Statement, and is supported by the other policies of the Counties Official Plan.

ATTACHMENTS

Meridian Planning Consultants Memorandum – Review and Response to Written Comments, January 17, 2022

Municipality of North Grenville Report, December 8, 2021

Township of Augusta Planner's Report, December 13, 2021

Mr. Tom Graham Correspondence, December 13, 2021

Mr. Tony Sevelka Correspondence and Attachments, December 31, 2021

Draft By-law to Adopt Amendment No. 3 to the Official Plan

Official Plan Amendment No. 3

Aggregate Resources Master Plan, January 19, 2022

CHERIE MILLS
MANAGER, PLANNING SERVICES **JANUARY 20, 2022**

RICK KESTER **JANUARY 20, 2022**
DIRECTOR, PUBLIC WORKS **DATE**

RAYMOND CALLERY **FEBRUARY 7, 2022**
CHIEF ADMINISTRATIVE OFFICER **DATE**

MERIDIAN PLANNING

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Vaughan, Ontario L4K 0A4
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www.meridian-vaughan.ca

MEMORANDUM

To: **Cherie Mills, United Counties of Leeds and Grenville**

Elaine Mallory, United Counties of Leeds and Grenville

From: **Nick McDonald and Jessica Tijanic**

Date: **January 17, 2022**

Re: **Review and Response to Public Meeting Written Comments – Proposed Official Plan Amendment No. 3 to the Counties Official Plan**

On December 14, 2021, a statutory Public Meeting was held to consider the proposed Official Plan Amendment No. 3 ('OPA 3') to implement the Aggregate Resources Master Plan. Staff prepared a report to Council that provided an overview of the study process and consultation, followed by a discussion of comments and considerations that informed the preparation of OPA 3. Meridian Planning Consultants delivered a presentation to the Planning Advisory Committee ('PAC'). Following the presentation, members of the PAC and the public made comments on the proposed OPA 3.

Following the question and comment period, the Clerk advised the PAC of three written correspondence documents that were received by the UCLG following the posting of the agenda for the Public Meeting. As a result of this, the PAC directed staff to review, consider and prepare a response to the three written correspondence documents. In addition, the UCLG also received a written comment after the public meeting that has also been reviewed and considered. Below is a summary of the comments and response to each.

Municipality of North Grenville

On December 13, 2021, the UCLG received correspondence from the Municipality of North Greenville in the form of a Council resolution from their Council meeting on December 8, 2021. Staff provided Council with Report PD-063-2021, titled 'Aggregate Resources Master Plan – Support for Edwardsburgh Cardinal Resolution ', and Council adopted the following resolution:

"That Council support the resolution from Edwardsburgh Cardinal to reduce the overburden for bedrock resources as identified in the Aggregate Resources Master Plan from 8 metres to 5 metres".

As noted above, the Municipality of North Grenville's resolution supports a resolution that was adopted by the Council for the Township of Edwardsburgh-Cardinal at their Council meeting on September 27, 2021. The resolution indicated that bedrock resources with an overburden of 8 metres was uneconomical and that an overburden of 5 metres would be more economical.

The UCLG received the Township of Edwardsburgh-Cardinal resolution in November 2021. Through the process of preparing the Aggregate Resources Master Plan, the UCLG also received a number of requests to consider limiting bedrock classifications to specified overburden depths. These options were discussed with the provincial Ministries and they confirmed that bedrock mapping at 5-metre intervals for overburden were not available.

The Ministries further indicated that they were not supportive of proposed mapping that implements an alternative overburden cutoff other than what is recommended in the Aggregate Resource Inventory Paper #183 (ARIP), which identified significant bedrock resource area as those areas that have an overburden depth of 0 to 8 metres. The Ministries also indicated that bedrock operations at 0 to 8 metres are feasible particularly when planning for the long-term and that any different classifications of bedrock overburden mapping is not consistent with the Provincial Policy Statement (2020), which requires municipalities to identify deposits of mineral aggregate resources as delineated in the ARIP as established by the province. **In this regard, no changes are recommended to the proposed OPA 3.**

Township of Augusta

On December 14, 2021, the UCLG received correspondence from the Township of Augusta in the form of a Council report prepared by Planning staff (Report 2021-120). The recommendation contained within the report reads as follows:

"THAT the Planner's report of December 13, 2021, be received for information and this report be forwarded to the United Counties of Leeds and Grenville for consideration of the two recommendations respecting the proposed Aggregate Resources Amendment, as highlighted on page 3."

The two recommendations contained within the report are reproduced below.

- It is recommended that in lieu of listing "exempted" types of development or planning applications from having to undertake an aggregates assessment study, for clarity, ease of implementation, and transparency, that the policies instead, or in addition to, list the types of applications that would warrant a consultant's assessment study of the impact on aggregate resources to support certain planning applications, e.g. new residential lot creation applications, institutional uses, Official Plan Amendments, other.
- It is recommended that these adjacent land/buffers of 300 m from sand and gravel resource areas and 500 m from Bedrock Resource Areas be added as a "note" to the screening map, for ease of policy reference/implementation, so these potential influence areas are flagged more immediately on the screening map itself.

In response to the first recommendation above, the proposed OPA 3 includes a list of planning applications that are exempt from an aggregate assessment. This means that if a development application is not on the list, then it requires an aggregate assessment. It is our opinion that this approach provides more clarity, rather than identifying the types of planning applications or scenarios where an aggregate assessment would be required. It is noted that there are two other baskets of exemptions as well that relate to agricultural uses and development as well as clusters of residential development. **In this regard, it is our opinion that no update is required to the proposed Official Plan Amendment to address this comment.**

In response to the second recommendation above, the current Schedule A to the proposed OPA 3 includes the Selected Sand and Gravel and Bedrock Resource Areas as well as constraints and buffers that have been applied. However, it is noted that the policy framework also includes reference to influence areas for sand and gravel (300 metres) and bedrock resources (500 metres) and this is not currently identified on the proposed Schedule A. **In this regard, it is our opinion that Schedule A to the proposed OPA 3 could be updated to include a note that references the policies that address influence areas.**

Mr. Tom Graham, Songwood Farm

On December 13, 2021, the UCLG received emailed comments from Mr. Graham on the proposed OPA 3. Mr. Graham's first comment concerns significant groundwater recharge areas. It is indicated that many of the areas identified as 'Selected Sand and Gravel Resource Area (Tertiary)' on Schedule A coincide with RVCA's Significant Groundwater Recharge Areas. Mr. Graham feels that the deposits of sand and gravel should not be identified as gravel resources and should otherwise be protected as areas for natural features such as wildlife and drinking water.

Mr. Graham's second comment indicates that the draft Aggregate Resources Master Plan and the proposed OPA 3 do not include reference to Source Water Protection, Significant Groundwater Recharge Area and Highly Vulnerable Aquifers. It is noted that Mr. Graham provided a similar comment to the UCLG on October 18, 2021 in response to his review of the initial draft Aggregate Resources Master Plan.

In response to Mr. Graham's comments, the Source Water Protection Act continues to apply to all lands identified in Appendix 3 to the UCLG Official Plan and this includes lands that may also be identified as Selected Bedrock Resource Area or a Selected Sand and Gravel Resource Area in Schedule A to the proposed OPA 3. Section 4.4 of the UCLG Official Plan currently contains a number of policies on water resources and source water protection. It is noted that a number of updates were made to policies contained in the proposed OPA 3 to include locally significant wetlands, other wetlands, watercourses and drinking water sources. **In this regard, it is our opinion that no updates are required to the proposed OPA 3.**

Mr. Tony Sevelka

On December 31, 2021, the UCLG received comments from Mr. Tony Sevelka of International Forensic & Litigation Appraisal Services Inc. on the draft Aggregate Resources Master Plan (October 4, 2021). Mr. Sevelka's comments are focused on the issue of fly-rock that is associated with blasting at aggregate operations. Mr. Sevelka considers fly-rock as an adverse effect and suggests that aggregate policies should require blasting quarries to locate further than 1,000 metres from sensitive receptors to provide protection from fly-rock.

It is noted that a number of constraints and buffers have been applied to the area identified as Selected Sand and Gravel and Bedrock Resource Areas. These are based on known features and on fixed boundaries such as settlement area boundaries. Aggregate operations that use blasting may generate fly-rock and the extent of the impact of fly-rock can vary from site-to-site, the extent of

blasting and other components of the operation itself. In addition, the need for setbacks is determined through the Aggregate Resources Act process that is administered by the province. As a result of the associated variability of fly-rock, it is our opinion that establishing a minimum setback for fly-rock in the Official Plan is not appropriate.

In addition to the above, as of January 1, 2022, new operating requirements for the Aggregate Resources Regulation (Ontario Regulation 244/97) came into force that require aggregate operations with a blasting component to implement measures to prevent fly-rock from leaving the site during blasting if a sensitive receptor is located within 500 metres of the boundary of the site.

On the basis of the above, it is noted that the proposed OPA 3 requires any application for a new or expanding operation to demonstrate that certain factors will be minimized and this includes noise, dust and vibration to name a few. **In this regard, it is recommended that the proposed OPA 3 be updated to add fly-rock to the list of factors to be considered when a planning application is submitted for a new or expanding aggregate operation.**

Municipality of North Grenville

To:	**COUNCIL**	Meeting Date: 2021/12/08
Subject:	**Aggregate Resources Master Plan – Support for Edwardsburgh Cardinal Resolution**	Report No: PD-063-2021
Prepared by:	**Amy Martin** **Director of Planning and Development**	File No: C7-PD

RECOMMENDATION(S)

That Council support the resolution from Edwardsburgh Cardinal to reduce the overburden for bedrock resources as identified in the Aggregate Resources Master Plan from 8 metres to 5 metres.

EXECUTIVE SUMMARY

Purpose

- To provide additional information to Council on the resolution from Edwardsburgh-Cardinal regarding the bedrock resources constraints mapping included in the United Counties of Leeds and Grenville's Aggregate Resources Master Plan.

Key Findings

- The proposed mapping in the Aggregate Resources Master Plan uses a maximum overburden of 8 metres to determine viability of the bedrock resource.
- Approximately 80% of North Grenville is identified as having a bedrock resource.
- The proposed mapping will not designate land as Bedrock Resources, rather it will identify Bedrock Resources as a constraint subject to further assessment.
- The Counties create a screening tool to identify which development projects would be exempt from undertaking further assessments where bedrock resources are identified as a constraint.
- Additional mapping would be required to understand what impact reducing the overburden maximum from 8 metres to 5 metres would have for lands within the United Counties of Leeds and Grenville.

- The Provincial Aggregate Resources Inventory Paper identifies overburdens of less than one metre, between 1 and 8 metres and over 8 metres. The Counties would have to undertake a mapping exercise to establish a 5-metre overburden. This would require substantial financial resources on behalf of the Counties.

Financial Implications

- There are no financial impacts associated with the recommendations of this report.

BACKGROUND

The Planning and Development Department brought forward a report to Council on November 10, 2021 which outlined the United Counties of Leeds and Grenville's Aggregate Resources Master Plan (ARMP). The ARMP proposes to update Official Plan policy as it relates to aggregate resources, modify the existing sand and gravel resources schedule within the County Official Plan and introduce a bedrock resources constraint schedule. Bedrock resources were identified as areas where the overburden was 8 metres or less.

Edwardsburgh-Cardinal passed a resolution requesting that the United Counties consider reducing the overburden from 8 metres to 5 metres. The resolution, provided in Attachment 1, was circulated to all lower-tier municipalities within the United Counties of Leeds and Grenville.

ANALYSIS

The United Counties of Leeds and Grenville was directed by the Province to undertake an Aggregate Resources Master Plan within 3 years of the adoption of the Official Plan. Prior to the County's Official Plan being adopted in 2016, the County and lower tier municipalities were unable to resolve the extent of the bedrock resources.

The identified bedrock resources in the ARMP would apply to approximately 80% of land within the Municipality.

The Province of Ontario maintains the Aggregate Resources Inventory Paper (ARIP). The mapping provided through ARIP 138, which pertains to Leeds and Grenville is attached as Attachment 2. The map for bedrock resources identifies areas where the drift thickness is less than 1 metre, areas where the drift thickness is between 1 metre and 8 metres, and areas where the drift thickness is greater than 8 metres.

The ARIP 138 Map bedrock map does not differentiate drift thicknesses that are less than 5 metres and greater than 5 metres.

Strategic Alignment

Strategic Focus Area 1: Sustainable, Strategic Growth (Goal 1: Development that Builds Community Connection)

- Outcome: Pursue a common vision and better alignment of community development, economic development and planning goals by ensuring sound policy development for aggregate resources located within the Municipality.

COMMENTS

The resolution from Edwardsburgh-Cardinal identified that bedrock resources with an overburden of 8 metres was uneconomical. Furthermore, the resolution identified an overburden of 5 metres as being more economical. An overburden of 8 metres depth is generally assumed to be the maximum amount of overburden that can be removed while still producing an economically viable product.

There is no mapping available that shows the extent of a 5-metre overburden for bedrock resources. Additional mapping would be required to determine the impact of changing the overburden from 8 metres to 5 metres. This would require significant financial resources.

The Bedrock Resources mapping would be a constraint layer within the United Counties Official Plan. The intent of the Bedrock Resources constraint layer is not to preserve all the bedrock resource but only what is worth preserving as determined by the Aggregate Resources Inventory Paper established by the Province of Ontario. The mapping will be used as a screening tool to trigger if an aggregate assessment is required when non-aggregate uses are proposed.

It is through implementation and interpretation of the policies by local municipal staff through "screening" that the potential impacts of the mapping can be reduced. The United Counties are preparing a checklist to assist local municipalities in screening potential applications. In that checklist, there are 16 exemptions, considerations, or influencing factors that could lead to an application being exempt from assessment.

For permitted development on or near aggregates, the below uses are exempt from an assessment being needed:

1. agriculture, agriculture-related or on-farm diversified uses
2. commercial, industrial or recreational uses (provided the Official Plan has enabling policies)
3. uses within a settlement area, lake or river and within 500 m of a settlement area, lake or river
4. uses in a residential cluster of 4 or more lots at road intersection or 3 or more in a linear fashion
5. uses within Provincially Significant Wetlands (PSWs) and/or Area of Natural and Scientific Interest (ANSI) and within 120 m of a PSW and/or ANSI
6. uses on an existing lot of record (provided OP enables)
7. lot line adjustments for legal or technical reasons
8. development that serves a greater long-term public interest (provided health, safety and environmental impacts are addressed)

For other areas of potential development on or in proximity to aggregates, all areas where any of the below criteria are met may be exempt from an assessment being needed:

1. the transportation route (road) does not support extraction activities (e.g. on a township road, distant from a provincial highway)
2. parcels are individually or collectively too small or irregularly shaped for mineral extraction
3. aggregate extraction is constrained by existing or potential uses in the area
4. aggregate extraction is constrained by sensitive surface water and ground water features
5. aggregate extraction is constrained by natural heritage features
6. aggregate extraction is constrained by cultural resources (heritage buildings, archaeology sites)
7. depth of overburden prohibits economical aggregate extraction
8. quality of the mineral aggregate is unsuitable for extraction

EXISTING POLICY/BY-LAW

Provincial Policy Statement (2020)

United Counties Official Plan (2016)

Municipality of North Grenville Official Plan (2018)

United Counties of Leeds and Grenville Aggregate Resources Master Plan (2021)

FINANCIAL IMPACT

This item has been identified in the current budget: Yes □ No □ N/A **X**

This item is within the budgeted amount: Yes □ No □ N/A **X**

There are no financial impacts associated with the recommendations of this report.

PUBLIC INPUT

The United Counties of Leeds and Grenville will be holding a public meeting to consider the proposed Official Plan Amendment associated with the Aggregate Resources Master Plan on December 14, 2021. Notice of public meeting is attached as Attachment Three.

INTERNAL/EXTERNAL CONSULTATION

The United Counties of Leeds and Grenville was further consulted on the implications of a 5 metre overburden and the development of a screening tool for development applications.

Communication

Should Council support the resolution from Edwardsburgh-Cardinal, staff will provide a copy of North Grenville's resolution to the United Counties of Leeds and Grenville and Edwardsburgh-Cardinal.

CONCLUSION

There is no available mapping that details the extent of an overburden of 5 metres over bedrock resources in Leeds and Grenville. Provincial mapping shows ranges of less than 1 metre, 1 metre to 8 metres and 8 metres and more. Undertaking additional mapping would require significant financial resources. The Bedrock Resources mapping is a constraint layer, and not a land use designation. The Counties have provided additional screening information to assist local municipalities in determining whether an assessment is needed to further define the bedrock resource at the time of a development application.

SIGNATURE

Prepared by:

Original Signed By

_____

Name: Amy Martin

Title: Director of Planning and Development

Submitted for

Council consideration by:

Original Signed By

_____

Name: Gary Dyke

Title: Chief Administrative Officer

ATTACHMENTS

- Attachment 1: Resolution from Edwardsburgh-Cardinal
- Attachment 2: ARIP 138 Map

THE TOWNSHIP OF AUGUSTA

REPORT NUMBER: 2021-120

REPORT TO COUNCIL: December 13, 2021

RE: Planner's Report

AUTHOR: Barbara Kalivas

RECOMMENDATION:

THAT the Planner's Report of December 13, 2021, be received for information and this report be forwarded to the United Counties of Leeds and Grenville for consideration of the two recommendations respecting the proposed Aggregate Resources Amendment, as highlighted on page 3.

PURPOSE:

This report addresses the following subject:

1. Proposed Amendments to the Official Plan for the United Counties of Leeds and Grenville (UCLG)

1. Proposed Amendments to the Official Plan for the United Counties of Leeds and Grenville (UCLG)

BACKGROUND:

Augusta Township is in receipt of the attached notice of public meetings to be held virtually by the Counties on December 14, 2021 at 9:00 a.m. regarding two proposed amendments to the UCLG Official Plan. This report is written to bring these two amendment matters to the attention of Council and the public.

Additional Residential Unit Amendment Policies

As detailed in the attached notice, the proposed amendment will expand the County second unit policies to not only permit one secondary dwelling unit within a detached dwelling, semi-detached and rowhouse or townhouse dwelling, but also introduces policies that would permit one additional dwelling unit in detached building, accessory to the above listed residential dwelling types. These proposed changes are in keeping with the provincial directives and the amendment directs that local municipal official plans and zoning by-law will implement policies and regulations/zone provisions around such added residential units. This will permit an added residential dwelling unit opportunity from a detached building for such residential type uses in the Township. Attached in full is the proposed Additional Residential Units proposed Amendment No. 2 to the UCLG Official Plan. No

issues are raised with this proposed amendment.

Aggregate Resources Amendment

As detailed in the notice, the aggregate study and proposed amendment policies related to aggregates were required by the initial UCLG Official Plan, to meet provincial policy. The amendment: provides for added bedrock mapping and sand/gravel resource mapping; allows certain types of development in proximity to mapped aggregate resources; requires assessments for other types of development in proximity to/within mapped aggregates and adds policies that apply to new or expanding aggregate resource extraction operations. Amendments to the County Official Plan will not be required for new or expanding aggregate resource extraction operations at the local municipal level, but local Official Plan Amendments may be required depending on the policies of local Official Plans.

Attached in full is the proposed Aggregate Resources proposed Amendment No. 3 to the UCLG Official Plan, which includes a Map identifying Bedrock Resource Areas, and Sand and Gravel Resource Areas (primary/secondary/tertiary). The map also denotes constraints, wherein aggregates resources are not applicable, e.g. within 120 m of a provincially significant wetland, within 500 m of a Settlement Area, and within 500 m of a lake or River. **Save and except for these noted buffered exceptions, the entirety of Augusta Township is delineated as a Bedrock Resource Area (hatched area on the map), with mainly tertiary sand and gravel resources/deposits denoted locations (in yellow on the map).**

While the amendments are in keeping with the Provincial Policy Statement (2020) regarding aggregate and bedrock resource protection, the amendment in full is being brought to Council's attention as the amendment requires that aggregate assessments done by a qualified consultant may be required to support certain types of non-exempted new development applications in areas of bedrock resources and sand and gravel resources, or in proximity thereto. The cost of such studies (and a possible peer review) would need to be borne by the applicant. This will also include a consultant assessment of the aggregate potential to be extracted to support rural residential lot severance applications, where there is the identification of bedrock resources and/or sand and gravel resources, or being in proximity thereto.

Existing lots of record would not be required to provide a supportive aggregates assessment in order to be built upon (provided the development otherwise complies otherwise with the Township's Zoning By-law and other applicable law).

The Map is to serve as a screening map, bringing the resources to the attention of the municipality when an application for development is being proposed or advanced. If the property is in a resource area an assessment is required if it is not an "exempted" type of development as detailed in the amendment.

The following types of new development would not require a supportive

assessment: clusters of development in the Agriculture and Rural areas, as defined in the amendment; development/expansion of an agricultural use, an agriculture-related use/on-farm diversified use. The following types of Planning Act applications are also exempted from requiring an aggregate assessment study: agricultural use new lots, the severance of a surplus farm dwelling in an agricultural designation, lot line adjustments, the rezoning of land for commercial, industrial or recreation use in the Agriculture or Rural designations provided an amendment to the local Official Plan is not required and the use does not include new dwelling units or accommodations; any expansion of a legal non-conforming use (subject to meeting all other tests in a local Official Plan); any application for site plan or minor variance, regardless of location.

The policy language in the proposed amendment refers to types of new development that would be "exempted" from requiring a supportive assessment of the aggregate potential to be done. Given the list of "exempted" types of new development, it appears that any "new" application for any new residential lot creation and institutional type use and any Official Plan Amendment would require a supportive aggregates assessment study to be done by a qualified consultant to support the new development application. This would need to be done at the applicant's sole expense and possibly include a peer review expense if deemed required by the County. **It is recommended that in lieu of listing "exempted" types of development or planning applications from having to undertake an aggregates assessment study, for clarity, ease of implementation, and transparency, that the policies instead, or in addition to, list the types of applications that would warrant a consultant's assessment study of the impact on aggregate resources to support certain planning applications, e.g. new residential lot creation applications, institutional uses, Official Plan Amendments, other.**

There are also buffers from sand and gravel resource areas of 300 m and 500 m of Bedrock Resource Areas and licensed existing quarries to be regarded as adjacent lands to such resources, with policy implications. **It is recommended that these adjacent land/buffers of 300 m from sand and gravel resource areas and 500 m from Bedrock Resource Areas be added as a "note" to the screening map, for ease of policy reference/implementation, so these potential influence areas are flagged more immediately on the screening map itself.**

POLICY IMPLICATIONS:

Upon approval of the pending Official Plan Amendments by the UCLG, the Township will need to regard these added Official Plan policies in the implementation of planning at the Township level. The Township's Official Plan would need to be updated to comply with the Counties Official Plan. There will be implications on applicants.

FUTURE FINANCIAL CONSIDERATIONS:

There will be financial implications on applicants where aggregate/bedrock resource assessment studies are required by proponents advancing a new development application where their development application has aggregate/bedrock policy implications, such as new residential lot severances in bedrock/sand/gravel resource areas.

The Township will need to undertake changes to the Township's Official Plan to be compliant with the UCLG Official Plan and the Provincial Policy Statement (2020) with respect to added residential units and aggregates/bedrock resource policies.

Barbara Kalivas Planner (Interim)

Steve McDonald, CAO

Attachments.

From: Tom Graham
Sent: December-13-21 12:22 PM
To: Mallory, Elaine <Elaine.Mallory@uclg.on.ca>
Cc: Mills, Cherie <Cherie.Mills@uclg.on.ca>; Amy Martin <amartin@northgrenville.on.ca>; Todd, Lesley <Lesley.Todd@uclg.on.ca>
Subject: Re: Notice of Proposed Counties Official Plan Amendment - Aggregate Resources

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Hi, Elaine – further to my detailed email of October 18, 2021, please accept these additional comments for the record.

1. Mapping
I appreciate that the consultant has correctly removed the bedrock overlay where identified earlier.

2. Significant Groundwater Recharge Areas
Many of the areas identified as 'Selected Sand and Gravel Resource Area (Tertiary)' on Schedule 'A' coincide with RVCA's Significant Groundwater Recharge Areas. These deposits of sand and gravel should not be marked as 'Gravel Resources' for extraction, but rather protected as areas important to natural features such as wildlife and drinking water.

3. Source Water Protection
There is still no reference anywhere in the draft Aggregate Resources Master Plan nor the Official Plan Amendment to:

- Source Water Protection
- Significant Groundwater Recharge Areas
- Highly Vulnerable Aquifers

I note the additional 'considerations' added to Section 3.5.2.1 b), including locally significant 'wetlands and other wetlands', 'watercourses', and 'drinking water sources'. These are important additions.

Yet, there is more emphasis on the 'protection' and 'viability' of aggregate resources and almost no mention of the 'protection' and 'viability' of the aquifer and drinking water sources that we all rely on. The wording is still predominantly in favour of aggregate extraction. Note that it states "…the Counties and local municipality will be satisfied that prior to approval of a local municipal Official Plan amendment that the impacts are minimized…".

The people living in this area draw their water from what has already been identified as a 'Highly Vulnerable Aquifer'. We shouldn't be looking to 'minimize impacts' on drinking water sources; we should be protecting drinking water sources at all costs.

You can truck in gravel a lot more easily than you can truck in drinking water.

4. Notice of Decision

Please keep me notified of the decision on this Amendment.

Thank you.

Sincerely,

Tom
--
Tom Graham
Songwood Farm | *FSC-Certified – A Forest for Seven Generations. Planted over 25 thousand trees since 1969.*

From:	Tony Sevelka
To:	Mills, Cherie
Subject:	FW: Draft Aggregate Resources Master Plan United Counties of Leeds and Grenville
Date:	December 31, 2021 9:02:02 AM
Attachments:	Flyrock Presentaton.pptx Flyrock Power Point Presentation 1623f1c3-98bd-42e3-9bde-c600d979b08f.pdf OPPI-Fly-Rock-Public-June-2021.pdf Designated Blast Area and Setbacks as Protection Against Land Use Incomp....pdf Preventing Consequences of Flyrock Revised.pdf Adverse Effects 13 Homeowners Bought Out by Quarry Owner (Jan-21).pdf Flyrock The Ultimate Adverse Effect From Quarry Blasting.pdf Blasting Vibrations, Airblast, Complaints & Lawsuits.pdf

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Cherie, FYI.

From: Tony Sevelka
Sent: Friday, December 31, 2021 8:56 AM
To: 'elaine.mallory@uclg.on.ca' <elaine.mallory@uclg.on.ca>
Subject: Draft Aggregate Resources Master Plan United Counties of Leeds and Grenville

Ms. Mallory, I have read the Meridian Draft Report on Aggregate Resources Master Plan (October 4, 2021) and found it lacking in objectivity, and essentially a one-sided presentation reflecting the views of the aggregate industry, with little or no independent research, and without input from the residents that would be most adversely impacted by the extraction of aggregate.

The attached independently conducted research should be of interest to you, and the residents of United Counties of Leeds and Grenville.

As noted from the research conducted, a municipality's jurisdiction over land use controls, including land use compatibility and setback requirements, is not preempted by the Aggregate Resources Act (ARA).

- Licencing requirements pursuant to Section 12 of the Aggregate Resources Act (ARA) do **not** replace a municipality's jurisdiction over land use controls and land use compatibility (avoidance of *adverse effects*), as described in *Kevin Matthews/Robin Latimer v. Gorham (Township)*, (2020),[1]

> *[84] Section 12 (1) of the ARA, which requires that a licence application provide information on "any planning and land use considerations," does not displace a municipality's role or jurisdiction in determining zoning issues, but instead actually highlights the municipality's role. This principle is laid out in Carlyle Development v. Baldwin (Township), 2017 CarswellOnt 7658 ("Carlyle") at paragraph 35:*
>
> Section 12(1) of the ARA sets out matters to be considered by the Minister in deciding whether to issue an aggregates licence, including the effect of the operation of a proposed quarry on nearby communities and planning and land-use considerations. Also, the Provincial Standards require that a licence application provide information on "any planning and land use considerations". The Board finds that these provisions do not

> displace a municipality's role or jurisdiction in determining zoning issues. **They reinforce the point that MNRF considers a municipality's land-use planning decisions associated with proposed quarry sites when deciding whether or not to issue a licence, thus highlighting a municipality's role in this regard**. [emphasis added]

- According to I. M. Rogers in *Canadian Law of Planning and Zoning* (Carswell, 1973),[2] the principal purpose of zoning is the preservation of property values and the separation of incompatible land uses.

- All *adverse effects*, including "flyrock" the ultimate adverse effect, as defined under the Environmental Protection Act and the Provincial Policy Statement, must remain on the quarry site, which can only be achieved by imposing appropriate mandatory setbacks.

- Why does the Aggregate Industry and their explosives engineers conceal flyrock from the public? Because,

  - flyrock is the ultimate *adverse effect*
  - flyrock is uncontrollable and can never be eliminated
  - flyrock has the potential to injure or kill humans, pets, livestock and wildlife
  - flyrock has the potential to damage tree stands and other crops
  - flyrock has the potential to damage personal and real property
  - concealing the dangers of flyrock from the public serves the financial interests of the Aggregate Industry

  Note: Flyrock meets the Ontario EPA definition of contaminant, and the *adverse effects* are not trivial. In *Castonguay Blasting Ltd. v. Ontario (Environment)*, 2013 SCC 52 (CanLII), [2013] 3 SCR 323, <https://canlii.ca/t/g1038> **the Supreme Court held that "the flyrock could easily have seriously injured or killed someone."**

- The carnage caused by flyrock is described and presented visually in the two attached Power Point presentations, which were presented to members of Gravel Watch on June 27, 2021. Also attached is the Ontario Professional Planners Institute's (OPPI) Member Advisory on the issue of "Fly Rock."

- The December 2009 State of the Aggregate Resource in Ontario (SAROS) Paper 5 (pages 31-32), prepared by Golder Associates and co-authored by David Hanratty (now front man for Votorantim Cimentos) does not disclose the significant number of jurisdictions with quarry setbacks/buffers of 500 metres to 800 metres, at the time of the study, while advocating for a 30-metre quarry setback (and possibly less) for the sole purpose of being able to extract more aggregate at the expense of innocent and vulnerable third-party property owners. There is no mention of flyrock, the ultimate adverse effect, nor any other adverse effects (as defined in the Environmental Protection Act and the Provincial Policy Statement), the

avoidance of which warrants a setback of 800 metres confined to the quarry site.

- Setbacks are a quintessential planning function, and to paraphrase Eloranta,[3] past president of the International Society of Explosives Engineers (ISEE), when it comes to blasting quarry operations, there are only two choices:

> ***Don't blast in a location that threatens public safety or adopt the safety measures required [i.e., impose adequate setbacks on the quarry operation]***…

- As aptly stated by a local resident in response to a proposed quarry expansion in the Township of McNab/Braeside seeking to externalize a setback requirement on adjoining privately-owned third-party property:[4]

> ***"We expect to retain full use of our lands as purchased and insist that we remain safe from the adverse effects while situated anywhere on our own property. We therefore demand respect for our property boundaries."*** (John Kerr)

- The health and quality of life implications from aggregated aggregate operations are not addressed in a proponent-driven Blast Design Report (Blast Impact Assessment) or any other studies related to aggregate extraction, a concern expressed by the Medical Officer of Health for the Region of Peel in a January 17, 2014, letter addressed to the Minister of the Environment:

> *I am writing to you to express Peel Health's concern about aggregate operations and their cumulative impacts on the local airshed.*
>
> *Currently [as of January 2014], there are approximately 1,400 hectares [3,459 acres] of aggregate operations in the area of Caledon Village, either proposed, under development or nearing the end of operations.* ***The local community is increasingly concerned about the health, environmental and social impacts of aggregate operations. As a result, the community has organized and formed a network which is sharing concerns and information with other communities province-wide, and which is seeking the assistance of Peel Public Health****.* [emphasis added]
>
> *Peel Public Health requests both the Ministries of Natural Resources and the Environment to assess and monitor the cumulative impact of multiple aggregate facilities currently operating in Caledon Village and of the new pits that are proposed. Peel Public Health staff would like to meet with you or your staff to discuss this further.*

- A list of major concerns identified and expressed by US citizens impacted by blasting quarry operations, as reported by the San Diego Union-Tribune (Oct. 18, 2009),[5] are as follows:

  - *They destroy communities;*
  - *They cause nervous, health, and sleep disorders in their communities;*
  - *People move away. Good luck selling your seriously depreciated house, though—to whom? is what one blogger asked [unsuspecting home buyers are often unaware or uninformed about the adverse effects of residing near a blasting quarry operation, and overpay];*

- *They are fined constantly by authorities. Sort of like a parking ticket. It's just a minor cost of business;*
- *They poison groundwater supplies with the deadly benzene runoff from the ammonium nitrate explosives;*
- *They damage houses with the blasts: e.g., cracked plaster, structures shifting off foundations. (You'll note that in the Massachusetts Web site below, the insurance companies won't cover the tens of thousands of dollars' damage from nearby mining companies.); [and]*
- ***Huge pieces of "flyrock" (isn't that a quaint new term!?) land as far away as three miles from the mine blasting, terrorizing residents and damaging houses (amazingly only one killed so far). Check the Nashville, Tenn., Web site for flyrock details of several nearby interstate highways closed down after huge boulders land on the road. The death was in West Virginia, of a little boy killed in his bed by flyrock smashing through his bedroom window**. *[emphasis added]*

> **<u>As noted, of the 163 discovered *flyrock* incidents, 26 incidents of *flyrock* ended in loss of life (29 people were killed), resulting in a "kill" rate of 16%. An additional 36 people were injured in the 26 *flyrock* incidents that resulted in loss of life</u>**. (see the attached research paper ***Preventing Deadly Consequences of Flyrock: Mandatory Minimum Setbacks Required***)

Residents of United Counties of Leeds and Grenville are concerned about blasting quarries, and recognize the need to incorporate robust Aggregate policies in the Aggregate Resources Master Plan that eliminate short- and long-term *adverse effects* or *impacts* on the *environment* and the *citizens*, which can only be achieved by separating incompatible land uses and imposing adequate setbacks on new blasting quarry applications. Appropriate aggregate policies, that restrict blasting quarries to farther than 1,000 metres from sensitive receptors and Settlement Areas (e.g., human targets exposed to flyrock)

- would provide clear direction as to where new blasting quarries could possibly locate within United Counties of Leeds and Grenville, while still protecting the *environment* and protecting and maintaining the *health, safety and welfare of its citizens and the general public* during the entire period a blasting quarry is expected to remain operational;

- save United Counties of Leeds and Grenville (i.e., taxpayers) and ratepayer groups from expending substantial resources (time and money) on fighting blasting quarry applications in inappropriate locations within the United Counties of Leeds and Grenville;

- virtually eliminate future citizen complaints and lawsuits that operational blasting, quarries inevitably generate (i.e., flyrock, noise, fumes, odour, dust, ground
  vibration, subsidence, sinkholes, airblast, soil contamination, personal or real property damage, injury or death of humans, pets or wildlife, well-water quality

or
quantity, etc.); and

- preserve United Counties of Leeds and Grenville's tax base by avoiding the deleterious effects that blasting quarries have on the value of nearby residential properties (e.g., Settlement Areas),[1] and ensure that homeowner equity is not eroded or that a community is not stigmatized, so as to render homes unmarketable or unmortgageable.[2] [3]

Best wishes for a safe, healthy and better New Year!

Regards, Tony

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[1] *Kevin Matthews/Robin Latimer v Gorham (Township)*, 2020 CanLII 32070 (ON LPAT), <https://canlii.ca/t/j6xdm>, retrieved on 2021-12-09.

[2] *Service Corporation International (Canada) Inc. v. Burnaby (City of)*, 1999 CanLII 7012 (BC SC), <https://canlii.ca/t/1d45r>, retrieved on 2021-12-09.

[3] Fischenich, Mark. "Expert: Flyrock from any blast 'unacceptable,' *The Free Press*, Oct 21, 2017, https://www.mankatofreepress.com/news/local_news/expert-flyrock-from-any-blast-unacceptable/article_8ad31cf8-b5cf-11e7-bf58-c3cdd328cf7f.html.

[4] Dunn, Derek. "Township passes bylaw limiting quarry size," *InsideOttawaValley.com,* January 8, 2015, https://www.insideottawavalley.com/news-story/5249453-township-passes-bylaw-limiting-quarry-size/.

[5] Biddle Jr, Nicholas. "Forum: National anti-quarry 'tea party' blasting across Web," https://www.sandiegouniontribune.com/sdut-forum-national-anti-quarry-tea-party-blasting-2009oct18-story.html.

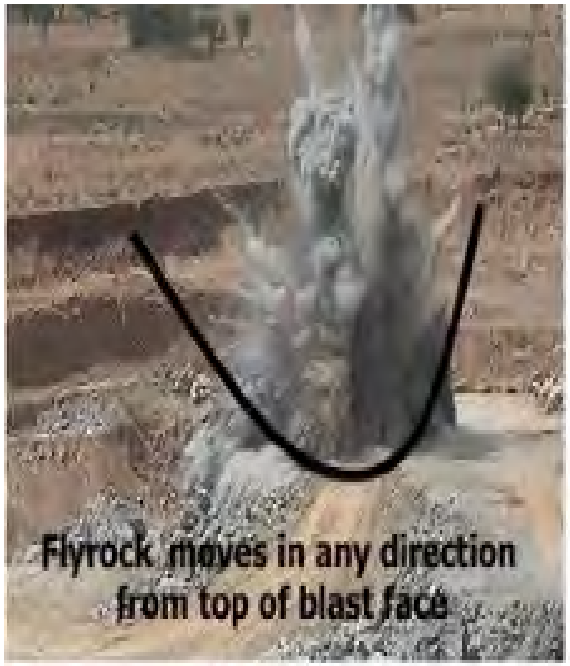
FLYROCK: AN INEVITABLE BY-PRODUCT OF QUARRY BLASTING OPERATIONS

Prepared: June 10, 2021
Prepared by: Tony Sevelka,
AACI, P App, FRICS, MAI, AI-GRS

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Cratering



Face burst



Rifling

Flyrock is the dirty little secret of the Aggregate Industry and the explosives engineers acting on their behalf, and they have done a remarkable job of concealing the dangers of flyrock from the public!

There are many undesirable environmental and health and safety risks associated with blasting quarry operations, but the focus of this presentation is generally on flyrock.

What is a Quarry?

"quarry" means land or land under water from which consolidated aggregate is being or has been excavated, and that has not been rehabilitated, but does not mean land or land under water excavated for a building or structure on the excavation site or in relation to which an order has been made under subsection (3) (Aggregate Resources Act)

https://www.ontario.ca/laws/statute/90a08



What is Flyrock?

- Flyrock means any material propelled by a blast that would be actually or potentially hazardous to persons or property

  https://www.lawinsider.com/dictionary/flyrock

- Flyrock is debris ejected from the blast site that is traveling through the air or along the ground. Flyrock may be rock or soil. Flyrock is considered a ***contaminant*** under the Environmental Protection Act (EPA), which results from human activities (i.e., quarry blasting) that causes or is likely to cause an ***adverse effect***.

Note: There is no definition of “flyrock” in the Ontario Aggregate Resources Act.

What does the Ontario Aggregate Resources Act Say About Flyrock?

- ***A licensee or permittee shall take all reasonable measures to prevent fly rock from leaving the site during blasting if a sensitive receptor is located within 500 metres of the boundary of the site***. (O. Reg. 466/20, s. 2 (2), effective January 1, 2022

  https://www.ontario.ca/laws/regulation/970244

- This ARA regulation implies that it is permissible for a licensed blasting quarry operation to launch flyrock off site as long as there are no sensitive receptors within 500 metres. (The term "sensitive receptor" is often code for "human targets.")
- The flaw in this ARA regulation is self-evident, and inconsistent with the EPA regulation that flyrock launched off site is not permissible.
- Launching flyrock off site onto privately owned third-party property constitutes unlawful "trespass."

What does the Ontario Aggregate Resources Act Say About Flyrock?

Note: In the Aggregate Resources Act “sensitive receptor” means (a) a school or child care centre, or (b) any residence or facility at which at least one person sleeps, including a long-term care home, hospital, trailer park or campground. O. Re. 466/20, s. 1.

In the Provincial Policy Statement (PPS) 2020 “sensitive land uses: means buildings, amenity areas, or outdoor spaces where routine or normal activities occurring at reasonably expected times would experience one or more ***adverse effects*** from contaminant discharges generated by a nearby ***major facility. Sensitive land uses*** may be a part of the natural environment or built environment. Examples may include, but are not limited to: residences, day care centres, and educational and health facilities. [underscoring added]

What does the ARA say about blasting?

(5) A licence, aggregate permit or wayside permit that authorizes blasting at the site is subject to the following conditions:

1. *No blasting shall occur on a holiday, or between 6 p.m. and 8 a.m., unless the permittee holds an aggregate permit and there is no sensitive receptor located within 2,000 metres of the area in which the blasting takes place.*

This ARA regulation implies that it is permissible for a licensed quarry operation to blast anytime during the day between 8:00 am and 6:00 pm, excluding holidays, provided there are no sensitive receptors within 2,000 metres.

Why does the Aggregate Industry and their explosives engineers conceal flyrock from the public?

- Because flyrock is uncontrollable and can never be eliminated
- Because flyrock is the ultimate ***adverse effect***
- Because flyrock has the potential to damage personal and real property
- Because flyrock has the potential to damage tree stands and other crops
- Because flyrock has the potential to injure or kill humans, pets, livestock and wildlife
- Because concealing the dangers of flyrock from the public serves the financial interests of the Aggregate Industry.

Note: Flyrock meets the Ontario EPA definition of contaminant, and the ***adverse effects*** are not trivial. In ***Castonguay Blasting Ltd. v. Ontario (Environment)***, 2013 SCC 52 (CanLII), [2013] 3 SCR 323, <https://canlii.ca/t/g1038> the Supreme Court held that "the flyrock could easily have seriously injured or killed someone."

What are ***adverse effects***?

The PPS takes its definition of ***adverse effects*** directly from the ***Environmental Protection Act***, and means one or more of:

a) impairment of the quality of the natural environment for any use that can be made of it;

b) injury or damage to property or plant or animal life;

c) harm or material discomfort to any person;

d) an adverse effect on the health of any person;

e) impairment of the safety of any person;

f) rendering any property or plant or animal unfit for human use;

g) loss of enjoyment of normal use of property; and

h) interference with normal conduct of business.

What are the causes of flyrock?

- Overloaded blastholes with excessive amounts of explosives
- Heavily confined charges or the lack of relief (i.e. lift blasts)
- Explosives loaded into incompetent materials (i.e. mud seams, fractures, and/or voids)
- Insufficient front-row burden, causing front-face blowouts
- Burdens and spacings too close together (resulting in high powder factors)
- Inadequate/insufficient stemming material
- Inadequate delay between holes in the same row and between rows; detonators firing out of sequence
- Deviation of blast hole detonation from the intended sequence
- Changing geology or rock type
- Spacing and burden exceeds borehole depth
- Angled boreholes
- Secondary blasting
- Human error (incompetence or negligence)
- Blaster under the influence of drugs or alcohol

Why is Flyrock so Dangerous?

- Flyrock can come at you from any direction. Flyrock can be thrown high like a fly ball, fly straight like a fastball, roll along the ground, or ricochet from any direction. Flyrock can be gravel, rocks, tree trunks, construction materials, mud—even water. (p. 3 Worker's Hazard Alert, https://www.cfins.com/wp-content/uploads/2019/01/blasting-safety-worker-alert.pdf)
- Flyrock can be as small as marbles or as large as a car. (p. 3, Worker's Hazard Alert)
- Each pound of explosives has the force of 76 million horse power. An 8½-pound piece of flyrock travelled 1,200 feet (366 metres) from the blast and with enough force to dent the roof of a truck. The dented roof killed the worker. (ISEE Blaster's Handbook)

Why is Flyrock so Dangerous?

- Flyrock debris can travel 6,000 feet (1,829 metres) or more, reach speeds of 400 miles per hour (644 kilometres per hour), and can penetrate buildings, smash vehicles, and cause great bodily harm or death. (Pits & Quarries, 1991 and Flyrock Hazard Alert, https://www.dmme.virginia.gov/dmm/PDF/SAFETY/ALERTS/blastingflyrock/FlyrockHazardAlert.pdf)
- Any size material is capable of damaging property or injuring or killing people, pets, livestock and wildlife.
- Blasting in a karst landscape makes the risk of flyrock an “extreme problem.” (Ludwiczak, Blasting Consultant)
- Wind can increase the distance that flyrock can be launched by as much as a factor of two (Zhou, et al).

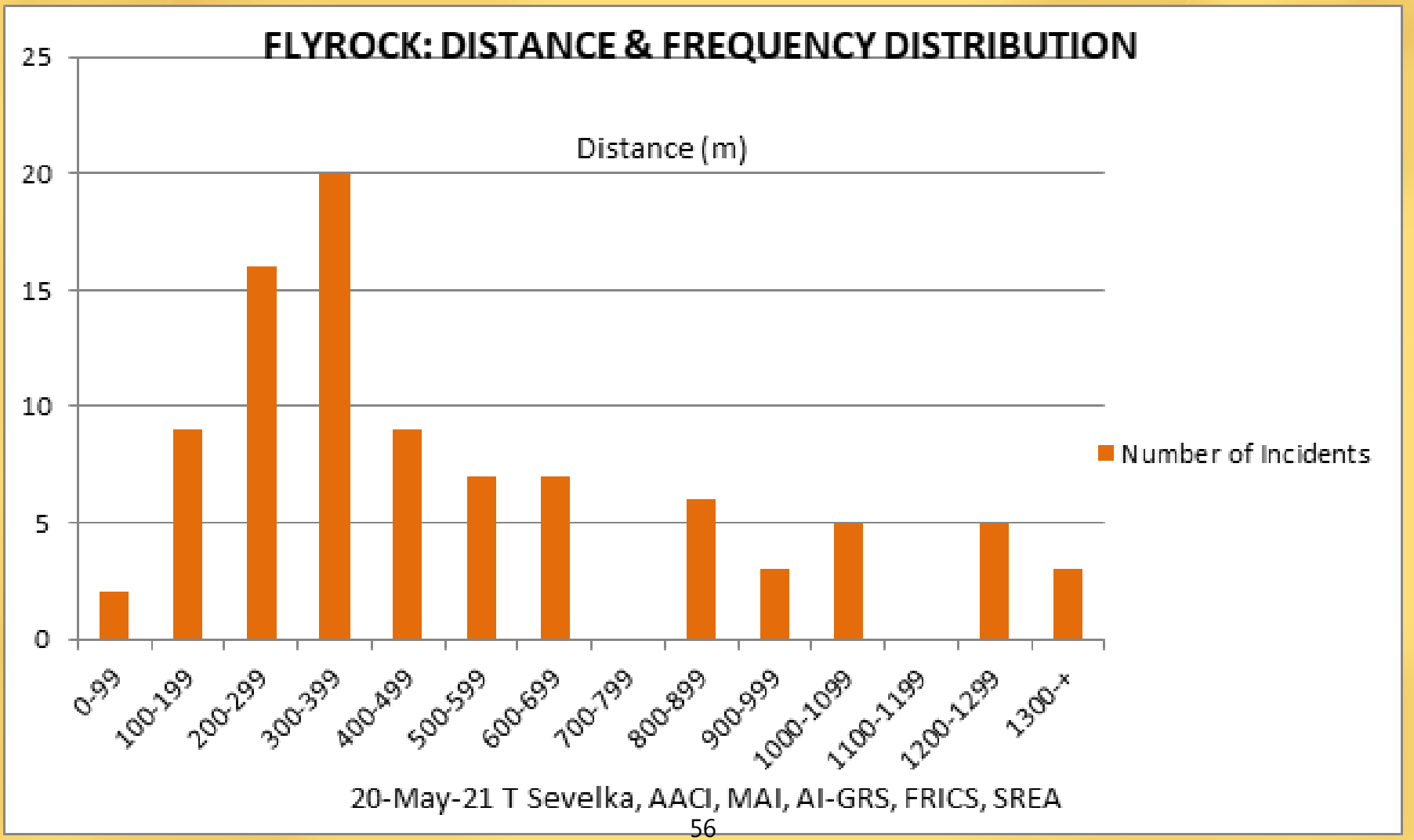
How Prevalent is Flyrock?

- Flyrock is a common occurrence (District Manager, Mining Safety and Health, Warrendale, Pa.)
- Flyrock occurs 5% of the time (Regional Operations Manager, Consbec Inc., Nova Scotia, para. 11, Parker Mountain Aggregates, 2007 CanLII 91661 (NS OHSAP)
- 5% of 15,000 to 20,000 yearly secondary quarry blasts will throw flyrock 800 feet (244 metres) to 850 feet (259 metres) (para. 435, Lee Lime Corp. v. Massachusetts Turnpike Authority, 149 NE 2d 905 – Mass: Supreme Court)
- Under reporting is responsible for five to 10 times the actual number of flyrock incidents (Davies 1995)

How Prevalent is Flyrock?

- Flyrock goes unreported by Blasting Quarry operators so as to avoid legal consequences (Raina et al. 2013)
- Flyrock that lands outside of the boundaries of a quarry in an uninhabited area unnoticed goes unreported.
- Most incidents of flyrock are only reported when uncovered by the public or when flyrock causes damage, injury or death.

Analysis of Flyrock Travel Distances



An analysis of 92 *flyrock* incidents, where the distance from the blast is known, indicate that 91% (84) of the *flyrock* incidents occurred within 1,099 metres, and 97% occurred within 1,299 metres.

The number of *flyrock* incidents within each interval, starting at between 300 and 399 metres, and the average distance travelled within each interval are summarized as follows:

- 20 (22%) of the flyrock incidents occurred between 300 and 399 metres (330 metres avg)
- 9 (10%) of the flyrock incidents occurred between 400 and 499 metres.(446 metres avg)
- 7 (8%) of the flyrock incidents occurred between 500 and 599 metres (515 metres avg)
- 7 (8%) of the flyrock incidents occurred between 600 and 699 metres (622 metres avg)
- 6 (7%) of the flyrock incidents occurred between 800 and 899 metres (802 metres avg)
- 5 (5%) of the flyrock incidents occurred between 1200 and 1299 metres (1225 metres avg)
- 3 (3%) of the flyrock incidents occurred over 1300 metres (2307 metres average)

Further, at 80%, which accounts for the first 74 *flyrock* incidents in ascending order, *flyrock* reached a distance of 800 metres, and, at 90%, which accounts for the first 83 *flyrock* incidents in ascending order, *flyrock* reached a distance of 1,020 metres.

Examples of Flyrock Incidents

- Flyrock 78: On January 10, 2006, a blast at a quarry in Ireland launched flyrock debris over 300 metres causing widespread damage to a quarry plant, private cars and buildings, and injuring three people.
- Flyrock 94: On December 12, 2017, a blast at a quarry in Belize showered flyrock debris over an area of approximately 800 metres, that killed Ronald Sutherland, injured five people, wrecked vehicles and left many houses badly damaged.
- Flyrock 98: A blast at a quarry in Ghana resulted in flyrock damaging the roofs of many homes in a nearby residential community, and in 2015, 300 residents sued two quarry companies for causing damage to their homes and properties.

Examples of Flyrock Incidents

- Flyrock 137: On May 7, 2016, a blast at a quarry in Africa launched flyrock debris that struck community members' homes and caused their homes to crack.
- Flyrock 138: On February 13, 2018, a blast at a construction site off Murfreesboro Road in Franklin, Tennessee, launched flyrock debris that "totaled" more than 50 cars at the neighbouring Ford Lincoln dealership
- Flyrock 140: On June 3, 2013, an explosion at a quarry in Quebec damaged 20 homes in the nearby community of Saint-Joseph-de-Coleraine.

Blast Design Report (Blast Impact Assessment)

An application for a permit for a blasting quarry requires preparation of a number of technical reports, one of which is the Blast Design Report.

- A blast design report is required if a sensitive receptor is within 500 metres of the limit of excavation to demonstrate that provincial guidelines for blast overpressure and ground vibration can be satisfied.
- An application for a quarry proposing to blast requires details about frequency and timing of blasts (more blast means greater potential for flyrock)

Blast Design Report (Blast Impact Assessment)

- An application for a quarry proposing to blast requires identification of the number of sensitive receptors located within 500 metres of the boundary of the site and the distance from the boundary to each sensitive receptor (more receptors means more property damage and more human targets that are likely to be injured or killed in the event of a flyrock incident)

A Proponent-Driven Blast Design Report

- Does not include an assessment of the potential for flyrock, the ultimate *adverse effect* on the communities in proximity to the proposed blasting quarry operation
- Does not include an assessment of the health risks from exposure to toxic fumes in communities in proximity to a blasting quarry operation.
- Does not include an assessment of complaints generated from residents residing in communities in proximity to a blasting quarry operation.
- Does not identity the number and age of residents in the communities in proximity to the proposed blasting quarry operation that will be exposed to the *adverse effects*
- Does not identity the number of patrons/visitors of businesses and tourist attractions in proximity to the proposed blasting quarry operation that will be exposed to the *adverse effects*.

A Proponent-Driven Blast Design Report

- Does not list the date and type of construction of each building or structure (i.e., sensitive receptor) in the communities in proximity to the proposed blasting quarry operation, each of which has a different tolerance to ground vibrations and overpressure from blasting.
- Does not identify as “sensitive receptors” unimproved “legal lots of record,” under separate and distinct ownership which possess “as-of-right” development potential.
- Does not take into account any *adverse effects* enhanced by wind conditions with respect to overpressure from blasting quarry operations.
- Does not include an estimate of the expected life of the proposed blasting quarry operation (i.e., all phases).

A Proponent-Driven Blast Design Report

The superficial nature of proponent-driven Blast Design Reports (Blast Impact Assessments) precludes meaningful analysis of potential health and safety risks, quality of life issues and potential nuisances that residents (and passers-by, visitors, workers, business employees and patrons) will experience as a result of a proposed blasting quarry operation.

Who is responsible for protecting the environment and the public from the dangers of flyrock?

The depraved indifference shown by Ontario explosives engineers in the preparation of proponent-driven Blast Impact Assessments (BIA) to the significant dangers of *flyrock* is exemplified in the testimony of the explosives engineer at a 2020 LPAT hearing involving an application for a quarry in the Township of Tyendinaga:

> *Mr. Cyr attempts to explain away the absence of any meaningful analysis of flyrock in the BIA on the grounds that this falls outside the scope of an BIA that is aimed primarily at the MECP's Noise Guidelines. He further suggests that the issue of flyrock is best left to provincial ministries which have the authority to "aggressively prosecute" flyrock incidents <u>after-the-fact</u> [p. 13].* [underscoring added]

The same explosives engineer absolved himself of any obligation to "make reasonable provision for the safeguarding of life, health or property of a person affected by the work for which the practitioner is responsible" (Professional Misconduct Section 72. (2) Regulation O. Reg. 941) in preparing a Blasting Impact Report for the proposed Childs Pit and Quarry Expansion.

> *While not specifically required as part of the scope of the Blast Impact Analysis under the Aggregate Resources Act, this report touches on the topics of the flyrock and general water wells for general information purposes only.* (p. 3, Blast Impact Analysis, Explotech, May 27, 2020)

Flyrock, as the ultimate *adverse effect*, is the most dangerous aspect of a blasting quarry operation, and, therefore, an analysis of flyrock must form part of the Blast Design Report (Blast Impact Assessment) together with ground vibration and overpressure (airblast) (Moore and Richards, 2005)

Flyrock Can Never Be Mitigated

Flyrock is a lethal product of ***unforeseen circumstances*** *which can never be mitigated. The likelihood of flyrock occurring from a delayed or accidental premature planned, or post blast inspection, a misfire or explosives accident,* ***can never be predicted****. No amount of planning will mitigate this risk.* [Section 2.1, Submission to the Senate Rural and Regional Affairs & Transport Legislation Committee Inquiry into Australia's General Aviation Industry, © *Fight Path Forum*, November 2020]

Protection From Flyrock

Setbacks are the only effective means of protecting third-party-owned property against flyrock, and protecting humans, pets, livestock and wildlife from injury or death.

- a minimum setback requirement of 800 metres imposed on the proponent of a proposed blasting quarry application would eliminate most of the risk associated with flyrock

Some jurisdictions have imposed mandatory setbacks on proposed blasting quarry operations:

- 800 metres setback between blasting and structures (Nova Scotia)
- >1,000 metres from a boundary of a Settlement Area (Algonquin Highlands)
- 500 metres minimum separation distance from sensitive land use (Timmins)
- 600 metres minimum from residential, commercial and mixed-use (Quebec)
- 600 metres from any drinking water supply well (New Brunswick)

Protection From Flyrock

Draft Ministry of the Environment, Conservation and Environment (MOECP) Land Use Compatibility Guideline (March 2021)

https://prod-environmental-registry.s3.amazonaws.com/2021-03/Proposed%20Land%20Use%20Compatibility%20Guideline.pdf

- The primary purpose of the Guideline is to support the implementation of the Provincial Policy Statement, 2020 (PPS) issued under Section 3 of the *Planning Act*, including policies 1.2.6.1 and 1.2.6.2 (Land Use Compatibility).

Protection From Flyrock

A new or expanding aggregate quarry operation, blasting and dewatering below the water table, is the most obnoxious, toxic and environmentally destructive land activity, with no prospect of rehabilitation, and qualifies as a *Class3 major facility.*

- A *Compatibility Study* is required when a new or expanding major facility is proposed to locate where there are existing or planned sensitive uses within the AOI (Area of Influence), including MSD (Minimum Separation Distance).
- A *Class 3 Major Facility* is subject to the following provisions
  - 1,000 meter Area of Influence (AOI) from existing or permitted land uses, and
  - 500 metre Minimum Separation Distance (MSD)

Protection From Flyrock

3. MINIMIZE and MITIGATE Impacts [p. 5]

- If the separation distance is not possible, the compatibility study must identify mitigation measures to ensure no adverse effects will remain post-mitigation.
- Even with proposed mitigation, the separation distance should be maximized to minimize impacts, and should not be less than the MSD. [underscoring added]
- Once implemented, monitor and maintain required mitigation measures over time to avoid future compatibility issues.

Where avoidance and minimization/mitigation of impacts is not possible, do not permit the proposed incompatible land use.

Note: Other planning issues that have not been addressed in this Guideline (e.g. issues related to species at risk, agricultural concerns, impacts to water, cultural heritage and archaeology) must be considered through other assessments and processes required under applicable legislation and policies.

Protective Blasting Shelter v Vulnerable Sensitive Receptor (i.e., Human Target)



5/8” thick steel construction



Fig. 9. The damage to structure (50 cm flyrock fragment at 320 m distance).

Wood-frame construction

Blasting Is An Ultrahazardous Activity Held To Strict Liability

- There is no duty to establish evidence of a breach of a standard of care to prove liability for damage, injury or death caused by blasting.
- In *Garland Coal & Mining Company v. Few*, 267 F.2d 785 (10th Cir. 1959) https://casetext.com/case/garland-coal-mining-company-v-few, blasting operations on adjoining land were upheld on a strict liability basis, and extend to more than flyrock, as it includes damages from concussion (airblast) and vibration.

Flyrock Canadian Cases

- ***Castonguay Blasting Ltd. v. Ontario (Environment)***, 2013 SCC 52 (CanLII), [2013] 3 SCR 323, <https://canlii.ca/t/g1038>
- ***Director of Occupational Health and Safety v. Government of Yukon, William R. Cratty and P.S. Sidhu Trucking Ltd***., 2012 YKSC 47 (CanLII), <https://canlii.ca/t/fs6vt>
- ***City Sand and Gravel Limited v. Newfoundland (Municipal and Provincial Affairs)***, 2007 NLCA 51 (CanLII), <https://canlii.ca/t/1sfnv>, (Leave to Appeal to Supreme Court of Canada denied)
- ***Miller Paving Ltd. v McNab / Braeside (Township)***, 2015 CanLII 70369 (ON LPAT), <https://canlii.ca/t/glwwn>, (para. 55)
- ***James v. Miller Group Inc.***, 2013 ONSC 3266 (CanLII), https://canlii.ca/t/g2f5j
- ***James v Miller Group Inc.***, 2015 ONSC 3138 (CanLII), <https://canlii.ca/t/gj16p>

- ***Dexter Construction Company Limited (Re)***, 2020 NSLB 41 (CanLII), <https://canlii.ca/t/j7xz3>
- ***Parker Mountain Aggregates Limited***, 2007 CanLII 91661 (NS OHSAP), <https://canlii.ca/t/j7q8f>
- ***R. v. Chenard***, 2005 ONCJ 501 (CanLII), <https://canlii.ca/t/1mfqs>
- ***Ontario (Ministry of Labour and Ministry of the Environment) v. Sunrise Propane Energy Group Inc. et al.***, 2013 ONCJ 358 (CanLII), <https://canlii.ca/t/fzhvs>
- ***MacMillan Bloedel (Alberni) Ltd. et al. v. British Columbia Hydro & Power Authority et al.***, 1972 CanLII 1042 (BC CA), https://canlii.ca/t/gwgbw
- ***Roy Judge Co. Ltd. v. Norris et al.***, 1973 CanLII 1236 (NS CA), https://canlii.ca/t/gwgdr
- ***WCAT-2009-01297 (Re)***, 2009 CanLII 36791 (BC WCAT), https://canlii.ca/t/24kng
- ***R. v. Austin Powder Ltd.***, ONCJ, 2014 (Charges under the ***Environmental Protection Act*** LSB File No. 11-8155) (Pakenham Quarry, Arnprior – 2009 unreported flyrock incident damaged a scale house and vehicles)

Flyrock American Cases

- ***Dept. of Energy v. Hobet Min. & Const.***, 358 S.E.2d 823 (1987), https://scholar.google.com/scholar_case?case=17148911866299365 66&q=flyrock&hl=en&as_sdt=2006
- ***Ramsburg v. Target Stores, Inc.***, 982 F. Supp. 1194 (1987) https://scholar.google.com/scholar_case?case=3137640203151959616&q=flyrock&hl=en&as_sdt=2006
- ***Fantasy Valley Resort, Inc. v. Gaylord Fuel Corp.***, 92 Md. App. 267 (1992) 607 A. 2d 584, https://scholar.google.com/scholar_case?case=8781503776859543886&q=flyrock&hl=en&as_sdt=2006
- ***Fagundes v. Ammons Development Group, Inc.***, 820 S.E.2d 350 (2018), NC App., https://scholar.google.com/scholar_case?case=15107525352572638587&q=flyrock&hl=en&as_sdt=2006

Flyrock American Cases

- ***Matter of Mastro v. Hudacs***, 224 A.D.2d 621 (1996) 638 N.Y.S.2d 681, https://scholar.google.com/scholar_case?case=8561234087670744605&q=flyrock&hl=en&as_sdt=2006
- ***Amerikohl Mining, Inc. v. Fayette County Zoning Board***, PA Commonwealth Court 2012, https://scholar.google.com/scholar_case?case=4967608865363526286&q=flyrock&hl=en&as_sdt=2006

FLYROCK AND SETBACKS

By

WILLIAM HILL P.Eng

BLASTING PROBLEMS

- 1. NOISE
- 2. VIBRATION
- 3. **FLYROCK**

BLAST & FLY ROCK




FLY ROCK CAN
BE BIG


FLYROCK MAKES ITSELF AT HOME



FLY ROCK CAN TRAVEL A LONG

Quarry boulder crashes through apartment rooftop

AMANDA PANACCI STAFF REPORTER
Published September 22, 2016 - 3:53pm
Last Updated September 22, 2016 - 8:50pm



Parkland Arms apartment was struck by a basketball-sized rock on Monday, causing property damage but no injuries.

The province is investigating after a "basketball-sized" boulder from a nearby quarry crashed through the roof of a Halifax apartment building Monday afternoon.

RECENT DISASTER - JULY 19, 2013

NEW STRAITS TIMES

19 July 2013 last updated at 10:50 pm

UPDATE: Explosion at rock quarry kills one, 11 injured




FLY ROCK CAN
BE FATAL

Damage at 350m



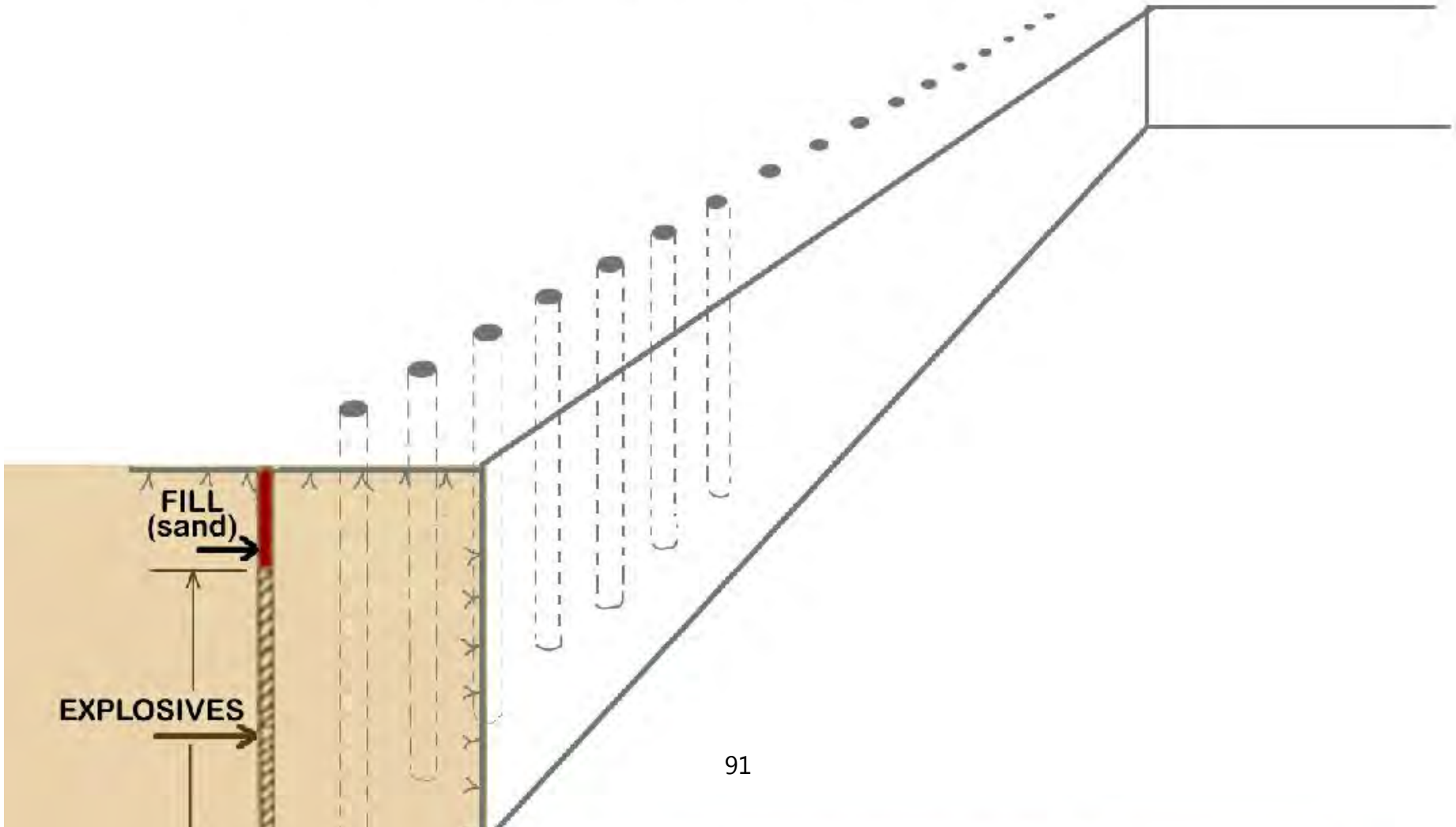
Dyno Nobel Liability Reduction

- **Eight years ago!**
- **Dyno Nobel Americas fires approximately 100 blasts per day**
  - ✓ **Approximately 150 flyrock incidents annually**
    - Many aren't reported
    - These numbers don't represent customer flyrock incidents
  - ✓ **Loss to the bottom line approximately $4 million dollars per year**
  - ✓ **Loss of sales**
  - ✓ **Loss of insurance to do business**
  - ✓ **Interruption of normal business flow**

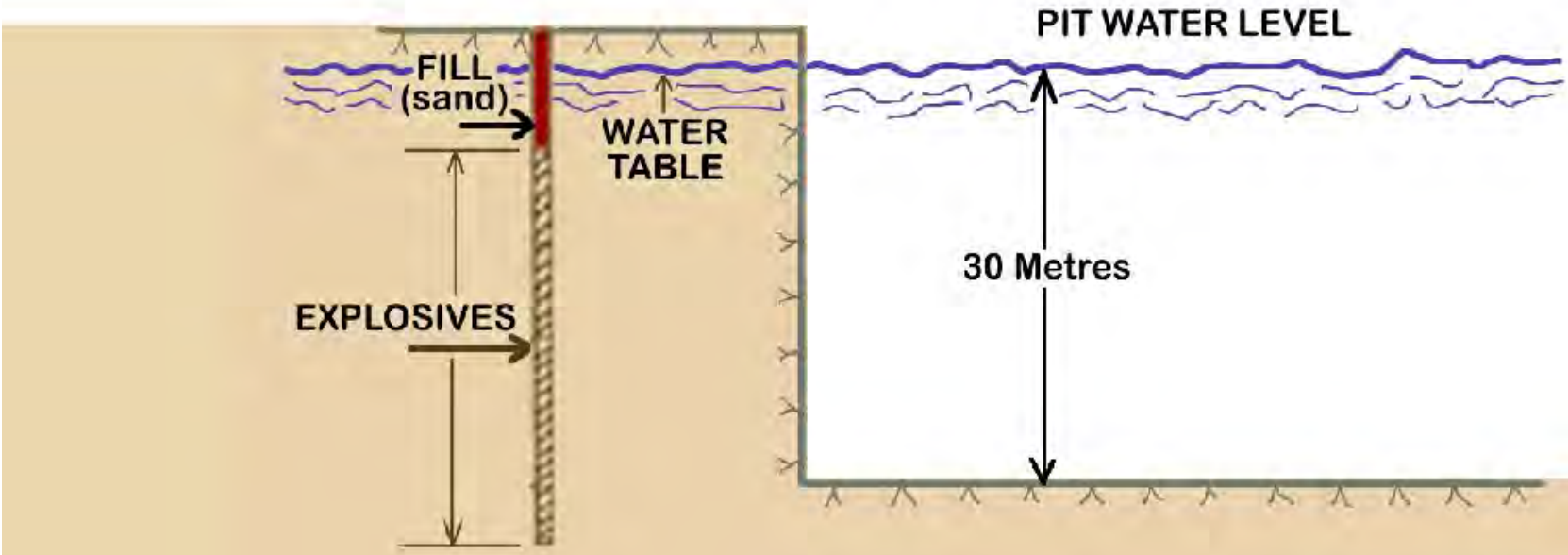
Information from Summa Insurance
Ralph Gremmel

QUARRY ACADEMY

BLASTING IN A MINE

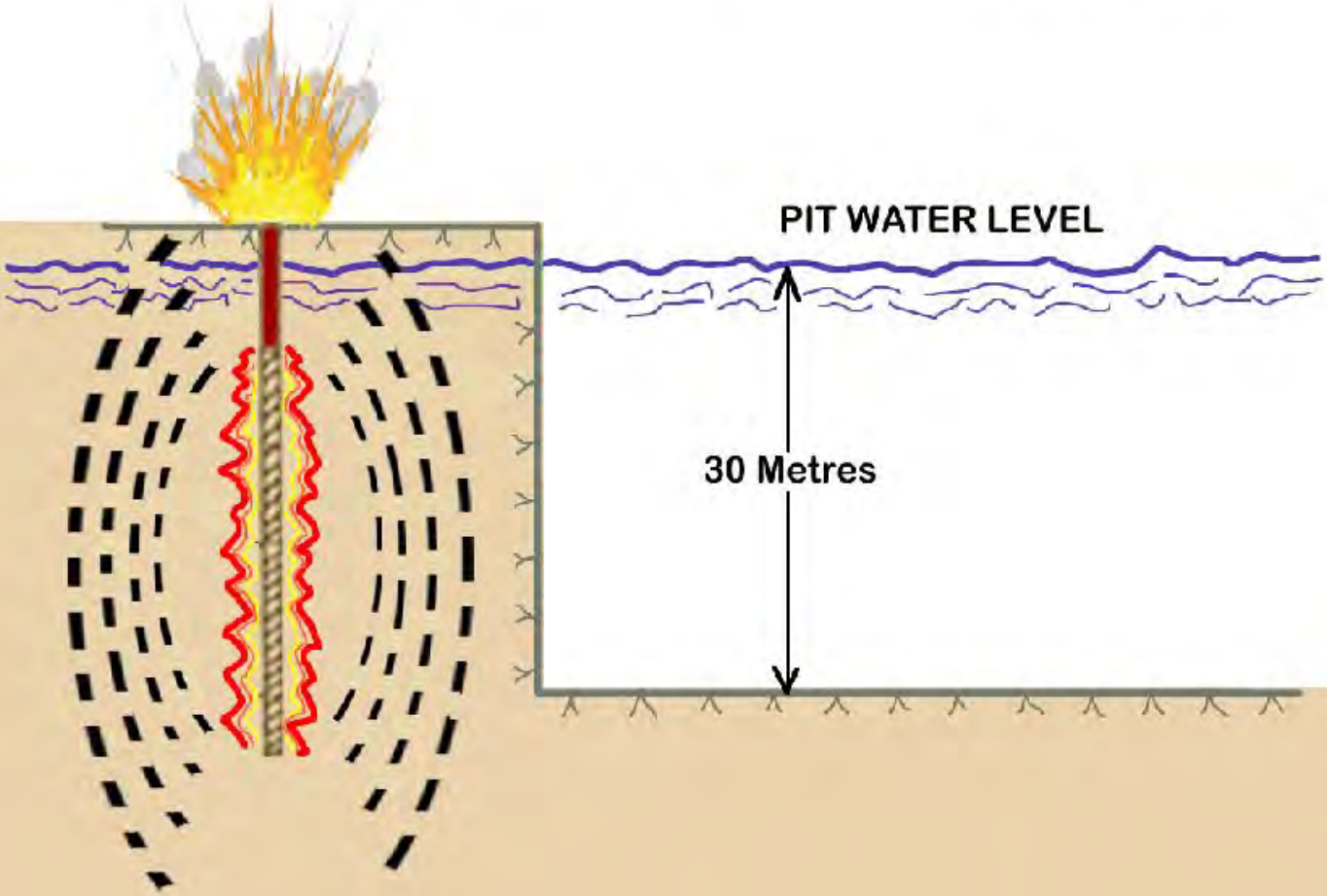


CROSS SECTION OF A DRILL HOLE

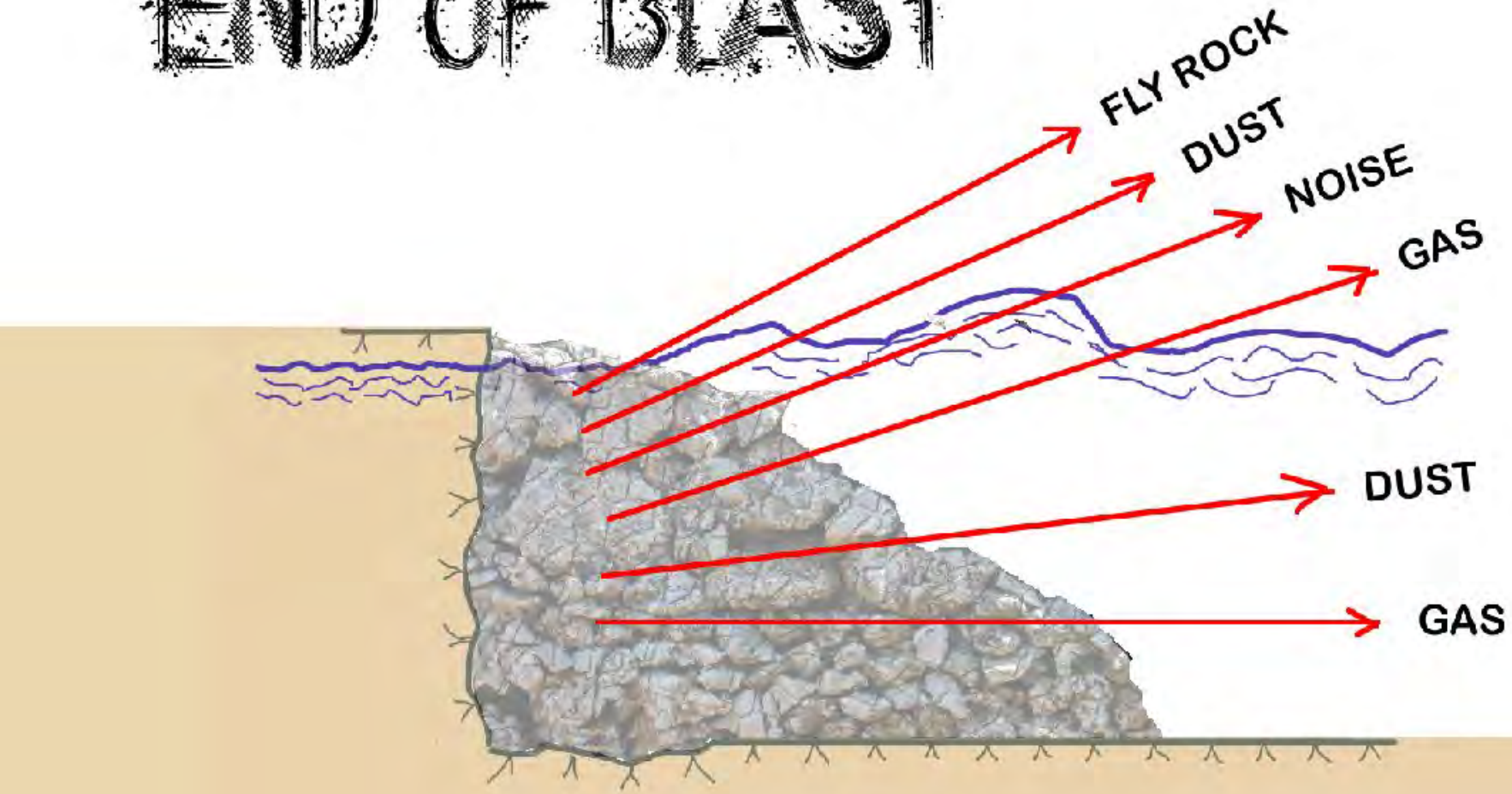


BLAST INITIATION

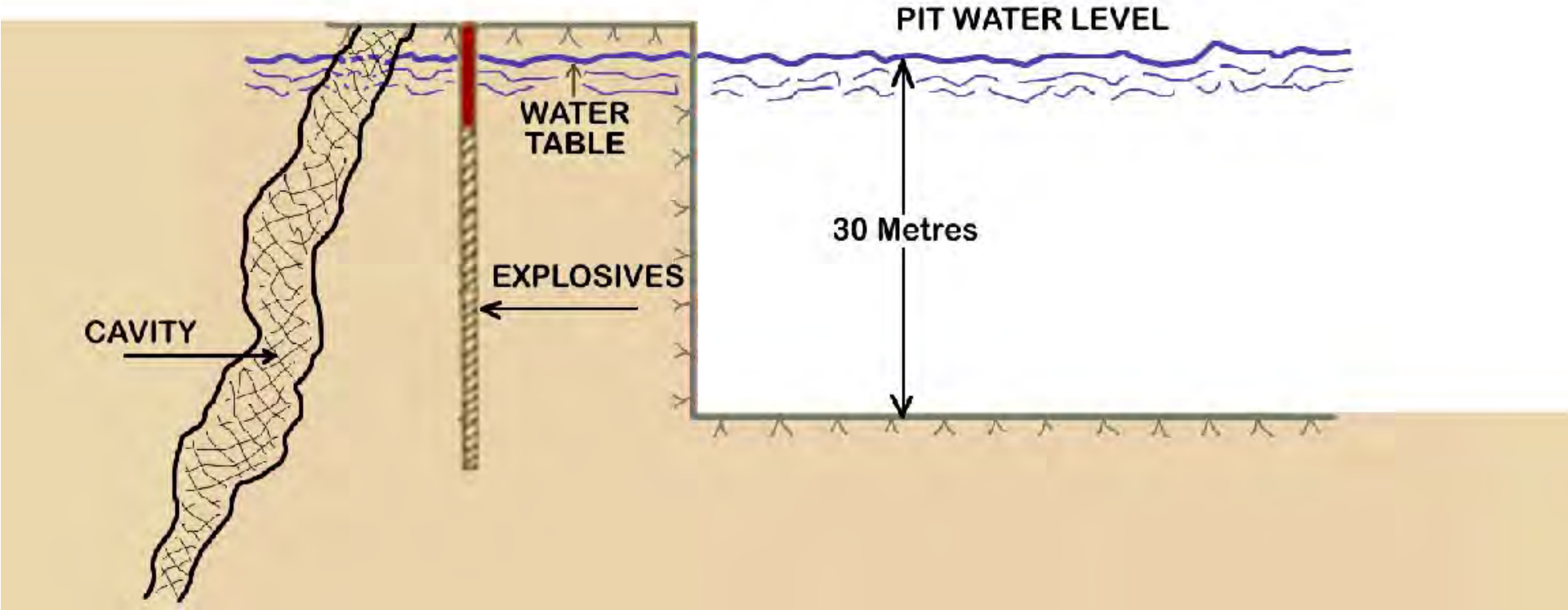
SHOCKWAVES TRAVEL 360 DEGREES



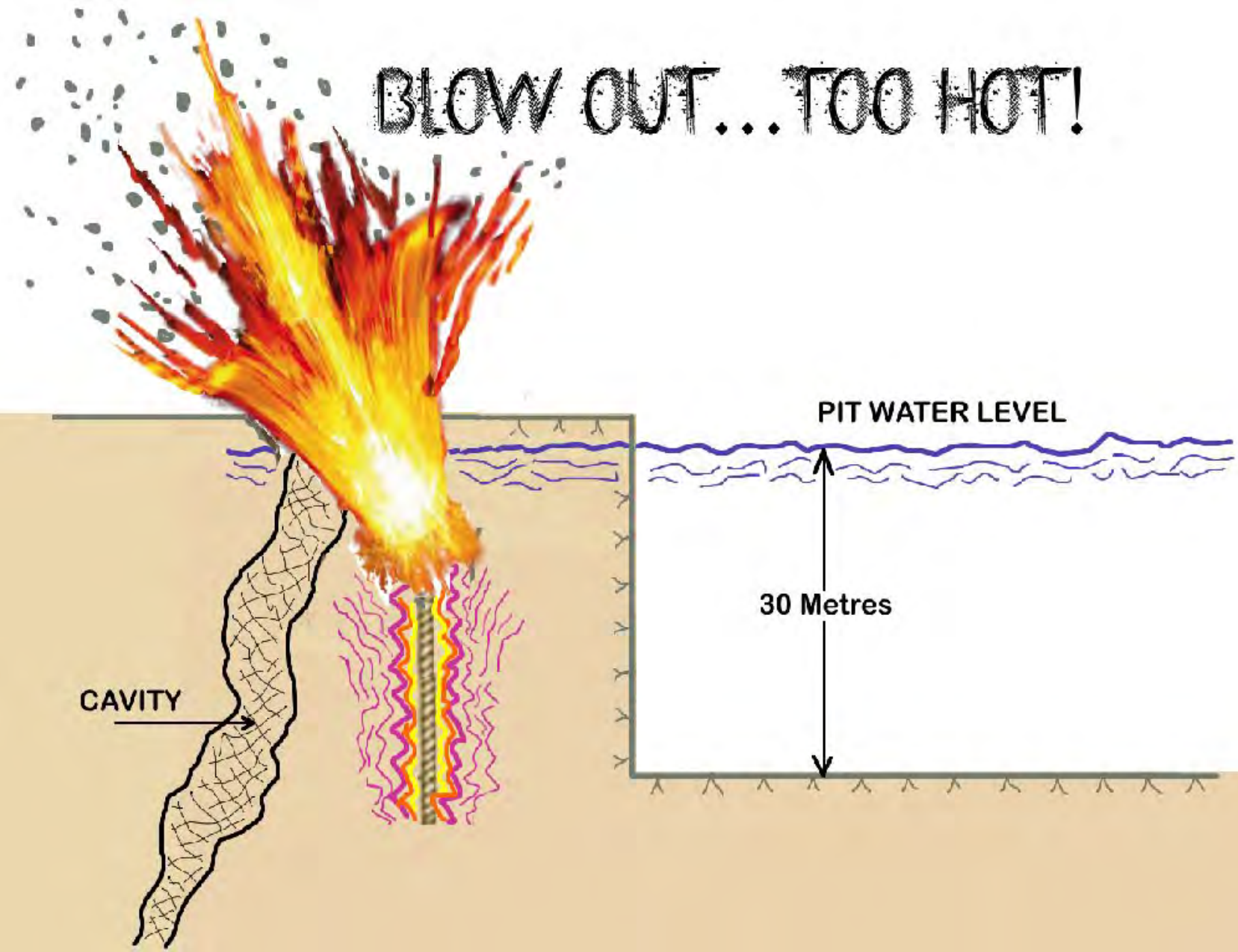
END OF BLAST



DRILL HOLE AND SOLUTION CAVITY



BLOW OUT…TOO HOT!





Ken Taylor of Austin Powder

- KT said that in consideration of the blasting experience - no difference would have resulted -that any experienced blaster woud have had the same fly rock incident take place
- There is no technology available to identify anomalies in rock such as mud seams or voids

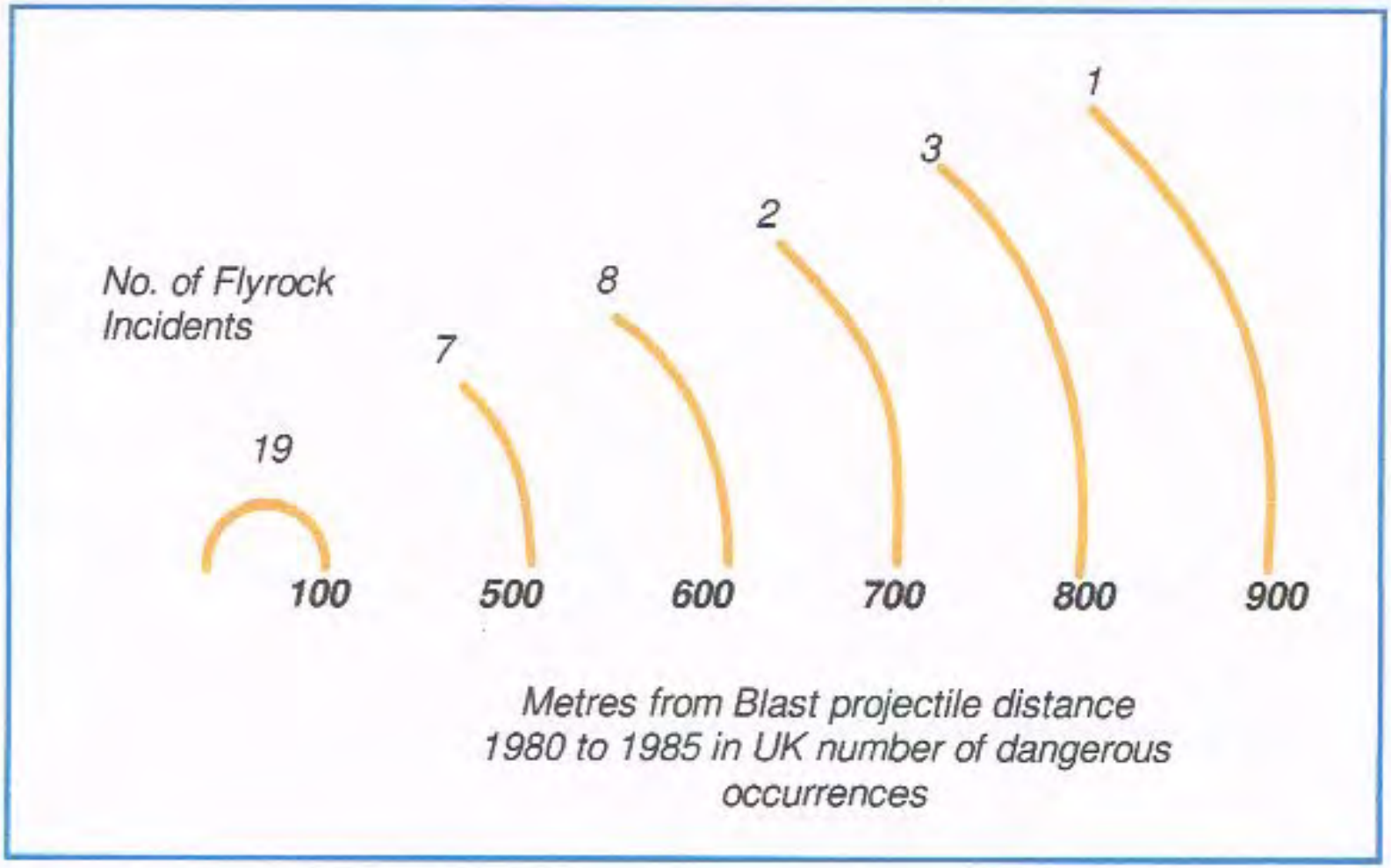
Mr. TAYLOR: Stated that there has never been a fly rock incident at this particular quarry prior to this one.

Mr. TAYLOR: Added that 90 % of fly rock incidents are "unexplainable"

HOW FAR?

- US BUREAU OF MINES RESEARCH
- NOISE – VIBRATION – FLYROCK
- SINCE 1970
- TERROCK CONSULTING ENGINEERS
- RICHARDS AND MOORE (AUSTRALIA)
- BETTER MODEL FOR FLYROCK
- SINCE LATE 1990S

Flyrock - occurrences



RPQ
richard@rpq.eu.com

We have applied the formulae as developed for the United States Bureau of Mines to predict expected range of fly rock for the products and patterns used on this blast. The validity of these equations for application in Eastern Ontario Quarries was confirmed by the Ontario Ministry of Labour in the early 1990's following a fatality resulting from fly rock at an Ontario limestone quarry.

EXPLOTECH

Recommendations

- Based on our site visits and a review of this incident, it appears that blast procedures were properly followed and that while not probable, the potential exists for a recurrence.

We strongly recommend that the hazard zone be increased to 500m when firing any future blasts in this quarry.

Yours truly,

René A. Morin, P. Eng.

LICENSED PROFESSIONAL ENGINEER
RENE MORIN
PROVINCE OF ONTARIO

- KT explained the mixture of mud and rock in the debris field confirmed for him that a mud seam caused the fly rock event
- KT GPS'd all positions from where photos taken and placed them on Google Earth - depicted in slide show - showing where vehciles were hit, where the guard zones were placed, where the people were located on the crew
- KT did a second Google earth showing a new guard zone, double in size, to a 2,000 ft distance - based upon a fly rock computer modelling "predictor" that calculates the safe distance - was not used prior to the 23'rd blast and the predictor does not take into account things like mud seams

THE ISSUE OF QUARRY FLY ROCK

June 2021

ADVISORY TO REGISTERED PROFESSIONAL PLANNERS

Prepared by Mark L. Dorfman, RPP, and George McKibbon, RPP

On January 1, 2022, Rule 22 of subsection 0.13 in Ontario Regulation 244/97 of the *Aggregate Resources Act*, comes into effect. It stipulates that the licensee of an aggregate quarry shall ensure that the quarry is in compliance with the Rule as follows:

> a licensee shall take all reasonable measures to prevent fly rock from leaving the site during blasting if a sensitive receptor is located within 500 metres of the boundary of the site.

Fly Rock discharge from quarry blasting is a contaminant as determined by the Supreme Court of Canada. It is likely to cause an adverse effect under the *Environmental Protection Act.*

Members of OPPI are advised to also consider the directions provided under Policy 1.2.6 under Provincial Policy Statement 2020 to establish the appropriate municipal planning policies as a preventative measure to achieve land use compatibility between quarries that undertake blasting and sensitive land uses.

Aggregates Resources Act and O. Reg. 244/97

The issue of blasting rock in a quarry is addressed by the Ministry of Natural Resources and Forestry ("MNRF") in consideration of applications for a licence under the Act. As of April 21, 2021, Ontario Regulation 244/97 under the *Aggregate Resources Act,* was amended to provide the following licence conditions and standards:

Licence Conditions

- No blasting on a holiday, or between 6 p.m. and 8 a.m.
- The Licensee shall monitor all blasts for ground vibration and blast overpressure.
- The Licensee shall prepare blast monitoring reports according to provincial guidelines on limits of blast overpressure and ground vibration for blasting operations.
- The Licensee shall retain blast monitoring reports for a period of seven years after each blast.

The MNRF Standards require the following for applications:

Blast Design Report

In the application for a licence to extract or remove more than 20,000 tonnes of aggregate annually, a Blast Design Report is required to be submitted by the applicant if a sensitive receptor is located within 500 metres of the limit of extraction. The Report must demonstrate that provincial guideline, NPC-119-blasting, for blast overpressure and ground vibration can be satisfied.

Site Operations Plan

The applicant's Operations Plan must:

(a) provide details about the frequency and timing of blasts;

(b) provide the number of sensitive receptors that are located within 500 metres of the boundary of the site and the distance from this boundary to each sensitive receptor. A sensitive receptor is defined as a school, childcare centre, or any residence or facility at which at least one person sleeps.

Land Use Compatibility - Provincial Policy Statement 2020

Section 1.2.6 sets out provincial policies with respect to Land Use Compatibility. In particular, Section 1.2.6.1 applies to the consideration by MNRF and municipalities of proposed quarries as a defined "Major Facility", as follows:

> *Major facilities* and *sensitive land uses* shall be planned and developed to avoid, or if avoidance is not possible, minimize and mitigate any potential *adverse effects* from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term operational and economic viability of *major facilities* in accordance with provincial guidelines, standards and procedures.

This policy is mandatory and it is to be considered by the ministries and the municipalities.

Conversely, where sensitive land uses are proposed in the vicinity of an existing or planned quarry (major facility), the Province directs the municipalities to apply the following provincial policy 1.2.6.2:

> Where avoidance is not possible in accordance with policy 1.2.6.1, planning authorities shall protect the long-term viability of existing or planned industrial, manufacturing or other uses that are vulnerable to encroachment by ensuring that the planning and *development* of proposed adjacent *sensitive land uses* are only permitted if the following are demonstrated in accordance with provincial guidelines, standards and procedures:

a) there is an identified need for the proposed use;
b) alternative locations for the proposed use have been evaluated and there are no reasonable alternative locations;
c) *adverse effects* to the proposed *sensitive land use* are minimized and mitigated; and
d) potential impacts to industrial, manufacturing or other uses are minimized and mitigated.

The Legal Obligations

The Supreme Court of Canada considered an appeal by Castonguay Blasting Ltd. and dismissed the appeal in favour of the Province of Ontario. The Court decided (October 17, 2013) that "Castonguay was required to report the discharge of fly-rock forthwith to the Ministry of the Environment" (Paragraph 40). In its decision, the Court stated the following relevant reasons:

> Applying these elements to this case, s. 15(1) was clearly engaged. Castonguay "discharged" fly-rock, large pieces of rock created by the force of a blast, into the "natural environment". There is also no doubt that fly-rock meets the definition of "contaminant". The discharge in this case was "out of the normal course of events" - it was an accidental consequence of Castonguay's blasting operation. Had the blast been conducted routinely, the fly-rock would not have been thrust into the air. (Paragraph 37).
>
> The adverse effects were not trivial. The force of the blast, and the rocks it produced, were so powerful they caused extensive and significant property damage, penetrating the roof of a residence and landing in the kitchen. A vehicle was also seriously damaged. The fly-rock could easily have seriously injured or killed someone. (Paragraph 39).

The *Environmental Protection Act* is preventive with respect to the discharge of contaminants. The Act and the Regulations apply to prevent the accidental impact of fly rock. Since the licensee is required to keep fly rock on the site during blasting, any discharge of fly rock beyond the controlled blast environment that is not a normal event, ie. it would have been prevented, must be reported forthwith to the MECP if the contaminant may likely cause an adverse effect. The Ministry may issue an order for remediation and preventive measures.

Analysis

The only provision for regulating and managing fly rock at a quarry site is contained in Ontario Regulation 244/97 under the *Aggregate Resources Act.* New quarries that are licenced after January 1, 2022, are required:

> "to take all reasonable measures to prevent fly rock from leaving the site during blasting if a sensitive receptor is located within 500 metres of the boundary of the site".

These following observations should be considered by Planners:

- There are no provincial government guidelines that indicate how the licensee is to keep fly rock within the quarry site when blasting.
- The Act and/or the Regulation do not indicate how the proponent is to take all reasonable measures to demonstrate that fly rock can be contained within the quarry site during blasting.
- At least one existing sensitive receptor must be located within 500 metres of the licenced boundary. There is no obligation if a new sensitive receptor is located within 500 metres after the quarry is operational.
- If there are vacant lots that are designated and/or zoned for sensitive receptors, these are not recognized by this obligation.
- If during blasting, fly rock discharges off the site within the 500 metre area, the municipality should be aware of the obligation to report this contamination forthwith to MECP.
- If there are other features such as roads, railways, infrastructure, outdoor recreation areas, waterways, that are located within 500 metres of the boundary of the quarry site, there is no obligation to keep fly rock within the quarry site during blasting if there are no sensitive receptors identified.

Blasting is referred to in section 49 of O. Reg. 419/05 "Air Pollution - Local Air Quality". There is a prohibition on the emission of any contamination beyond the limits of the property upon which blasting is being carried out.

This Advisory was prepared by Mark L. Dorfman, RPP, and George McKibbon, RPP. The views expressed within the Advisory are their own based on research of existing legislation, policies and court records.

This is not legal advice. Members should rely on relevant laws, standards, by-laws, regulations and legislation that govern this issue.

Designated Blast Area and Setbacks as Protection Against Land Use Incompatibility and Potentially Deadly Adverse Effects From Blasting Quarry Operations (December 14, 2021)

Table of Contents

Blast Zones 2

Analysis of Flyrock Travel Distances 5

Minimum Distances From Blasting Quarry Operations to Protect Quarry Employees, Offsite Residents and the Public, and Existing Residential, Commercial and Industrial Development 6

Golder Associates' State of the Aggregate Resource in Ontario Study (SAROS) Paper 5 – December 17, 2009 6

The Role of Zoning: Preservation of Property Values and Separation of Incompatible Land Uses to Avoid Adverse Effects 16

Quarry Application Denied For Its Potential Negative Impact on the Health, Safety and Welfare of Those Who Live, Work and Play in The Community (Law Witness Testimony Prevails) 17

Court Awards Homeowner Damages Caused By Rock Blasting: Diminution in Property Value and Loss of Use 18

Homeowners Sue for Damages Caused by Road Construction Blasting 22

Blasting Quarry Impacts Water Quality and Quantity of Neighbouring Wells 23

Quarry Blasting Produces Toxic Fumes 24

Compromised Lung Function and Respiratory Health of Residents In Proximity to Operational Quarries 25

Governmental Agencies Recognize Fugitive Dust As A Significant Health Issue 26

Court Rules Quarry's Blasting Operation a Common Law Nuisance 28

Quarry Rock Fines Pumped Into Creek Causing Ecological Damage Ruled A Pollutant and Not Covered By Insurer 29

Quarry Operator Pays $1 Million to Settle 28 Homeowners' Claims For Loss of Well Water 30

Homeowner Unable to Sell Home Without Water: A Loss Attributed to a Nearby Quarry Operation 30

Quarry Operator Convicted For Exceeding Total Suspended Solids In Effluent From Sewage Works Dumped Into The St. Lawrence River 31

Health & Quality of Life 32

Failure to Apply Setbacks Reciprocally Exposes Owners of Legal Lots of Record to Future Adverse Effects From Aggregate Extraction 33

Complaints of Cracking Concrete, Silica Dust and Inaccurate Monitoring of Ground Vibrations at Blasting Quarry Ignored 36

Students Injured and Structures Damaged by Blasting (Vibrations and Airblast) at Nearby Quarry 37

Dangers Due to Blasting Projectiles (Flyrock) 38

Benefits of Mandatory Minimum Setbacks Applied to Blasting Quarry Operations 39

Tony Sevelka, AACI, P.App, MAI, AI-GRS, SREA, FRICS (Contact: info@intval.com)

Blast Zones

The designated blast zone or blast area is confined within the boundary of a quarry operation, and all of the adverse effects associated with blasting must remain on site:

> *"designated blast area" includes the danger area, which is the zone in which there exists a possibility of hazard to a person or property from flyrock, fume, air blast or ground vibrations, and is the area where the blaster has made arrangements to evacuate all persons whose safety might be threatened by the blasting operation. (Province of Newfoundland and Labrador, Department of Natural Resources,* https://www.gov.nl.ca/iet/files/Quarry-Permit-Standard-Terms-Conditions.pdf)

- The blast zone, as delineated in a proponent-driven Blasting Impact Assessment in Ontario, never takes *flyrock* into account and is solely for the benefit of a quarry operation, intended to protect onsite equipment from damage, and employees from injury and death, without regard for land use incompatibility of adjoining public and private third-party real property, and the deleterious effects on those who live, work, play or drive/cycle/walk/ski in the surrounding area.
- The blast zone must be large enough to cover all of the potential deleterious adverse effects associated with quarry blasting.
- The blast zone must not extend beyond the property boundaries of the quarry onto neighbouring public and privately owned third-party property.

Similarly, approval of Copcan Contracting Ltd.'s[1] aggregate permit required the applicant to confine the anticipated adverse effects of blasting quarry operations onsite:

> ***All blasts shall be designed such that the blast hazard zone lies entirely within the quarry property**, and that peak particle velocities and noise levels do not exceed 19 mm/sec, as measured at a position along the mine property boundary, directly in line between the active pit and the nearest adjacent residence. [emphasis added]*
>
> *Noise from quarry operations shall not exceed 3 minute Leq of 55 dBA as measured along the quarry side of Jameson Road.*

According to T.M. International, LLC, the use of explosives to blast rock has many hazards, one of which is flyrock:[2]

> *There are many hazards inherent in the use of explosives, not the least of which is flyrock. In fact, flyrock may be the greatest threat related to working with explosives, and it's something that those involved in the blasting situation may not realize. They may be primarily concerned about staying out of the blast radius [blast zone] and thereby avoiding being damaged by concussive force or ground vibrations, not realizing that flyrock may create a much greater danger.*
>
> *Flyrock is created when the force of an explosion projects rock fragments in varying directions that exceed the desired or expected distances from the blast face. Since the trajectory, size and speed of flyrock are difficult or impossible to anticipate, flyrock can create a tremendous danger for workers on…site.*

---

[1] *Anning v. British Columbia (Minister of Energy and Mines)*, 2002 BCSC 896 (CanLII), <https://canlii.ca/t/5jrd>, retrieved on 2021-12-09.

[2] https://www.tmi2001.com/blog/preventing-controlling-flyrock/.

> *Flyrock is an integral part of blasting. However, uncontrolled or unexpected flyrock that is projected past a defined safety [blast] zone is not acceptable:*
>
> ***It is well known that rock and/or debris can be thrown over a kilometer [1,000 metres] from the blast site, and in a recent case rocks travelled approximately 1.3 kilometres [1,300 metres]*** (Explosives information bulletin no. 69 I 27 February 2009 I Version 1)[3] [emphasis added]
>
> *…[I]njuries due to flyrock and lack of blast area security accounted for 61% of all blasting injuries in surface US coal, metal, and non-metal mines during the period 1978-2003. Adding the injuries due to premature blast and misfires, it exceeds 82% for the same period [Bajpayee, Verakis & Lobb] [p. 1][4]*
>
> *"**For the past two decades, most explosives-related injuries and fatalities in surface mines occurred when workers were struck by rock, either because they were too close to the blast or rock was thrown much farther than expected**." (Verakis & Lobb, 2003) [p. 8]* [emphasis added]

And, the dangers associated with blasting rock as identified and witnessed by Tripathy and Gupta (2004) are as follows:

> *Flyrock is one of the most hazardous unwanted effects of rock blasting used in quarrying, mining and construction activities In contrast to the other unwanted effects like ground vibration and airblast, which generally cause structural damage and annoyance to people living very close to the blasting site, the flyrock may be responsible for damage to property as well as fatal accidents and serious injuries at very long distances from the blasting site. More than 50% of the 103 accidents from different mining sites in United Kingdom during 1980-85 are reported to be due to flyrock up to distances ranging from 350 to 900 m (Bhandari, 1997). The authors have witnessed property damage up to 300 m at several construction sites. It is, therefore, imperative to have a reliable prediction of the maximum distance of flyrock and use suitable means and measures to control it within the safe and secured distance around a blasting site [p. 141].[5]*

As reported in the 2014 issue of the *Journal of Rock Mechanics and Geotechnical Engineering*, flyrock is an inevitable consequence of blasting rock and can never be entirely eliminated:

> *Due to the explosive force, rock fragments are propelled and thrust high into the air and beyond the safety limit of blast area, thus termed as "flyrock". This is mainly due to the flaws presented in the blast design and also due to the misinterpretation of rock mass behavior. The phenomena of flyrock are always uncontrolled and can never be brought down to zero [p. 26].[6]*

As flyrock is an inevitable and uncontrollable by-product of quarry blasting, and is not to leave the site according to the Ontario Aggregate Resources Act (ARA), mandatory minimum setbacks are the only remedy that can effectively eliminate flyrock from being launched off-site.

---

[3] https://www.rshq.qld.gov.au/safety-notices/explosives/flyrock-incidents2.

[4] Dozolme, Ph. and Bernard, T. " Ultimate Technological Combination in Electronic Blasting, A Conclusive Contribution to Blasters' Health & Safety, *BME Delta Caps*, © 2006 International Society of Explosives Engineers, https://miningandblasting.files.wordpress.com/2009/09/ultimate-technological-combination-in-electronic-blasting.pdf.

[5] Tripathy, G.R. and Gupta, I.D. "Technical Note on The Prediction and Control of Flyrock During Rock Blasting," *J. of Rock Mechanics and Tunnelling Tech.*, Vol. 10 No.2, 2004.

[6] https://intval.com/articles/Flyrock-and-Other-Impacts-from-Quarry-Blasting-Operations.pdf.

On January 1, 2022, a licensee and permittee shall take all reasonable measures to prevent fly rock from leaving the site during blasting if a sensitive receptor (often code for human target) is located within 500 metres of the boundary of the site. (O. Reg. 466/20, s. 2(2))

According to GEO REPORT No. 260, Halcrow China Limited, 2002,[7] separation distance (setbacks) is the only totally effective safety measure against flyrock:

The only totally effective safety measure is a minimum clearance distance, acting as a safety zone. In order to determine the required minimum clearance distance, it is necessary to ascertain the 'flying distance', (the distance to which flyrock may be thrown). ***The available [flyrock] data is of two types: reported instances and experimental/theoretical estimation****. [emphasis added]*

- ***Recorded instances****. The data on recorded flyrock projection is based on published HSE and Mines & Quarries Division of GEO data. Both indicate significant numbers of rocks passing beyond 200 m. Very few (4 out of 80, or 5%) travelled beyond 300 m. Only one exceeded 450 m, and this travelled to 800 m.* ***It should be noted that these numbers are the minimum number that occurred, being those that were reported. Numerous incidents at shorter ranges (up to 500 m) may not have travelled outside the quarry boundary or may not have caused injury and therefore were not treated as reportable incidents. In the UK, under-reporting by factors of 5 to 10 are considered possible below 500 m (Davis, 1995).***
- *[In the United Kingdom, over a five-year period, 85 flyrock incidents had been reported and documented: 25 incidents (29%) were between 200 and 300 metres; 15 incidents (17%) were between 300 and 500 metres; 5 incidents (6%) were between 500 and 700 metres; and only one incident (1%) exceeded 700 metres. Overall, 95% of the analyzed flyrock incidents occurred within 600 metres. p. 268]*
- ***Experimental data****. Research on flyrock was undertaken by the Swedish Detonic Research Foundation (Lundborg et al., 1975). It was summarized in more accessible form by Hoek & Bray (1981) in their textbook "Rock Slope Engineering". It has been established that maximum 'flying distance' is about 540 m for a 200 m diameter (about 15 kg) block. For fragments of 75 to 100 mm size (about 2.5 kg) the maximum range is 410 to 470 m.*

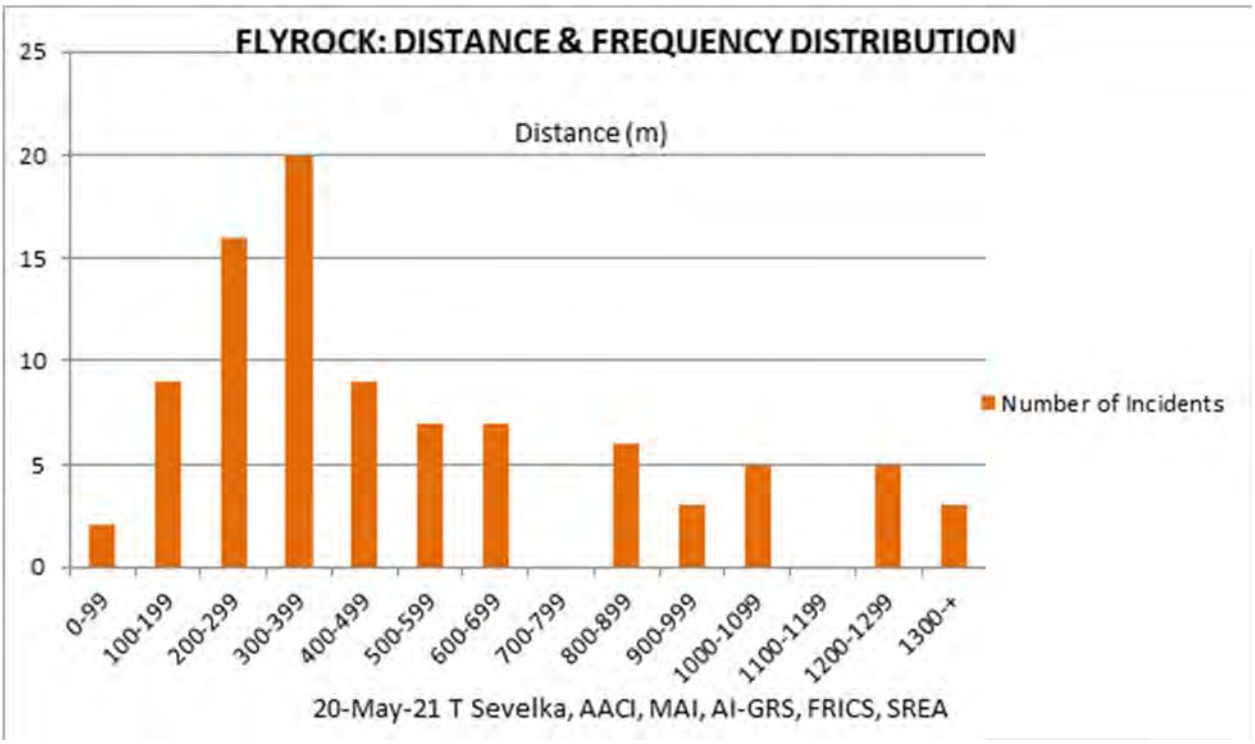
From the foregoing, it is apparent that the only absolute guarantee for safety from flyrock is a large minimum clearance distance, the size of which depends on the blasthole diameter in use. The Safety Zone would need to extend 400 to 600 m from the blast*. [emphasis added] [pp. 182-83]*

A more recent study of discovered flyrock incidents undertaken by Sevelka (2021), where the flyrock distances are known, resulted in an analysis of 92 flyrock incidents. The results of the flyrock study, the largest known of its kind, are as follows:

[7] This report was prepared by Halcrow China Limited in August 2002 under Consultancy Agreement No. GEO 10/98 for the sole and specific use of the Government of the Hong Kong Special Administrative Region, https://www.cedd.gov.hk/filemanager/eng/content_475/er260links.pdf.

[8] https://intval.com/articles/Flyrock-and-Other-Impacts-from-Quarry-Blasting-Operations.pdf.

Analysis of Flyrock Travel Distances



An analysis of 92 *flyrock* incidents, where the distance from the blast is known, indicate that 91% (84) of the *flyrock* incidents occurred within 1,099 metres, and 97% occurred within 1,299 metres.

The number of *flyrock* incidents within each interval, starting at between 300 and 399 metres, and the average distance travelled within each interval are summarized as follows:

- 20 (22%) of the flyrock incidents occurred between 300 and 399 metres (330 metres avg)
- 9 (10%) of the flyrock incidents occurred between 400 and 499 metres.(446 metres avg)
- 7 (8%) of the flyrock incidents occurred between 500 and 599 metres (515 metres avg)
- 7 (8%) of the flyrock incidents occurred between 600 and 699 metres (622 metres avg)
- 6 (7%) of the flyrock incidents occurred between 800 and 899 metres (802 metres avg)
- 5 (5%) of the flyrock incidents occurred between 1200 and 1299 metres (1225 metres avg)
- 3 (3%) of the flyrock incidents occurred over 1300 metres (2307 metres average)

At 80%, which accounts for the first 74 *flyrock* incidents in ascending order, *flyrock* reached a distance of 800 metres, and, at 90%, which accounts for the first 83 *flyrock* incidents in ascending order, *flyrock* reached a distance of 1,020 metres. On the basis of this most recent study of flyrock incidents, the designated blast area would have to be extended to approximately 1,200 metres to prevent flyrock from leaving the boundaries of a blasting quarry site, equivalent to a 1,200-metre setback.

Minimum Distances From Blasting Quarry Operations to Protect Quarry Employees, Offsite Residents and the Public, and Existing Residential, Commercial and Industrial Development

According to the Nigerian National Environmental (Quarrying and Blasting Operations) Regulations, 2013, the minimum separation distances from a blasting quarry operation are:[9]

> 20. A person shall not locate a quarry or engage in blasting within three kilometers (3km) [3,000 metres] of any existing residential, commercial or industrial area.
>
> 22. (1) A person shall not blast in such a way that the impact of such blast will cause any form of discomfort or nuisance to the public and residents within 1,000 meters from the epicenter of the site or users of the roads thereof.
>
> (2) Subject to the provisions of these Regulations, the act of blasting shall be complete, whether or not the alleged act is preceded or accompanied with vibration, noise, air over pressure, fly rock, dust, fumes, or that the impact is felt within 1,000 meters from the site or epicenter of the blasting.
>
> Schedule VI 7. All personnel not involved in the actual blast shall maintain a distance of at least 300m and workers involved in the actual blast 200m from the time the blast signal is given until the "All Clear Signals" has been sounded.

Golder Associates' State of the Aggregate Resource in Ontario Study (SAROS) Paper 5 – December 17, 2009

While the 2009 Golder report, co-authored by David Hanratty (now front-man for Votorantim Cimentos) recognized the need for setbacks to protect adjacent property from physical, environmental and social impacts of blasting quarries, the analysis is superficial, misleading and biased in favour of the aggregate industry, and without regard to the health, safety and welfare of the public.

> ***7.2 Varying Excavation Setbacks***
> *The AROPS requires each Site Plan to indicate how much area may be extracted (to a maximum) and to what depth (or elevation). In simple terms, the extraction area is the licenced area less areas not to be extracted, which would include excavation setbacks. These regulatory excavation setbacks (AROPS) are:*
>
> - *15 m from the boundary of a site;*
> - *30 m from the boundary of site that abuts a highway, land in use or zoned for residential purposes; and*
> - *30 m from a body of water, except for on-site extraction related ponds.*
>
> *MNR's Aggregate Resources Program Policies and Procedures (ARPPP) manual describes the intent of excavation setbacks as follows:*
>
> > "Property owners adjacent to licenced sites are entitled to the buffers provided by the setback provisions of the operational standards. Their interests and concerns must be considered when dealing with variations in setback widths".
>
> *Given the nature of the pit or quarry land use, which involves the physical excavation of land, usually in below grade situations, the need to protect adjacent property from physical impacts of extraction such as erosion and, in general, slope failure is readily apparent. In addition, setbacks have been implemented in order to further protect the surrounding land uses from environmental*

[9] https://standards.lawnigeria.com/2020/08/21/national-environmental-quarrying-and-blasting-operations-regulations-2013/.

and social impacts. Permission of the adjacent landowner is usually required if setbacks are to be reduced.

The AROPS [Aggregate Resources Ontario Provincial Standards] prescribed setback locations and distances have been compared with setback provisions, known usually as ordinances, in the United States and other parts of Canada. The Ontario prescribed distances are in excess of those prescribed in British Columbia, which requires a minimum setback of 5 m from the property line of an aggregate operation (British Columbia, 2007); and, Alberta, where the recommended setback from the property line is 3 m in pits (Alberta, 2004). The Ontario prescribed distances are generally representative of those in the U.S., although given the very local level of regulation in the U.S., there is a wide variation in setback (ordinance) distances. There is further commonality between Ontario and U.S. jurisdictions in that setback distances can be varied (i.e., reduced or eliminated) under certain conditions.

Excavation setbacks also result from site specific studies that are completed as part of the licence application process. Commonly, the recommendations of reports in natural environment, ground or surface water, noise, blasting (quarries only), and archaeology may require excavation setbacks to be put in place to protect the subject environmental or social features from unacceptable impacts or to ensure impacts on adjacent land uses (noise, vibration) are within specified limits.

Variations to these types of setbacks could be applied for with the support of monitoring data or impact evaluation, carried out by professionals. Should the data indicate the actual effects from extraction on the feature are less than what was anticipated at the time the setback was determined, it would give cause to reevaluate the setback distance and reduce it to something more appropriate [p. 31-32].[10]

In 2009, when Golder prepared the SAROS paper there were numerous jurisdictions with substantially greater setback requirements for blasting quarry operations, which Golder failed to mention. A 30-metre blast zone, equivalent to a 30-metre setback, will not prevent flyrock from leaving a quarry site, nor will it protect onsite quarry equipment and quarry employees.

Also absent from the Golder paper is any reference to *adverse effects*, including flyrock, the ultimate *adverse effect* associated with a blasting rock quarry, which warrants an increase in the onsite setback distance rather than a decrease. (See *Ontario* Environmental Protection Act and Provincial Policy Statement 2020, Section 6,[11] for the definition of *Adverse Effect*).

Why do the Aggregate Industry and their explosives' engineers conceal flyrock from the public? Because,

- flyrock is the ultimate *adverse effect*
- flyrock is uncontrollable and can never be eliminated
- flyrock has the potential to injure or kill humans, pets, livestock and wildlife
- flyrock has the potential to damage tree stands and other crops
- flyrock has the potential to damage personal and real property
- concealing the dangers of flyrock from the public serves the financial interests of the Aggregate Industry

[10] https://files.ontario.ca/saros-paper-5-aggregate-reserves-in-existing-operations-en.pdf.
[11] https://files.ontario.ca/mmah-provincial-policy-statement-2020-accessible-final-en-2020-02-14.pdf.

Note: Flyrock meets the Ontario EPA definition of contaminant, and the *adverse effects* are not trivial. In *Castonguay Blasting Ltd. v. Ontario (Environment)*, 2013 SCC 52 (CanLII), [2013] 3 SCR 323, <https://canlii.ca/t/g1038> **the Supreme Court held that "the flyrock could easily have seriously injured or killed someone."**

> ***Quarrying negatively affects the environment in a variety of ways from exploration and blasting, transport and disposal of waste rocks. The major environmental effects are destruction of vegetation, disruption of animal habitats, diversion and blockage of natural drainage systems, soil erosion and river siltation, noise,…vibration [and flyrock debris] and dust pollution (Maponga and Munyanduri, 2001) [p. 316].***[12] [emphasis added]

According to A. G. Taylor of the Ministry of the Environment, the acoustic wave (concussion) generated by quarry blasting can be of greater significance than ground vibration induced by the same blast, and that sonic boom research can be applied to quarry blasts:[13]

> *Quarry blasts were monitored during 1973--1974 at several locations in Southern Ontario to determine if the acoustic wave (concussion) was likely to be of significance from the points of view of structural damage and human annoyance. The monitoring instrumentation used included sonic boom microphone-- carrier system and FM tape recorder.* ***The characteristics of the blast wave, overpressure, spectrum, and duration were analyzed using a storage oscilloscope and real-time analyzer and were compared with the characteristics of sonic booms. The two phenomena were shown to be similar in spectral content to most energy in the infrasonic region; the overpressure at several thousand feet from a blast can be similar to that of a sonic boom, whereas the duration of the pressure perturbation is several times longer for a blast than for a sonic boom. It is concluded that damage and annoyance criteria developed from sonic boom research may reasonably be applied to quarry blasts. It was also found that in many instances the acoustic wave can be of greater significance than ground vibration induced by the same blast***. [emphasis added]

A Noise and Nuisance by-law enacted by the City of Burlington (No. 19-2003),[14] states, in part, that,

> ***No noise or vibrations shall be made, caused or created so as to be heard or felt or otherwise perceived outside the property*** *and which are, in the view of all the circumstances including the nature of the neighbourhood and the use to which adjoining properties are put and the time of day during which such noise or vibrations are made, caused or created excessive or which are, or may cause a nuisance to the public generally or to others residing or carrying on a manufacture, trade or business in the vicinity.* [emphasis added]

Advocating for decreased setbacks on behalf of the aggregate industry compromises the health, safety and welfare of the public and the environment, in light of the known adverse effects associated with aggregate extraction, especially quarries accompanied by blasting below the water table.

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[12] Marzouk, S.H. and Mohamed, Abuo El-Ela A., "Influences of limestone stone quarries on groundwater quality," *Int. J. Hum. Capital Urban Manage.*, 3(4): 315-324, Autumn 2018, http://www.ijhcum.net/article_34117_cb311e43b286d3457041ebfec70faa52.pdf.

[13] Taylor, A.G., "Quarry blast acoustic wave (concussion) – response of structures and human annoyance," *Ontario Ministry of the Environment*, Toronto, *JASA*, https://asa.scitation.org/doi/pdf/10.1121/1.1995087.

[14] file:///C:/Users/Windows%207%20PC/Downloads/19-2003%20(5).pdf.

> *8) **The most productive/expedient techniques to maximize the amount of aggregate reserves in existing operations are: to reduce/eliminate the width of excavation setbacks**, allow for deeper excavation, remove road allowances where available and to rehabilitate the site through the use of imported material, which will substitute in part or in full, the material that would have to be retained on-site to undertake rehabilitation [p. 47]..[emphasis added]*

Did Hanratty, the co-author of the Golder report, not know about flyrock, an inevitable by-product of blasting rock? There had been numerous reports of flyrock incidents in Ontario prior to completion of the Golder study in December 2009.

- On July 20, 2009, and, again, on July 23, 2009, blasting at the 98-acre Pakenham Quarry launched flyrock debris off-site and struck a worker at a neighbouring business on the arm. (The July 23, 2009 flyrock incident also struck the onsite quarry scale house 230 metres from the blast, which Austin Powder Ltd. failed to report to the Ministry of Labour.) Two civilian vehicles occupied by passengers at a controlled stop on the edge of the quarry property located about 300 metres from the blast were also struck by flyrock debris, resulting in extensive damage. (Flyrock 18) Following an investigation of the two flyrock incidents, the government's expert witness recommended a 500-metre setback be imposed on the quarry site**.**

- **On** two occasions blasting at the 328-acre Miller Braeside quarry in the Township of McNab/Braeside propelled flyrock debris outside of the limits of the quarry, once in September 2005 and again in August 2007. (Flyrock 22) The 300-metre setback (Zoning By-law No. 2015-03) from the quarry boundary proved inadequate as a blast safety zone, and put neighbours and property at considerable risk. Blasting at the quarry in September 2005 propelled flyrock debris into a nearby residential neighbourhood causing damage to residences, driveways and wells. "**One neighbor, Mr. Battison, described flyrock that landed on his roof over 400 metres from the site**."[15] Reportedly, some neighbours received compensation but only if they signed a confidentiality agreement, and to never come after Miller again for any damages. The August 2007 quarry blast hurled flyrock debris that damaged a home and structurally damaged the foundation of another home in another direction, with one of the property owners (James), claiming $250,000 in damages.[16] [emphasis added]

A September 2, 2005 blast at the *Parker Mountain Aggregates Limited* quarry in Granville, N.S.[17] that launched flyrock debris 280 metres (three football fields) onto the properties of a nearby residential subdivision was investigated by the Occupational Health and safety Division. Mr. Gill, a qualified engineer employed by Consbec Inc., the company responsible for blasting at the quarry, testified as to the frequency of flyrock being five percent.

> ***He [Mr. Gill] gave his opinion that the incidence of fly rock may occur in five percent of the cases where explosives are used** [para. 11]*. [emphasis added]

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[15] *Miller Paving Ltd.,* PL130785, OMB, October 27, 2015 [para. 55].
[16] *James v. Miller Group Inc*, 2013 ONSC 3266 (CanLII), <https://canlii.ca/t/g2f5j>, retrieved on 2021-12-14.
[17] *Parker Mountain Aggregates Limited*, 2007 CanLII 91661 (NS OHSAP), <https://canlii.ca/t/j7q8f>, retrieved on 2021-12-11.

Setbacks or buffer zones for blasting quarries vary from 500 metres to 1,000 metres in the following jurisdictions:

		Setback/Buffer Zone
- Nigeria		1,000 metres[18]
- Nova Scotia, Canada	:	800 metres[19]
- New Brunswick	:	600 metres[20]
- Quebec, Canada	:	600 metres[21]
- India	:	500 metres[22]
- Malaysia	:	500 metres[23]
- Victoria, Australia	:	500 metres[24]

A private for-profit company such as a quarry operator does not possess a legal right to externalize setback (blast safety zone) requirements and diminish the utility and value of neighbouring properties, the owners of which do not participate in the anticipated profits of the quarry operation or receive any financial compensation.

As aptly stated by a local resident in response to a proposed quarry expansion in the Township of McNab/Braeside seeking to externalize a setback requirement on adjoining privately-owned third-party property:[25]

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[18] https://standards.lawnigeria.com/2020/08/21/national-environmental-quarrying-and-blasting-operations-regulations-2013/.

[19] "The NSE *Pit and Quarry Guidelines* (1999) stipulated setbacks to prevent structural and environmental damage as well as the requirements for pre-blast surveys, blast monitoring, and blast designs. The setback between blasting for a quarry and structures is 800 m. "http://www.scotianmaterials.info/quarry.html#:~:text=The%20setback%20between%20blasting%20for,800%20m%20of%20the%20Project..

[20] "k) 600 metres from any drinking water supply well, unless the written permission of the owner(s) within the 600 metres is obtained and submitted to the Department for acceptance….", Department of Environment and Local Government, Rock Quarry Siting Standards, https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/RockQuarrySitingStandards.pdf.

[21] "11. The operating site of a new quarry must be located at a minimum distance of 600 m from any dwelling, unless the dwelling is owned or rented to the owner or operator of the quarry." 10. It is prohibited to establish a new…quarry, the operating site of which is located in a territory zoned by the municipal authorities for residential, commercial or mixed purposes (commercial residential0. It is also prohibited to establish a new quarry less than 600 m from such territory…", http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/q-2,%20r.%207.

[22] "As per Directorate General of Mines Safety circular n. – DGMS (SOMA)/(Tech) Cir. No. 2 of 2003 Dt. 31/01/2003 (Annexure ll), on subject of **Dangers due to blasting projectiles**, all places within the radius of **500 m** from the place of firing to be treated as danger zone and accordingly, all person in danger zone to take protection in substantially built shelter at the time of blasting." "The regulations for danger zone (500 m) prescribed by Directorate of Mines…have to be complied with compulsorily and necessary measures should be taken to minimize the impact on environment." https://mpcb.gov.in/sites/default/files/whats_new/2020-08/CircularSitingcriteriaforstonequarriesinthestateofMaharashtra03082020.pdf.

[23] Environmental Requirements: A guide to Investors 2010, Appendix G.

[24] Gill Higgins, "Fair Go: Dust particles from quarry causing adverse health effects for residents nearby," !news, June 22, 2020, https://www.tvnz.co.nz/one-news/new-zealand/fair-go-dust-particles-quarry-causing-adverse-health-effects-residents-nearby.

[25] Dunn, Derek. "Township passes bylaw limiting quarry size," *InsideOttawaValley.com,* January 8, 2015, https://www.insideottawavalley.com/news-story/5249453-township-passes-bylaw-limiting-quarry-size/.

> ***"We expect to retain full use of our lands as purchased and insist that we remain safe from the adverse effects while situated anywhere on our own property. We therefore demand respect for our property boundaries."*** (John Kerr)

A list of major concerns identified and expressed by US citizens impacted by blasting quarry operations, as reported by the San Diego Union-Tribune (Oct. 18, 2009),[26] are as follows:

- *They destroy communities;*
- *They cause nervous, health, and sleep disorders in their communities;*
- *People move away. Good luck selling your seriously depreciated house, though—to whom? is what one blogger asked [unsuspecting home buyers are often unaware or uninformed about the adverse effects of residing near a blasting quarry operation, and overpay];*
- *They are fined constantly by authorities. Sort of like a parking ticket. It's just a minor cost of business;*
- *They poison groundwater supplies with the deadly benzene runoff from the ammonium nitrate explosives;*
- *They damage houses with the blasts: e.g., cracked plaster, structures shifting off foundations. (You'll note that in the Massachusetts Web site below, the insurance companies won't cover the tens of thousands of dollars' damage from nearby mining companies.); [and]*
- ***Huge pieces of "flyrock" (isn't that a quaint new term!?) land as far away as three miles from the mine blasting, terrorizing residents and damaging houses (amazingly only one killed so far). Check the Nashville, Tenn., Web site for flyrock details of several nearby interstate highways closed down after huge boulders land on the road. The death was in West Virginia, of a little boy killed in his bed by flyrock smashing through his bedroom window**. [emphasis added]*

Licencing requirements pursuant to Section 12 of the Aggregate Resources Act (ARA) do not replace a municipality's jurisdiction over land use controls and land use compatibility (avoidance of *adverse effects*), as described in *Kevin Matthews/Robin Latimer v. Gorham (Township)*, (2020),[27]

> *[84] Section 12 (1) of the ARA, which requires that a licence application provide information on "any planning and land use considerations," does not displace a municipality's role or jurisdiction in determining zoning issues, but instead actually highlights the municipality's role. This principle is laid out in Carlyle Development v. Baldwin (Township), 2017 CarswellOnt 7658 ("Carlyle") at paragraph 35:*
>
> > Section 12(1) of the ARA sets out matters to be considered by the Minister in deciding whether to issue an aggregates licence, including the effect of the operation of a proposed quarry on nearby communities and planning and land-use considerations. Also, the Provincial Standards require that a licence application provide information on "any planning and land use considerations". The Board finds that these provisions do not displace a municipality's role or jurisdiction in determining zoning issues.

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[26] Biddle Jr, Nicholas. "Forum: National anti-quarry 'tea party' blasting across Web," https://www.sandiegouniontribune.com/sdut-forum-national-anti-quarry-tea-party-blasting-2009oct18-story.html.

[27] *Kevin Matthews/Robin Latimer v Gorham (Township)*, 2020 CanLII 32070 (ON LPAT), <https://canlii.ca/t/j6xdm>, retrieved on 2021-12-09.

They reinforce the point that MNRF considers a municipality's land-use planning decisions associated with proposed quarry sites when deciding whether or not to issue a licence, thus highlighting a municipality's role in this regard.

[85] Carlyle clearly outlines the concept that the municipality's role is to determine the zoning issue and the MNRF subsequently will decide whether or not to issue a licence. In the current case, an application for a ZBL [zoning by-law] was approved by the LRPB [Lakehead Rural Planning Board]. There was no application for a licence under the ARA; it is intended to proceed following the determination of the principle of the land use.

[86]….The Tribunal notes that the legislation provides MNRF with a distinct role in licensing under the ARA; however, the Tribunal notes that this does not displace the LRPB's role in zoning under the Act.

[87] In Ottawa (City) v. Sample, 2001 CarswellOnt 4408 (SCJ), ("Sample"), the OMB considered the evidence that supported an environmental assessment, because it was presented in support of an Official Plan amendment. In paragraph 15 of Sample, the court stated: "It would be unprecedented to require the OMB to decline its independent jurisdiction to decide whether an undertaking is good land use planning or not, simply because an undertaking has received an approval from the Ministry of the Environment.

*[88] **Sample underscores the principle that the same evidence may be, and often is, considered by several authorities as they make related decisions on an application**. This is exactly the situation in this matter—LRPB was required to make a decision on the planning merits of the ZBL application. A future ARA licence application is a separate and distinct process with its own approval that is undertaken under a separate regime and jurisdiction, notwithstanding that some of the same information may inform both decisions. [emphasis added]*

[91] There is no hard and fast dividing line between the planning and operational aspects of a proposed development; however, the approach taken by the LRPB is not what the legislation intends. It is incumbent upon the planning authority to assess the planning merits of the application, which requires testing the proposal against consistency with the appropriate planning policy and conformity with the appropriate plans. This responsibility cannot be pushed forward to another agency.

[92] The planning authority is tasked with the determination of the principle of the land use at a specific location. The Tribunal finds that when evaluating the ZBL application, the LRPB erred when it expressly declined in the Resolution to consider the key requirement that extraction be undertaken in a manner "which minimizes social, economic and environmental impacts" as required by s. 2.5.2.2 of the PPS.

*[93] **The Tribunal finds that the LRPB improperly found that s. 2.5.2.2 relates only to the operation of the extraction process, not to the principle of establishing aggregate extraction at that specific location. The interpretation by Quartek and the LRPB of PPS s. 2.5.2.2 is inconsistent with the case law**. [emphasis added]*

*[94] **In Ontario (Ministry of Natural Resources), Re, 2012 CarswellOnt 10693, at paragraph 25, the OMB found that the PPS makes it "abundantly clear" that a planning authority must consider all relevant interests, and that all policies must be considered and weighed when land use decisions are to be made**. [emphasis added]*

*[95] **The Tribunal finds LRPB's Decision to approve the ZBL was inconsistent with the PPS because it declined to consider all relevant policies of the PPS. As required by Policy 4.4 and Part III of the PPS, the approval authority, which was the LRPB, and is now the Tribunal, must consider all relevant sections of the PPS, and must consider the PPS in its entirety**. [emphasis added]*

[96] In support of the ZBL, based on evidence of Mr. Whyte and Mr. Huzan, the Applicant submits that even if the LRPB expressly did not consider s. 2.5.2.2 of the PPS, the impacts are minimized

because the ZBL establishes a Rural zone that is a buffer to the Extractive Zone. The contention is that the Rural zone buffer appropriately mitigates any impacts to sensitive receptors and the environment, and therefore the presence of the buffer in effect meets the intent of PPS Policy 2.5.2.2 "to minimize social, economic and environmental impacts".

[97] The Applicant contends that with the buffer established in the ZBL, the proposed new land use is compatible with the existing residential use, and limitations use along the McIntyre River. Furthermore, Mr. Whyte and Mr. Huzan are both of the opinion that overall, policies of the PPS and the Official Plan favour extraction, in particular, at this location in the Township of Gorham.

[98] To assess the merit of this submission, the Tribunal looks to s. 2.5 of the PPS which relates to Mineral Aggregate Resources. The OMB highlighted how s. 2.5.2 should be interpreted in Capital Paving Inc. v. Wellington (County), 2010 CarswellOnt 697 ("Capital Paving"). Paragraph 16 provides useful commentary:

> **Aggregate Resources**
> Aggregate resources are given a privileged position in the PPS section 2.5.2. As much of the mineral aggregate resources as is realistically possible shall be made available as close to markets as possible. The Board accepts the evidence of **Capital** that the proposed site is in an advantageous location … Aggregate extraction is the only use in the wide ranging PPS where need is not specifically required. The word realistically may be a qualification as is section 2.5.2.2 which requires extraction be undertaken in a manner which minimizes social and environmental impacts. The word minimizes suggests the acceptance of some impact.… While residential sensitive uses would be restricted in locating near to existing or expanding aggregate operations and in the area of known deposits, the PPS also provides protection in buffering and or separation when the residential use is in place first.…**It is fair to say the PPS speaks to the incompatibility of sensitive residential use with earlier aggregate operations and the reverse is also true that a proposed pit may be incompatible with the prior residential use**. [emphasis added]

[99] As laid out by the OMB above, ***Capital Paving holds that although aggregate extraction is given a privileged position in the planning documents, it is "fair to say that the PPS speaks to the incompatibility of sensitive residential use with earlier aggregate operations and the reverse is also true that a proposed pit may be incompatible with the prior residential use****". [emphasis added]*

[100] ***As Capital Paving sets out, it is clear that the proposed new use must be assessed with respect to compatibility with existing use. The Tribunal finds that appropriate assessment by the LRPB and Quartek has not been undertaken in the current case****. [emphasis added]*

In *Bettiol v. Conmee (Township)*, 2017,[28] the Local Planning Appeal Tribunal (LPAT) concluded that the Township focused its attention on the potential of the lands for aggregate extraction, while ignoring the incompatibility of aggregate extraction with surrounding vulnerable and sensitive land uses.

[16]…[I]n the Board's view, although the ZBA [zoning by-law amendment] recognizes the utilization aspect of the policy regime, it is less attentive to the protection of vulnerable and sensitive land uses, which surround the subject property. Although the planner was confident that the ARA would manage impact in line with its legislative mandate, the Board finds that the ZBA should also reflect preferred measures of land use compatibility in line with existing OP policy. Although the ZBA should inform applications pertinent to the ARA to ensure the implementation of compatibility measures, the ZBA should stand as a distinct instrument of good land use control in partnership with the OP.

[28] *Bettiol v Conmee (Township)*, 2017 CanLII 31077 (ON LPAT), <https://canlii.ca/t/h3x7k>, retrieved on 2021-12-09.

> *[17] This finding is particularly relevant in consideration of recent history, which, understandably, has not inspired a sense of security or confidence in the municipal planning process by residential landowners adjoining the subject property.*

In *Parker Mountain Aggregates Limited v. Nova Scotia (Minister of Environment)*, 2010,[29] the Supreme Court of Nova Scotia granted standing to four (4) property owners, three residing within 800 metres, and one property owner at a distance of 1,000 metres from the quarry, to oppose the quarry owners' request to renew the licence. The court also found that the four property owners will experience a number of adverse effects, including a decline in the value of their property.

> *[10] Angela Vroom claims to be an interested person because she has lived on Bloomington Road since 1991. She claims that her residence is 1000 metres from the Quarry. She also owns a 25 acre parcel adjacent to the quarry. She reported excessive noise, dust, dirt and traffic when the Appellant started operations in 2009.* ***She further reports that the 2009 blasting threw rocks [flyrock] on her property damaging her trees****.*
>
> *[14] The applicants, Daye, Daye and Akin all live within 800 metres of the quarry. The Appellants quarry is subject to the pit and quarry guidelines which state at part IV(2)(c):*
>
> > *(2) No person responsible for the operation of a quarry shall blast within:*
> >
> > *(c) 800 m of the foundation or base of a structure located off site. Structure includes but is not limited to a private home, a cottage, an apartment building, a school, a church, a commercial building, or a treatment facility associated with the treatment of municipal sewage, industrial or landfill effluent, an industrial building or structure, a hospital, nursing home.**
> >
> > *NOTE:* The distance is measured from the working face and point of blast to the foundation or base of the structure. This distance can be reduced with written consent from all individuals owning structures within 800 m.*
>
> *[15] There is a requirement upon the Appellant to determine and obtain consent from all residents owning structures within 800 metres from where blasting will occur. Given this requirement, Daye, Daye and Akin have a direct interest by virtue of their location.*
>
> *[16] Angela Vroom does not have a structure within 800 metres of the quarry. However, that does not mean she is unaffected by virtue of living 1000 metres from the quarry. She will clearly be affected by blasting, dust, traffic as well as run-off and damage to her property.* ***It is not just speculation that Ms. Vroom, as well as the other Applicants, will experience a decline in the value of their properties. Such a decline will be a direct result of the development and operation of the quarry.*** *[emphasis added]*

The City of Timmins Zoning By-law 2011-7100 applies the following separation distances to pits and quarries from *sensitive land uses* reciprocally:

> ***3. Pits and Quarries***
>
> ***a****. The* ***influence area*** *between any pit and any* ***sensitive land use*** *shall be 1,000 m [3,280 ft.] measured as the shortest horizontal distance from the zone boundary of the RD -MX Zone or the maximum approved limit of the excavation, whichever is the lesser, and the closest property line of the* ***sensitive land use*** *unless technical studies and or the use of mitigative measures can demonstrate that the minimum separation distance can be reduced to 300 m [984 ft.] without any* ***adverse effects****. The separation distance shall apply on a reciprocal basis with respect to*

[29] *Parker Mountain Aggregates Limited v. Nova Scotia (Minister of Environment)*, 2010 NSSC 277 (CanLII), <https://canlii.ca/t/2bjb4>, retrieved on 2021-12-09.

*establishing a new **pit**. This provision shall not apply to infill on any existing lot of record approved or zoned for a sensitive land use as of the effective date of this by- law. [underscoring added]*

***b**. The minimum separation distance between any quarry and any **sensitive land use** shall be 500 m [1,640 ft.] measured as the shortest horizontal distance from the zone boundary of the RD -MX Zone or the maximum approved limit of the excavation, whichever is the lesser, and the closest property line of the **sensitive land use**. The separation distance shall apply on a reciprocal basis with respect to establishing a new **quarry**. This provision shall not apply to infill on any existing lot of record approved or zoned for a **sensitive use** as of the effective date of this by- law. [underscoring added]*

Algonquin Highlands' Official Plan, By-law 2018-75, approved November 28, 2018, restricts blasting quarry operations to areas

- *Farther than 1,000 metres from a residential or sensitive land use;*
- *Farther than 1,000 metres from a boundary of a Settlement Area; and*
- *Farther than 1,000 metres from the Waterfront designation.*

Hanratty, as a member of the Professional Engineers of Ontario, is ethically and statutorily obligated to protect the public, an issue that appears to have been glossed over in the 2009 SAROS report.

If an explosives engineer ignores flyrock, that is a failure to protect the public and potentially a violation of the Professional Engineers of Ontario's *Code of Ethics*, in particular,

2. *fidelity to public needs*
3. *devotion to high ideals of personal honour and professional integrity*
4. *knowledge of developments in the area of professional engineering relevant to any services that are undertaken*
5. *competence in the performance of any professional engineering services that are undertaken*

It also appears to point to **negligence** and **professional misconduct** under the *Professional Engineers Act, R.S.O. 1990, c. P.28*:

"negligence" means an act or an omission in the carrying out of the work of a practitioner that constitutes a failure to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances. R.R.O. 1990, Reg. 941, s. 72 (1); O. Reg. 657/100, s. 1 (1).

"professional misconduct" means,

a) negligence,
b) failure to make reasonable provision for the safeguarding of life, health or property of a person who may be affected by the work for which the practitioner is responsible.

Flyrock from blasting rock is a danger to the public,[30] as flyrock has the potential to injure or kill people or damage their property, and the failure to disclose and address the potential dangers of flyrock in the 2009 SAROS report is troubling.

In response to growing concerns over flyrock, Orica USA and Orica Canada, two related major blasting companies, undertook a series of internal initiatives in 2009: [31]

> *In late 2009, Orica USA and Orica Canada undertook a series of initiatives designed to address growing concerns with flyrock incidents throughout North America. The "Flyrock Roadshow" (FRS) took to the road in July and August 2009. In all, 33 sites in the US and Canadian businesses were visited; 277 Orica personnel participated in FRS sessions that included; video address from senior management, a review of blasting tools and best practices, an examination of recent flyrock incidents, and interactive group discussions resulting in take-away points to improve performance [p. 100].*
>
> *A large number of incidents…occurred on mine sites (17 per cent), involving misfires, unauthorized movement of vehicles into blast areas or flyrock extending from the blast area [p. 87]*

As recently as July, 2020, the Pennsylvania Regulator (Chief, Explosives & Safety, Department of Environmental Protection, Bureau of Mining Programs) felt compelled to remind members of the ISEE (International Society of Explosives Engineers) that blasting is an "ultrahazardous activity" and that "flyrock is an inherent risk of blasting":[32]

> *Blasting is an ultrahazardous activity and is regulated as such. Flyrock is a serious violation and appropriate enforcement action will be taken in each case. All blasting in PA must be authorized by DEP permits. The activities on those permits should not be a danger to the public or their property.*

The Role of Zoning: Preservation of Property Values and Separation of Incompatible Land Uses to Avoid Adverse Effects

According to I. M. Rogers in *Canadian Law of Planning and Zoning* (Carswell, 1973),[33] the principal purpose of zoning is the preservation of property values:

> ***The principal purpose of zoning regulations, as with restrictive covenants, is to preserve property values by prohibiting uses which are believed to be deleterious to neighbourhoods mainly residential in characte****r. People living in an area of single family homes naturally want the same type of homes in the district, that is, a use that is compatible. They want to preserve the amenities of their locality. Thus from the standpoint of the rate payers it is the status quo that is sought to be maintained and build up residential areas which are figuratively rimmed with "keep out" signs. Industry, always an unwelcome intruder in a residential community, also favours a zoning wall that bars residential and other incompatible encroachments.* [emphasis added]
>
> *The notional route is segregation of people and the uses they make of their land. Density and development standards control the costs of the dwelling placed on the land and a latter determines*

[30] "Flyrock, arguably the most dangerous hazard due to blasting, refers to rock fragments that are propelled beyond the blast are by the force of an explosion. Indisputable evidence for flyrock damage is a hole in the roof of a abuilding and a rock on the floor [p. 14]." http://aspasa.co.za/wp-content/uploads/2020/03/Guidance-Note-on-Minimum-Standards-on-Ground-Vibration-Noise-Airblast-Flyrock.pdf.

[31] file:///C:/Users/Windows%207%20PC/Downloads/2010-Orica-Sustainability-Report.pdf.

[32] https://www.easternpaisee.com/letter-from-the-chief-on-flyrock/.

[33] *Service Corporation International (Canada) Inc. v. Burnaby (City of)*, 1999 CanLII 7012 (BC SC), <https://canlii.ca/t/1d45r>, retrieved on 2021-12-09.

> *the economic (and usually the social) position of those who live in them. Ghettos are created for the rich as well as the poor by walls of exclusionary restrictions. Land values are thus preserved by keeping out undesirable uses and consequently undesirable people. The preservation of property investment is the prime motive underlying many bylaws although they do not always clearly articulate this policy.*

And, as noted in *Saint-Romuald (City) v. Olivier,* 2001,[34] private law and municipal land use controls protect adjoining owners in the enjoyment of their amenity space and promote separation of incompatible land uses to avoid *adverse effects*.

> *9. Private law has long protected adjoining owners in the enjoyment of the amenities of their land. Article 947 of the Civil Code of Québec, S.Q. 1991, c. 64, protects that enjoyment, as does the tort of nuisance at common law. Thus neighbours obtained an injunction in nuisance against a tobacco factory that emitted "noxious odours" in Appleby v. Erie Tobacco Co. (1910), 22 O.L.R. 533 (Div. Ct.), and on the same basis successfully opposed the establishment of a dog hospital in a residential area in Macievich v. Anderson, 1952 CanLII 206 (MB CA), [1952] 4 D.L.R. 507 (Man. C.A.). The doctrine of Rylands v. Fletcher (1868), L.R. 3 H.L. 330, imposes virtually absolute liability on owners who bring on their land "anything likely to do mischief if it escapes" and causes damage to a neighbour, unless the escape was due to the neighbour's default (pp. 339-40). These private law remedies were designed, in a general sense, to protect neighbourhood amenities.*
>
> *14 An Act Respecting Land Use Planning and Development, R.S.Q., c. A-19.1, authorizes Quebec municipalities to regulate the use of land by dividing their territories into zones to which are allocated various groups and classes of uses. This is to be done: [TRANSLATION] "based on common characteristics of land occupation relating to volume, nuisance, compatibility, use and aesthetics" (s. 16 of the new zoning by-law). The impact of a particular land use on neighbouring lands is clearly a key concern, which is shared by common law jurisdictions. The loss of amenities by noise and air pollution, increased traffic, increased demands on municipal services, or other disruptions, may conveniently be referred to as "neighbourhood effects". The minimization of such adverse effects on surrounding owners or the community as a whole is one of the principal objectives of zoning controls.*

Quarry Application Denied For Its Potential Negative Impact on the Health, Safety and Welfare of Those Who Live, Work and Play in The Community (Law Witness Testimony Prevails)

In *Kramer Mining & Materials, Inc. v. Polk County Land Information Committee*, (2013),[35]the Wisconsin Court of Appeals upheld the County's decision to deny the quarry operator's application to permit a quarry in an area zoned for agriculture. The five reasons for rejecting the quarry application, which the appeal court found to be supported by sufficient evidence, are:

- *First, it credited evidence that there would be "increased traffic in the area disrupting the flow of emergency services."*
- *Second, it concluded the quarry would cause noise issues attributable to blasting, operation of the crusher and other heavy equipment, and increased traffic.*
- *Third, the Committee expressed skepticism that proposed noise reduction efforts would sufficiently reduce harmful effects of cumulative noise.*

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[34] *Saint-Romuald (City) v. Olivier*, 2001 SCC 57 (CanLII), [2001] 2 SCR 898, <https://canlii.ca/t/51z2>, retrieved on 2021-12-09.

[35]https://scholar.google.ca/scholar_case?case=15339741773914762388&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cproperty+value%E2%80%9D&hl=en&as_sdt=2006

- *Fourth, it credited the report and testimony of Dr. Daryoush Allaei, an expert in noise vibration and shock controls, concluding that vibrations could cause structural damage within the area.*
- *Finally, the Committee concluded that water quality could be negatively impacted for residents.*

It was the Committee's conclusion that "operating the proposed [q]uarry at the proposed site would have a negative impact on the health, safety and welfare of those who live, work and play in Polk County." [emphasis added]

The appeal court found no merit in the proponent's argument that the refusal to issue a quarry permit, based essentially on the lay testimony of 24 witnesses, should be dismissed for not being founded on personal experience or academic or technical training.

10…Kraemer discounts entirely lay testimony presented at the public hearings. Kraemer complains that these lay witnesses (twenty-four, by Kraemer's count) "offered no personal experience or academic or technical training to support their `beliefs' [about the deleterious effects of the quarry]." It further agues their testimony does not comply with case law construing WIS. STAT. § 907.01, which establishes certain criteria for the admission of non-expert opinions or inferences.

11 However, ***Kraemer cites no legal authority whatsoever that would have required the Committee to conduct its hearing in accordance with the rules of evidence****. Indeed, Kraemer concedes that was not mandatory. This is a proper concession. Wisconsin courts have repeatedly observed that the rules of evidence do not apply in these types of informal proceedings. See State ex rel. Ortega v. McCaughtry, 221 Wis. 2d 376, 389 n.4, 585 N.W.2d 640 (Ct. App. 1998) (prison adjustment committee not bound by rules of evidence); State ex rel. Kaczkowski v. Board of Fire & Police Comm'rs of City of Milwaukee, 33 Wis. 2d 488, 504a, 148 N.W.2d 44 (1967) (record of board inquiry revealed that rules of evidence were "scrupulously observed, a standard not required in most board hearings").* [emphasis added]

Court Awards Homeowner Damages Caused By Rock Blasting: Diminution in Property Value and Loss of Use

In *Clay v. Missouri Highway and Transportation Commission*, the Missouri Court of Appeals upheld an award against Max Rieke & Brothers, Inc., under strict liability for blasting of rock that damaged an aquifer of high quality water, and reduced the value of the homeowners' property.[36]

Leslie R. Clay, Jr. and his wife Alma Clay are residents of Tiffany Springs, Missouri. Their residence in Tiffany Springs sits above an aquifer. This aquifer had supplied a well on their property with unusually high-quality drinking water since 1945.

In November 1989, roadwork began on Highway 152 in the Tiffany Springs area. MHTC hired Rieke to cut the right of way for the new highway down to a grade specified by MHTC. Rieke used explosives to break up and remove rock from the roadway site. MHTC had anticipated that Rieke would use explosives to blast away rock, but had not specifically required the use of explosives in its contract.

Rieke tried to blast in a controlled fashion. Specially-placed explosive charges cut the rock and left smooth walls of rock for the sides of the highway. At trial, some experts testified that this controlled blasting only caused shock waves to move about twenty feet into the rock. ***The Clays alleged, however, that the blasting caused vibrations at their home some .85 miles [1,368 metres] away and that it affected the quality and quantity of the water coming from the aquifer. More***

[36] *Clay v. Missouri Highway and Transp. Com'n*, 951 S.W.2d 617 (1997), https://scholar.google.ca/scholar_case?case=6636206402696025097&q=clay+v+missouri+highway+and+transp+com%27n&hl=en&as_sdt=2006.

specifically, they alleged that due to cracks in the aquifer caused by the blasting, sediment such as sand and oil contaminated the aquifer and, ultimately, their well-water, that the water level of their well dropped, and that the water flow in their well was drastically reduced. [emphasis added]

After a civil jury trial, plaintiffs Leslie and Alma Clay were awarded…$22,340 from contractor Max Rieke & Brothers, Inc. (Rieke) under a theory of strict liability for blasting, for property damage caused by the blasting of rock during construction of a nearby road. The Clays alleged that the blasting damaged their property by damaging an aquifer that had been supplying unusually high quality water to their property.

The Appeals Court rejected defendant Rieke's arguments, while countering with a detailed analysis of *strict liability, causation* and *diminution of value*:

A. Submissibility of Strict Liability for Blasting

We note that there was evidence to support the submission that vibrations or concussions resulting from the explosion entered the plaintiffs' property, for there was testimony that the Clays and their neighbors felt and heard the blasting. They also testified that they began to have problems with their water supply after the blasting. Thus, they do claim a trespass, and they do claim their damage resulted from the blast. What they do not claim, however, is that the vibrations or concussions which they felt directly caused their damage. Rather, they claim that the same blasting that caused the vibrations also, but separately, split and cracked rock outside their property, and that as a result, it caused a lowering of the water level in the entire aquifer, including that on their property, and polluted the aquifer that supplied their well.

We think that the trial court properly refused to require the Clays to prove that it was the vibrations or concussions from the blasting that directly caused their damage; they were required to submit only that it was the blasting that caused their damage. We so rule because we conclude from a review of the history of the doctrine of strict liability for blasting that, while such a claim may be established by proof of vibration and concussion, see Wiley v. Pittsburg & Midway Coal. Mining Co., 729 S.W.2d 228, 232 (Mo. App.1987), it may also be established by other methods of proof.

The doctrine of strict liability for abnormally dangerous activities such as blasting originated in the English case Rylands v. Fletcher, 1 L.R.-Ex. 265 (1866), aff'd, 3 L.R.-E. & I App. 330 (1868). Missouri applies the "true rule," or narrow rule, of Rylands v. Fletcher. As Rylands v. Fletcher is narrowly applied in Missouri, a person is strictly liable "when he damages another by a thing or activity unduly dangerous and inappropriate to the place where it is maintained, in the light of the character of that place and its surroundings. "Bennett, 698 S.W.2d at 867 (quoting Prosser, Law of Torts § 78, at 508 (4th ed.1971)); Richardson v. Holland, 741 S.W.2d 751, 755 (Mo.App.1987). The narrow application of the rule means that the activity (1) must be an activity relating to land or other immovables and (2) must itself cause the injury and the defendant must have been engaged directly in the injury-producing activity. Richardson, 741 S.W.2d at 755 (explaining the imposition of strict liability on abnormally dangerous activities in Missouri). Sections 519 and 520 of the Restatement (Second) of Torts (1977) also reflect this narrow application of Rylands v. Fletcher. See Bennett, 698 S.W.2d at 867. The Restatement limits strict liability for abnormally dangerous activities "to the kind of harm, the possibility of which makes the activity abnormally dangerous." Restatement (Second) of Torts § 519.

The potential that blasting might cause widespread damage to other people's property is precisely the reason that liability is imposed on users of explosives without regard to their negligence. As a general rule, under a theory of strict liability for blasting defendants are liable for any damage caused by the blasting, irrespective of their negligence. Wiley., 729 S.W.2d at 232; Donnell v. Vigus Quarries, Inc., 526 S.W.2d 314, 316 (Mo.App.1975); Summers v. Tavern Rock Sand Co., 315 S.W.2d 201, 203 (Mo. 1958); Richards v. C.B. Contracting Co., 395 S.W.2d 737, 739-40 (Mo.App.1965). Plaintiffs must present evidence that the blasting was of sufficient capacity to have

caused the damage. This evidence may be circumstantial. Wiley, 729 S.W.2d at 232*;* Donnell, 526 S.W.2d at 316*.*

Certainly, in most cases involving damage from blasting, plaintiffs will make their case for damages by presenting testimony that rocks landed or vibrations or concussions were felt coincidentally with the blasting and that physical damage was observed thereafter as a result of the vibrations or concussions. Wiley, 729 S.W.2d at 232. But Rieke cites no cases that state that these are the only ways to show that blasting caused physical damage to the property. In contrast, our own research has identified a number of cases from other jurisdictions which have permitted submission of a strict liability for blasting theory based on damage to water supply in plaintiff's property without regard to trespass.

The most analogous case is Bumbarger v. Walker, 193 Pa.Super. 301, 164 A.2d 144, 149 (1960). In Bumbarger, landowners brought a trespass action against defendants who were conducting a strip mining operation. The defendants' strip mine was approximately 2,250 feet [686 metres] from, and at a higher elevation than, a spring used by the landowners for their water supply. The plaintiffs alleged that water with a high sulphur content that the defendants used in the mine had flowed into their spring and rendered it unfit for use. They presented testimony that there had been blasting and drilling at the mine, that water disappeared from the bottom of the mine after the blasting, that the ground and underground rock strata sloped downward from the mine to the spring, that local home owners felt concussions and suffered some direct damages from the blasting, and that their spring was fed by subterranean percolating water.

The Superior Court of Pennsylvania found that the plaintiffs' evidence was sufficient for a jury to find that the defendants' blasting and removal of the water from the mine altered underground geological structures in a manner that damaged the plaintiffs' spring. Bumbarger, 164 A.2d at 147. It relied on Section 519 of the Restatement of Torts (1938), which did not limit recovery for ultrahazardous activities to direct damages. As a general rule, it provided that:

> one who carries on an ultrahazardous activity is liable to another whose person, land or chattels the actor should recognize as likely to be harmed by the unpreventable miscarriage of the activity for harm resulting thereto from that which makes the activity ultrahazardous, although the utmost care is exercised to prevent the harm.

Restatement of Torts § 519 (quoted in Bumbarger, 164 A.2d at 148). See also Opal v. Material Serv. Corp., 9 Ill.App.2d 433, 133 N.E.2d 733 (1956) (rejecting requirement of proof of trespass in blasting cases and extending strict liability for direct and consequential damages that are the natural and probable result of blasting); Atlas Chem. Indus., Inc. v. Anderson, 514 S.W.2d 309 j(Tex.Civ.App.1974) (imposing strict liability where defendant intentionally discharged pollutant into stream and holding defendant liable for all foreseeable damages resulting from the pollutant), aff'd in part and rev'd on other grounds, 524 S.W.2d 681 (Tex.1975); Branch v. Western Petroleum, Inc., 657 P.2d 267 (Utah 1982) (applying strict liability to nontrespassory injuries to plaintiff's wells caused by the defendant's pumping of polluted water into its own oil wells and the subsequent percolation of the polluted water into the subterranean water supply).

Policy considerations support such imposition of strict liability for blasting even though no physical invasion of the premises has taken place. Neither an industry nor the State should be allowed to use its property in an abnormally dangerous way that injures the property of its neighbors with impunity, because to do so is effectively an appropriation of the neighbor's property for the industry or State's use. The blaster, and not the wholly innocent party, should assume the costs of its blasting*. See Atlas Chem. Indus., 514 S.W.2d at 316 (characterizing the damage inflicted on other people's property as inverse condemnation); Branch, 657 P.2d at 275.* [emphasis added]

We think these principles have application here, where the Clays similarly claim that the blasting caused physical damage to their property by damaging the rock formations underlying nearby property, thereby causing injury to the aquifer or to other subterranean aspects of the property in question. They presented expert testimony by Dr. Paul Hilpman, a Professor Emeritus of Geology

at the University of Missouri and the Director of the Center for Underground Studies, to support this theory. He testified that the blasting damaged geological structures that resulted in the contamination of the Clays' well. Dr. Hilpman testified that the blasting fractured rock and sandstone layers in the aquifer and that these fractures in turn caused the water table to drop and allowed oil to migrate up into the water-producing area of the rock strata. This resulted in a lower water level in the Clays' well and in pollution of their well water. This type of damage is equally serious and equally likely to affect the value of property as is damage caused by vibrations or concussions on the property. Rieke also argues that any damage to the aquifer was not caused by the blasting, but rather by the fact that the road had to be dug to a level which required penetration of numerous layers of rock and sediment. It argues that even if it had dug the road by hand, it eventually would have had to break through the same layers of rock, and the same lowering and contamination of the aquifer would have occurred. Thus, it argues, the injury (if any) was not from the blasting but from the design and location of the road, matters which were in MHTC's control, and as to which Rieke had no input or discretion.

B. Proof of Causation

Rieke also argues that any damage to the aquifer was not caused by the blasting, but rather by the fact that the road had to be dug to a level which required penetration of numerous layers of rock and sediment. It argues that even if it had dug the road by hand, it eventually would have had to break through the same layers of rock, and the same lowering and contamination of the aquifer would have occurred. Thus, it argues, the injury (if any) was not from the blasting but from the design and location of the road, matters which were in MHTC's control, and as to which Rieke had no input or discretion.

While the jury might have agreed with this interpretation of the evidence, there was also evidence that the blasting itself caused more severe fracturing of the rock strata than would have been caused by other methods of digging. Dr. Hilpman testified that some of the rock had to be blasted and that the blasting would cause more subterranean fracturing than simple cutting. He also testified that the oil showed up in the Clays' well because it was able to migrate up into the water zone through fractures in a limestone layer that were caused by blasting. While the evidence on this point was not extensive, the jury apparently accepted it and it was adequate to support the jury's verdict.

C. Diminution of Value

Rieke also argues that the Clays failed to make a submissible case because they failed to offer sufficient evidence that there was a diminution in fair market value of their property, and further that the evidence did not support the amount of the jury's verdict.

We disagree. Rieke's position is based on its argument that the only evidence of fair market value was (1) its own appraiser's testimony that the difference in fair market value of the Clays' property before and after the blasting was $12,700, and (2) Mr. Clay's testimony that his property did not have any fair market value prior to the blasting because of its zoning and proximity to Kansas City International Airport. Rieke argues that Mr. Clay's testimony necessarily implied that the water problems did not affect the fair market value of the property and so that defeated the Clays' own claim.

While Mr. Clay's testimony did not help his position, he clarified that he meant that the home had little or no value as a residence due to its location near the airport, but that it would have considerable value as a farm. In addition, on cross-examination Rieke's appraiser admitted that his appraisal was incomplete in that he had not considered some relevant facts in reaching his $12,700 figure.1

More specifically, the appraiser testified that because fair market value is based on the "highest and best use" of the "next most likely buyer," and because he had determined that the "highest and best use" of the "next most likely buyer" to be as a "suburban residence with small acreage," he did not determine whether the property had any incidental agricultural use that should be reflected in its value. He admitted that if the well water had some unique characteristics it might enhance the

property value. He also admitted that he had not given the well water any special value because of its favorable chemical balance, had not specifically checked a water bill for the property, had not considered the $2,800 cost to hook-up to the city water line once the well was polluted, had not considered the "storm water charge" on the water bill, and had not considered that such factors could affect the property value.

The evidence was sufficient to support the jury's determination that the blasting caused a decrease in fair market value of the Clay's property in the $19,640 amount found by the jury. [emphasis added]

Homeowners Sue for Damages Caused by Road Construction Blasting

More than a dozen homeowners filed law suits against Beckley Drilling & Blasting seeking damages for cracks to their homes due to blasting, as well as for a decrease in property value and for expenses to repair their homes.[37]

Stella McClellan; Nathan Vance and Carrie Vance; Tommy Blair and Deanna Blair; Lonna Moore, as executrix of the estate of Diana Robertson, and Gary Carter; Richard Spears and Jennings Spears; and Helen Brown, through her power of attorney, Angela Miller filed their lawsuits in Logan Circuit Court against Beckley Drilling & Blasting Services.

The defendant began blasting through bedrock near the plaintiffs' homes while it was constructing a highway in 2014 and that blasting continued until November 2016, according to the suits.

The plaintiffs claim they suffered cracks to their homes due to the blasting, as well as a decrease in property value and expenses to repair their homes.

The blasting done by the defendants created a nuisance that was substantial and unreasonable, according to the suits.

The plaintiffs claim vibrations and concussions caused by the blasting constitute a trespass on their properties and their rights as homeowners.

The interference with the private use and enjoyment of another person's land is unreasonable when the "gravity of the harm outweighs the social value of the activity alleged to cause the harm."

The plaintiffs are seeking damages not to exceed $65,000 in each suit. They are represented by attorneys G. Patrick Jacobs of the Law Office of G. Patrick Jacobs in Charleston; and John H. Skaggs of The Calwell Practice in Charleston.

More than a dozen lawsuits have already been filed against Beckley Drilling & Blasting this year for the work done constructing the highway in Logan.

[37] Ashbury, Kyla. "More lawsuits filed against Beckley Drilling & Blasting for property damage," *West Virginia Record*, Nov 20, 2018, https://wvrecord.com/stories/511635008-five-more-lawsuits-filed-against-beckley-drilling-blasting-for-property-damage.

Blasting Quarry Impacts Water Quality and Quantity of Neighbouring Wells

The South Carolina Department of Natural Resources undertook an investigation of ground-water problems in the vicinity of Vulcan Materials Marble Quarry in Cherokee County, South Carolina.[38]

> *Citizen complaints about wells drying up and having poor water quality due to blasting at a marble quarry prompted the Office of the Lieutenant Governor to request the South Carolina Water Resources Commission (SCWRC) to conduct an investigation. Since January of 1986 the Piedmont Office of the SCWRC has been conducting a study in the vicinity of the quarry.* ***The study area is in northeastern Cherokee County, approximately 5 miles north of Blacksburg. About 210 people live in the 1.2 square-mile area that contain a trailer park, houses, farmland, and the Vulcan Materials marble quarry****.* [emphasis added]
>
> *The quarry is situated on a portion of an elongated marble body that trends northeast-southwest through the area.* ***The geology of the area is characterized by intensely folded and faulted rocks, which greatly influence ground water properties. Wells are generally of medium to low yield and water quality is generally good****.* [emphasis added]
>
> *The Piedmont SCWRC Office set out on the following objectives: (1) To identify problems that local residents are experiencing; (2) To evaluate the extent of the problems; (3) To determine the cause(s) of these hydrologic problems; and (4) To present recommendations.*
>
> *Water levels were measured in 31 wells during March of 1986 to construct a water table map. Automatic data recorders were installed on two deep wells to monitor water levels continuously. Blasting records and other information were obtained from the quarry.*
>
> *Several residents complained that, after blasting at the quarry, their wells would dry up temporarily or the water would become silty or have an "iron taste". A more common complaint was that of ground vibration from the blasting, in some cases, causing structural damage to houses and/or wells.*
>
> *An estimated 60 families live in the general area and 37 of these were contacted by the SCWRC.* ***Fifty-four (54) wells were inventoried and descriptions of problems were taken from residents. Of the wells inventoried, 59 percent have had water problems. Of those wells with problems, drilling new wells solved 19 percent or installing water filters. Of the seven families still having problems, five have water quantity and quality problems while two have only water quality problems****.* [emphasis added]
>
> ***Causes of hydrologic problems****:*
>
> - *Topographic and drainage modifications by the quarry resulted in lowering of the water table and a reduced ground-water recharge area. These changes proved critical for wells upgradient from the quarry.*
> - *Water quality has been adversely affected in ungrouted wells that allow loose material along the wellbore to travel down the outside of the well casing and enter the well hole after blasting or rainfall.*

[38] Castro, Joffre., Harrigan, Joseph. and Mitchell, Lee. "Investigation of Ground-Water Problems near Vulcan Materials Marble Quarry, Cherokee County, South Carolina," 1988, https://www.dnr.sc.gov/water/hydro/HydroPubs/Abs_wrc_of19.htm.

Quarry Blasting Produces Toxic Fumes

As reported by Mainiero et al,[39] blasting operations produce toxic gaseous products, mainly carbon monoxide (CO) and the oxides of nitrogen (NO_x). The quantity of toxic gases produced by an explosive is affected by formulation, confinement, age of the explosive, and contamination of the explosive with water or drill cuttings, among others. The concentrations Immediately Dangerous to Life or Health (IDLH) for NO_2, NO, and CO are 20, 100, and 1,200 ppm (parts per million), respectively (NIOSH, 1994).

> *Blasters at surface mines and construction operations have not been as concerned about blasting fumes as their counterparts in underground mines, believing that fumes would disperse in the open air (ISEE, 1998). Surface blasters, however, must be aware that toxic fumes have the potential to create hazards in their operations. Large surface mines may detonate up to two million pounds of blasting agent in a single shot. Some of the shots produce a product cloud colored red or orange by the presence of NO_2 (Barnhart, 2004), (Barnhart, 2003), and (Lawrence, 1995). At present it is not known whether the orange cloud contains toxic levels of NO_2 since there have been no published reports of direct measurements. However, in the interest of safety every blaster should assume that any blasting product cloud is unsafe to breathe.*
>
> *For surface blasting operations, the CO in the gaseous products released immediately after a blast is not of great concern since CO is much less toxic than NO_2; the IDLH for CO is 1,200 ppm compared to 20 ppm for NO_2. For CO, the danger lies with the gas that remains in the ground after the blast. This CO will be released during loading operations or may migrate hundreds of feet through the ground and collect in confined spaces. Since 1988, there have been eighteen documented incidents of CO migration in the United States and Canada; the confined space typically being a home and in one case a sewer manhole vault (NIOSH, 1998), (Eltschlager, Schuss, Kovalchuk, 2001), (NIOSH, 2001), and (Santis, 2001). There have been thirty-nine suspected or medically verified carbon monoxide poisonings, with one fatality. In one incident in Kittanning, Pennsylvania, blasting fumes traveled 450 feet [137 metres] from a coal strip mine into a home, poisoning a couple and their baby. Fortunately, all three recovered following treatment in a hyperbaric chamber (Eltschlager et al. 2001) and (NIOSH, 2001).*

According to Okeke,[40] there are a number of reasons why quarry blasting can generate toxic fumes

> *In quarry blasting, the explosives that produce fumes are normally a mixture of porous ammonium nitrate prills and fuel oil alongside other additives. These explosives may be in the form of ammonium nitrate and fuel oil (ANFO), emulsions or water gel containing ammonium nitrate. Most of the ammonium nitrate blast fume cloud is composed of dust, water vapour (H_2O), carbon dioxide (CO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), nitric oxide (NO), soil and rock particulate matter that is released by the forces exerted on the surrounding rock during the blasting operations (DEED, 2011) [p. 13].*
>
> *Conditions encountered during quarry blasting are not always ideal. Commercial explosives having ammonium nitrate as the main component produce fumes under non ideal conditions…*
>
> *The presence of nitrogen dioxide gives post detonation fume its characteristic reddish-orange coloration and pungent odour (NIOSH, 1994). By and large, some factors such as the age and*

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[39] Mainiero, Richard J., Harris, Marcia L. and Rowland III, James H., "Dangers of Toxic Fumes from Blasting," https://www.cdc.gov/niosh/mining/userfiles/works/pdfs/dotff.pdf.

[40] "Analyzing the role of blast design on post detonation toxic fumes generation in quarries," *Institute of Explosives Engineering*, https://www.researchgate.net/publication/321912206_Analysing_the_role_of_blast_design_on_post_detonation_toxic_fumes_generation_in_Quarries

composition of the explosive, moisture content of the drill hole, velocity of detonation, charge diameter, initiation type, and most significantly explosive confinement determine the amount of non-ideal detonation products formed. Research has revealed that the level of confinement of an explosive charge and the material being blasted both have a considerable impact on production of post detonation toxic fumes (Persson and Persson, 1980).

Geology and ground conditions influence the confinement of the explosives which is a vital requirement to ensuring the explosive reaction is near ideal. The explosive may flow into fissures, voids and cervices around the drill hole hence not being able to confine properly. At this instance it forms below the critical diameter prompting an incomplete detonation leading to the generation of toxic fumes (ISEE, 2015).

Compromised Lung Function and Respiratory Health of Residents In Proximity to Operational Quarries

Researchers at the Institute of Community and Public Health, Birzeit, Ramallah, in 2020 completed a cross-sectional comparative study of two groups, both consisting of 79 participants, with one group residing within 500 metres of the quarry sites, while the control group lives more than 500 metres away from the quarry sites, to measure the impact of fugitive dust on lung function and respiratory health.[41]

A cross-sectional comparative study was conducted among 79 exposed participants, who lived less than 500 m away from the quarry sites, and 79 control participants who lived more than 500 m away.

All participants answered a questionnaire on dust exposure at home and health effects, as well as performed a lung function test in which both reported and measured health effects were investigated.

Research has shown that dust concentration, deposition rates, and potential impacts tend to decrease rapidly away from the dust source [3,23]. *This explains why our control participants, who live more than 500 m away from quarry sites, have reported significantly lower symptoms.*

- *People who live in close proximity to the quarry sites reported exposure to dust at home (98%), land destruction (85%), plant leaves covered with dust (97%), and an inability to grow crops (92%).*
- *The exposed group reported significantly higher eye and nasal allergy (22% vs. 3%), eye soreness (18% vs. 1%), and dryness (17% vs. 3%), chest tightness (9% vs. 1%), and chronic cough (11% vs. 0%) compared to the control group.*
- *Lung function parameters were significantly lower among the exposed group compared to the control group; mean forced vital capacity (FVC) was 3.35 L vs. 3.71 L (p = 0.001), mean forced expiratory volume in the first second (FEV1) was 2.78 L vs. 3.17 L (p = 0.001).*
- Higher levels of airway restriction were found among the exposed group. Among the exposed group, lung function parameters worsened with the increasing closeness of home to the quarry site.

The researchers of the controlled study cite the following studies, which add support to their findings that people residing in proximity to an operational quarry are more prone to have their health compromised.

[41] Nemer, Maysaa., Giacaman, Rita. and Husseini, Abdullatif., "Lung Function and Respiratory Health of Populations Living Close to Quarry Sites in Palestine: A Cross-Sectional Study," *Int. J. Environ. Res. Public Health* 2020, *17*(17), 6068, **https://doi.org/10.3390/ijerph17176068**.

- *The study from Jammain village has shown that the main reported health effects among the populations living close to the quarry sites were nasal inflammation, cough, and hearing impairment [23].*
- *Although several studies in Palestine and the region have investigated the environmental effects of the quarrying activities in terms of water, air, and soil pollution, there is a limited number of studies that investigated the health effects among the population who live nearby.*
- *Studies from India found silicosis and other respiratory inflammatory diseases among close populations to stone mining [14]…*
- *…[A] study conducted in Puerto Rico found an elevated prevalence of bronchitis and nasal allergy among the communities who live close to quarry sites compared to others who live fare from them [15].*

Additional resident concerns over fugitive dust generated by quarry operations, and the magnification of fugitive dust caused by weather conditions are described below:

- *wind-blown dust can cause a significant nuisance to residential and commercial neighbours. The most common areas of complaint relate to dust on roofs, walls, windows, paths and gardens, and on residents' cars and washing (QM Oct 2005, p. 41)*[42]
- *when material is transported off site the problem of dust once again becomes a very public issue, as delivery trucks and staff/visitors' vehicles joining the public highways can lead to the build-up of dust and deposits on road surfaces, creating hazardous driving conditions for other road users (QM, p. 41).*
- *changes in weather conditions can magnify the problems caused by dust. Wind is obviously the most significant cause of dust emission.* ***Research has shown that large dust particles (larger than 30µm) will be dispersed within 100m of the source. Intermediate sized particles (10–30µm) are likely to travel 200–500m. However, smaller particles (less than 10µm) can travel much further [than 500 metres] from the source (QM, p. 41)****. [emphasis added]*

Governmental Agencies Recognize Fugitive Dust As A Significant Health Issue

Fugitive dust is a major issue to regulatory agencies, according to a 2017 Technical Bulletin on the management of fugitive dust sources published by the Ministry of the Environment and Climate Change (MOECC).[43]

> *…[D]ust is defined as small solid particles which settle out under their own weight but which may remain suspended for some time. Mechanical disturbance of granular material can generate a significant amount of dust. The amount of dust emission is affected by a wide range of factors such as material characteristics (e.g. particulate size distribution), climatic conditions (e.g. wind and precipitation), control measures in place (e.g. wind screen, stabilizers, dust suppression), and the amount and frequency of mechanical disturbance to which the material is exposed.*
>
> *Fugitive dust emissions are recognized as a significant issue by regulatory agencies such as the United States Environmental Protection Agency (USEPA) and the Ontario Ministry of the Environment and Climate Change (ministry). The effects of the dust are related to the particle size distribution, the composition, the amount emitted and the dispersion pattern. These effects can range from surface staining to health impacts, depending upon the factors involved. Once dust is emitted (particles put in suspension), it will travel away from the source again affected by various*

[42] "Controlling Dust and Erosion in Quarries," *Air Spectrum Environmental*, QM 2005, https://www.agg-net.com/files/aggnet/attachments/articles/controlling_dust_and_erosion_in_quarries_0.pdf.

[43] Technical Bulletin, Standards Development Branch, MOECC, February 2017, https://files.ontario.ca/management-approaches-for-industrial-fugitive-dust-sources.pdf.

parameters, including meteorological conditions and particulate size distribution. Larger particles will likely settle closer to the source whereas smaller particles are likely to settle further away. Particulates that are less than 30 µm in size do not settle as easily and can travel even longer distances before deposition. Wind speed and direction have a significant influence on the dispersion of the dust.

Past reviews of facilities have shown that unless appropriately controlled, fugitive sources often contribute to the total site emissions as much as or greater than process sources. As a result it is important to include fugitive sources in the modelling assessment of off-site concentration levels of contaminants. [emphasis added]

Main Sources of Fugitive Dust Emissions

Fugitive dust can be emitted from vehicle traffic on paved or unpaved roads (or surfaces); blow-off from a load during haulage; loading and unloading of materials, products or packaging; handling of materials; screening and sorting; dry sweeping; and wind erosion of storage piles, berms and road surfaces.

Open storage of granular materials and material handling can result in dispersion of the dust to a wider area, which may then be re-suspended by vehicle traffic or wind. Fugitive dust is also generated by wind erosion of exposed surfaces and piles. By reducing the primary emission source, less effort is required on the secondary sources, which typically result from re-entrainment or re-suspension.

Other common industrial activities that may contribute to fugitive dust emissions include, but are not limited to, trimming, blasting, drilling, crushing, grinding, sawing and screening.

Example: Addressing fugitive dust in an Emission Summary and Dispersion Modelling (ESDM) Report[44]

Fugitive particulate from on-site roadways, storage piles and other fugitive sources must be included in the assessment of compliance with ministry POI [point of impingement] Limits including SPM [suspended particulate matter] unless the facility:[45]

- *develops and implements a BMP [best management practice] plan (includes in Appendix to ESDM report); and*
- *retains a copy of the BMP plan and implementation records on-site for inspection by the ministry: and*
- *demonstrates that each contaminant that has a health-based ministry POI Limit (or that may cause health effects) has been adequately assessed in the ESDM report and any issues have been addressed.*

If the dust emissions contain significant quantities of contaminants with health-based ministry POI limits, then these sources would not be considered negligible and should also be included in the modelling. [emphasis added]

Sectors listed in ESDM Procedure for use of fugitive dust BMP

- *Table 7-2 "Sectors where metal content within fugitive particulate must be considered" (i.e., metal ore mining, primary metal manufacturing, coating-engraving-heat treating, and fabricated metal product manufacturing)*

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[44] Procedure for Preparing an Emission Summary and Dispersion Modelling Report [Guideline A-10], Version 4.1, March 2018, https://files.ontario.ca/books/20180309_moecc_65_emission_aoda_en-aoda.pdf.

[45] Air and Waste Management Association Ontario Section Conference June 21, 2017, Power Point Presentation, Slide 13, https://static1.squarespace.com/static/50ba2be5e4b012760add2bd3/t/5970d3816a496339d98aa46e/1500566402181/2_+MOECC+Fugitive+Dust+Management.pdf.

- *Table 7-3 "Sectors where metals in fugitive particulate is generally not anticipated" 9e.g. quarries, sawmills, cement…)*

According to Section 45, **Prohibition of Certain Emissions**, of O. Reg. 419/05,[46]

> *45. No person shall cause or permit to be caused the emission of any air contaminant to such extent or degree as may*
>
> *(a) cause discomfort to persons;*
> *(b) cause loss of enjoyment of normal use of property;*
> *(c) interfere with normal conduct of business; or*
> *(d) cause damage to property. O. Reg. 507/09, s. 32 (1)*

In *Eureka Stone Quarry, Inc. v. Commonwealth of Pennsylvania*, [2008] [47] the appeal court upheld the ruling of the Environmental Hearing Board (EHB), which convicted the quarry owner of violating the Pennsylvania Air Pollution Control Act, following numerous complaints from neighbouring landowners The DEP placed the company on a Compliance Docket because it "determined that Eureka lacks the intention and ability to comply with the pertinent regulations." [underscoring added]

> *No person shall cause, suffer, or permit fugitive particulate matter to be emitted into the outdoor atmosphere from any source or sources specified in § 123.1(a)(1)-(9) (relating to prohibition of certain fugitive emissions) if such emissions are visible, at any time, at the point such emissions pass outside the person's property. (Emphasis added.)*

The appeal court also ruled that the Department of Environmental Protection (DEP) is authorized to implement a policy of deterrence.

> *A review of the record reveals that Vlot [inspector, DEP] considered Eureka's fugitive emissions to have a moderate level of environmental impact, as the quarries were "on-going violator[s]'.*
>
> *…[T]he DEP is authorized to implement a policy of deterrence without proof that there will be an actual deterring effect on the company or the industrial community. The DEP may consider deterrence in conjunction with such factors as the number of violations and the hazards the violations caused.*

Court Rules Quarry's Blasting Operation a Common Law Nuisance

In *Commonwealth of Pennsylvania, Department of Environmental Resources* (DER) *v. Glasgow Quarry Inc.*,[48] the DER refused to renew Glasgow's permit on the grounds that

> *the blasting procedures used and intended to be used did not adequately safeguard the public*

The quarry owner appealed denial of a permanent permit to the Environmental Hearing Board (EHB), which held a 10-day hearing that generated 2,202 pages of testimony, and an order was issued permitting continued operation of the quarry under certain restrictions.

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[46] O. Reg. 419/05: Air Pollution – Local Air Quality under *Environmental Protection Act, R.S.O. 1990, c. E.19*, https://www.ontario.ca/laws/regulation/050419.

[47] https://caselaw.findlaw.com/pa-commonwealth-court/1412455.html.

[48] *DER v. Glasgow Quarry*, 23 Pa. Commonwealth Ct. 270 (1976), https://scholar.google.com/scholar_case?case=15884448365410180316&q=%E2%80%9Cblasting+damages%E2%80%9D&hl=en&as_sdt=2006.

The Environmental Hearing Board [EHB], supported by a very carefully prepared adjudication by its chairman, sustained the denial of the permanent permit but ordered that one or more interim permits be granted appellant so that a satisfactory method of blasting could be achieved [para. 272].

The quarry owner then filed a further appeal to the Commonwealth Court of Appeal seeking a ruling on the following two issues:

I. When the Department of Environmental Resources refuses to license a lawful quarry operation, alleging nuisance, does the Department meet its burden of proof with oral and visual testimony only?

II. Has the Environmental Hearing Board applied the proper standards in its determination that Appellant's blasting operation constitutes a common law industrial nuisance?

As for Issue 1, the appeal court accepted the finding of the Board, commenting as follows:

Appellant [Glasgow Quarry] offered the testimony of acknowledged blasting experts of national reputation, together with seismographic reports. These reports showed that the vibrations, "peak particle velocity," were substantially below the 2.0 level determined to be the maximum allowable as recommended by the U.S. Bureau of Mines. The appellee [DER] offered one expert who made at least two trips to the site and examined the alleged blasting damages to property in the vicinity. His "visual" examination led him to conclude, taking all factors into consideration, that the blasting was causing the alleged damage.

On Issue II, the appeal court ruled that the record supported the Board's finding that the blasting constituted a public nuisance, commenting as follows:

A study of the blasting cases in which the blasting was declared to be a nuisance indicates that where there is credible evidence that the blasting is causing damage to the property of others, as there is here, and if it is so found as a fact, as it has been here, a public nuisance does exist. See Beecher v. Dull, 294 Pa. House of Refuge v. J.T. Dyer Co., 43 Pa. Superior Ct. 320 (1910). See also Federoff v. Harrison Construction Co., 362 Pa. 181, 66 A.2d 817 (1949) [para. 274].

Quarry Rock Fines Pumped Into Creek Causing Ecological Damage Ruled A Pollutant and Not Covered By Insurer

In *Eastern Concrete Materials, Inc. v. Ace American Ins.,* 948 F.3d 289 (2020)[49], the Fifth Circuit of the United State Court of Appeals upheld the trial court's ruling that "rock fines" are a pollutant under the insurance policy, for which there is no coverage. The rock fines pumped into Spruce Run Creek had a negative impact to a trout producing stream and a documented habitat for threatened or endangered species.

*…[T]he district court concluded that rock fines are pollutants under the GAIC Policy and, thus, that GAIC had no duty to defend or indemnify Eastern Concrete. By way of reminder, the GAIC Policy's pollution exclusion bars coverage for liability "arising out of or in any way related to ... discharge, dispersal, seepage, migration, release *301 or escape of `pollutants.'" "Pollutants," in turn, is defined as "any solid, liquid ... irritant or contaminant, including, but not limited to ... waste material," which "includes materials which are intended to be or have been recycled, reconditioned or reclaimed." After explaining how rock fines are generated, the district court determined that rock*

[49] *Eastern Concrete Materials, Inc. v. Ace American Ins.,* 948 F.3d 289 (2020), https://scholar.google.com/scholar_case?case=3797479738571789884&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cfumes%E2%80%9D&hl=en&as_sdt=2006.

fines are "waste material generated in the rock crushing process" because they are "materials intended to be reclaimed." Moreover, the rock fines "became irritants or contaminants when they were discharged and dispersed where they did not belong." If this were not so, the district court reasoned, "New Jersey would not have required remediation," and Eastern Concrete would not have been sanctioned for violating New Jersey's Water Pollution Control Act. (citing N.J. STAT. ANN. § 58:10A-3(n), which lists "rock, sand, [and] cellar dirt" as "pollutants").

…[W]hen we look at the effects on the overall ecosystem, rock fines are contaminants. Eastern Concrete's own counsel described the incident as pumping "a deleterious substance resulting in a negative impact to a trout producing stream and a documented habitat for threatened or endangered species." And Eastern Concrete's expert explained that the incident "chang[e]d the flow and contours of the stream, including areas used for trout spawning" and "physically cover[e]d the micro and macro invertebrates that serve as a food source for fish and other species." The rock fines, in short, "render[e]d [the creek] unfit for use" as a habitat for trout and other species. This explains why Eastern Concrete was required to remove the rock fines from Spruce Run Creek.[6]

Quarry Operator Pays $1 Million to Settle 28 Homeowners' Claims For Loss of Well Water

An entire neighbourhood filed a law suit against Halquist Stone Co. in 2004, after experiencing problems with their wells, which the quarry owner settled in 2007 for $1 million ($35,714 average per claim) to provide for an alternative water supply.[50]

Lisbon, WI: (May-13-07) 28 families who lived in a 45-acre area north of county Highway K and west of Sussex Creek, filed a lawsuit against Halquist Stone Co. in 2004, alleging that the entire neighborhood experienced problems with their wells, including muddy, turbid water and, in some cases, no water at all, as a result of the quarry where Halquist did its blasting. The case went to trial in Waukesha County Circuit Court in 2006, with Halquist contending that well problems were not new to the area, and some of the wells in the neighborhood were more than 40 years old. One of the plaintiffs' Jane and Emil Glodoski were left with no water for days and a huge puddle of mud surrounding their well cover. Once they got water running from the well again, initial tests showed it had coliform bacteria and E coli, forcing them to use bottled water for drinking and cooking. Halquist, which mines the area's famous Lannon stone at the quarry, has been in operation in the area since 1929. After the lawsuit, Halquist agreed to a settlement, paying $1 million to set up a fund to provide an alternative water source to the area.

Homeowner Unable to Sell Home Without Water: A Loss Attributed to a Nearby Quarry Operation

In *Wood et al. v. American Aggregates Corporation*, (1990), the Appellate Court of Ohio, overturned the trial court's summary judgment in favour of the quarry operator on the grounds that the four-year statute of limitations had expired. In this dispute, the homeowners claimed that its supply of ground water had been eliminated by the operations of the quarry owner, and forced the homeowners to vacate the property, which they were unable to sell.

On March 8, 1988, appellants instituted this action seeking monetary and injunctive relief from appellee for the unreasonable use of underground water. Appellants are the owners of real property located in Grove City, Jackson Township, Ohio. In 1973, appellee began operating a sand, gravel and stone quarry also located in Jackson Township which uses a large quantity of water in its operation. Both properties are situated over a well-defined semi-artesian aquifer.

[50] HALQUIST STONE CO.

Originally, appellants obtained all their water needs from a well drilled into the aquifer underlying their property. Appellee also abstracted its needed water from this aquifer. Shortly after appellee commenced its quarry activities, appellants noticed a reduction in the quantity and quality of their underground water. Attempts to rectify this situation by drilling a new well proved fruitless. In 1980, appellants stopped using their well altogether when they moved from their Grove City home. Appellants claim that they were unable to sell their home because of the water problem and were eventually forced to have the home connected to Columbus city water when it became available in 1982.

Following a non-oral hearing, the trial court sustained appellee's motion for summary judgment. The trial court held that, since the latest date that damages occurred was 1982, at the time appellants were connected to city water, appellants' claims were time barred by the four-year statute of limitations contained in R.C. 2305.09(D).

The appeal court found that the quarry operator did not enjoy an unfettered right to drain the aquifer for use in its quarry operations, and, in turn, deprive the owners of the neighbouring property of access to water from the same aquifer for domestic use.

The acquisition of a vested right necessarily implies that the right cannot be taken away. Yet, ground water under Frazier was available to anyone who could avail themselves of it. If an adjoining landowner constructed a more powerful pump, a neighbor's water supply could be totally drained without the landowner incurring liability. Under Frazier, an underground water user could be divested of his right to use the water at any time. Therefore, Cline, supra, applies as the test for the propriety of appellee's activity, although Cline was decided after appellee had commenced its quarrying activities.

Appellants offer two explanations for the timing of their lawsuit: (1) they did not become aware of the reason for the depletion of the water table until 1983; and (2) and their cause of action did not arise until Cline was decided in 1984. We have previously decided that appellants' action was filed within the applicable statute of limitations and, while this is not conclusive, it is some evidence of reasonableness. Finally, appellee has failed to show prejudice. For these reasons, the doctrine of laches is inapplicable.

Quarry Operator Convicted For Exceeding Total Suspended Solids In Effluent From Sewage Works Dumped Into The St. Lawrence River[51]

Lafarge Canada owns and operates Brockville quarry located on Prescott Road east of Brockville, and in September 2017 it ran afoul of the Ontario Water Resources Act.

The quarry operates under a ministry approval for the company's sewage works for the collection, transmission, treatment and disposal of wastewater from the quarry pit. The sewage works ultimately discharges via a drainage ditch to the St. Lawrence River.

Lafarge is required to operate the sewage works such that the monthly average concentration of total suspended solids in the effluent from the sewage works does not exceed 25 mg/L. In September 2017, samples collected and analyzed for total suspended solids yielded a monthly average concentration of 54.25 mg/L, which exceeds the limit.

Lafarge was convicted of one violation (count) under the Water Resources Act and was fined $140,000 plus a victim fine surcharge of $35,000 and was given 6 months to pay.

Lafarge committed the offence during the month of September 2017, and it took approximately 3.5 years before Lafarge was convicted.

[51] Court Bulletin, "Aggregate Construction Company fined $140,000 for Ontario Water Resources Act Violation," *Environment, Conservation and Parks*, March 8, 2021, https://www.fcpreservation.ca/.

Health & Quality of Life

The health and quality of life implications from aggregated aggregate operations are not addressed in a proponent-driven Blast Design Report (Blast Impact Assessment) or any other studies related to aggregate extraction, a concern expressed by the Medical Officer of Health for the Region of Peel in a January 17, 2014, letter addressed to the Minister of the Environment:

> *I am writing to you to express Peel Health's concern about aggregate operations and their cumulative impacts on the local airshed.*
>
> *Currently [as of January 2014], there are approximately 1,400 hectares [3,459 acres] of aggregate operations in the area of Caledon Village, either proposed, under development or nearing the end of operations.* ***The local community is increasingly concerned about the health, environmental and social impacts of aggregate operations. As a result, the community has organized and formed a network which is sharing concerns and information with other communities province-wide, and which is seeking the assistance of Peel Public Health****.* [emphasis added]
>
> *Peel Public Health requests both the Ministries of Natural Resources and the Environment to assess and monitor the cumulative impact of multiple aggregate facilities currently operating in Caledon Village and of the new pits that are proposed. Peel Public Health staff would like to meet with you or your staff to discuss this further.*

In a UK inquest into the death of nine-year old Ella Roberta Adoo Kissi-Debrah, the coroner ruled the girl's death to air pollution, with the primary source of exposure due to traffic emissions.[52] "Halton Regional Chair Gary Carr, along with Halton's Mayors, assert the UK ruling provides tangible evidence of the dangers of air pollution and that it underscores the importance of the Federal Government's unconditional statutory mandate to protect public health":

> *For the first time ever, on December, 16, 2020, the London Coroner ruled that a death was caused by air pollution. In particular, the Coroner found air pollution had helped induce and exacerbate asthma, which was largely attributed to exposure to traffic emissions.* ***This landmark finding officially recognizes excessive air pollution (specifically referencing nitrogen dioxide and particulate matter) as a cause of death and will serve as an important case study that can be applied in other jurisdictions, including Canada****.* [emphasis added]
>
> *The Federal Review Panel assessing the proposed CN project in Milton found that the project will have significant adverse effects on human health—the first Panel in the history of Canadian environmental assessments to have made such conclusion. The CN Milton project will add over 1,600 truck trips every day of the year within close proximity to 34,000 current and future residents, one hospital, twelve schools and two long-term care homes.* ***Similar to the London ruling, the Federal Review Panel found that the proposed project will increase the air concentration of three "no threshold" pollutants that are unsafe at any level, including nitrogen dioxide and particulate matter. These project emissions will have direct health effects on Halton residents as the Panel concluded that significant adverse effects from air pollution on human health cannot be mitigated****.* [emphasis added]
>
> *The significant health and environmental effects caused by this project are unavoidable. The Federal Review Panel concluded that, even after taking feasible mitigation into account, the project would cause significant effects on air quality and human health and cumulative effects on air quality, human health, wildlife habitat, and land available for agricultural use.*

[52] https://www.halton.ca/The-Region/News/2021/Landmark-coroner-ruling-on-air-pollution-confirms.

Note: In an April 16, 2021, joint news release, Halton municipalities and Conservation Halton said that they have resumed their Ontario court case from 2018 to ensure that CN complies with laws that protect the health of thousands of residents who live near CN-owned lands in Milton, as well as to protect the environment.[53]

Failure to Apply Setbacks Reciprocally Exposes Owners of Legal Lots of Record to Future Adverse Effects From Aggregate Extraction

The Municipality of Marmora and Lake added subsection 5.35.1 (By-law No. 2014-07) to its Zoning By-law (ZBL) permitting "as-of-right" development of Legal Lots of Record, which is in conflict with the restriction against residential development within a 500-metre Area of Influence (AOI) of lands zoned to permit extractive quarries.

> *Section 5.35 of the ZBL is as follows:*
>
> *s. 5.35 AREAS OF INFLUENCE*
>
> No person shall erect any residential structure in any zone within 500 m (1,640.4 ft.) of lands zoned and licenses MX – Mineral Extractive (quarries) and within 300 metres of lands zoned and licenses *MX – Mineral Extractive (pits) without the approval of the Ministry of Natural Resources upon successful application for a minor variance and provided the residential use of the adjacent lands within the area of influence.*
>
> *No person shall erect any residential structure within the area outlined on the attached schedules as being an Area of Mineral Aggregate Preservation without the approval of the Ministry of Natural Resources upon successful application for a minor variance and provided the residential use is a permitted use on the lands in question.*
>
> ***5.35.1 Legal Lots of Record within Areas of Influence***
>
> *Notwithstanding the provisions of paragraphs 5.35 items i) and ii), and provided that such structure does not contravene any other provisions of this by-law, a residential structure may be erected on a lot approved under the Planning Act and within a Residential Zone, which was held under distinct and separate ownership as shown by a registered conveyance in the records of the Registry or Land Titles Office at the time of the passage of this by-law, provided that such structure shall be setback a minimum of 30 metres (98.4 ft.) from any lands zoned and licensed MX-Mineral Extraction for Extraction and Storage uses, and a minimum of 90 metres (295.3 ft.) from any lands zoned and licensed MX-Mineral Extraction for Open and Closed Pit and Quarry Processing Operations. Such residential structures shall be constructed in accordance with noise and dust attenuation designs or standards.*

As noted by the Ontario Municipal Board (OMB),[54] zoning provision 5.35 would either preclude development of a Legal Lot of Record within the AOI or reduce the AOI if a minor variance were granted by the municipality to permit residential use in the form of a single family dwelling, putting the health and safety of future residents at considerable risk, including damage to their properties:

> *The effect of the proposed ZBA (s. 5.35.1) would be to reduce the area of influence in order to permit residential use for only those lots which had been approved for residential use under the Planning Act ("PA"), and, which were in separate and distinct ownership as a matter of record at the*

[53] Sadewo, Bambang, "Halton taking CN to Ontario court in bid to stop proposed Milton intermodal facility," *The Star*, April 16, 2021, https://www.thestar.com/local-milton/news/2021/04/16/halton-taking-cn-to-ontario-court-in-bid-to-stop-proposed-milton-intermodal-facility.html?li_source=LI&li_medium=star_web_ymbii.

[54] *Danes (Re)*, 2015 CanLII 28467 (ON LPAT), <https://canlii.ca/t/gj5w5>, retrieved on 2021-06-08.

time the Comprehensive ZBL was passed (January 20, 2004). The larger 'Area of Influence' restrictions would continue to apply to any new residential lots to be created.

The municipality identified seven Legal Lots of Record (2.2 to 7.6 acres), created during the 1980s, all of which are zoned for residential purposes and are within 500 metres of an existing licensed aggregate area, putting them in conflict with the AOI.

A former member of Council and the owner of the Kelly pit expressed concerns as to the consequences of permitting the future development of the Legal Lots of Record, and argued against the zoning by-law amendment (s. 5.35.1) before the Ontario Municipal Board:

[10] Bonnie Danes is a former member of the Council of Marmora and Lake. Although she does not reside or own property in the vicinity of a pit or quarry operation, she has concerns about the "drastic decreases in setbacks from quarries/pits to allow new development on lots or record", as is being proposed by the ZBA. In her view, "the change [in setback] is too much".

[11] In the case of the Kelly pit, Ms. Danes is concerned that if the adjacent legal lots of record are allowed to be developed, the future residents of these homes will be exposed to noise and dust impacts. This will result in nuisance complaints and possibly put pressure on the current or future operations of the Kelly pit. She is also concerned about any potential liability to the Municipality that could arise as a result of the reduced setbacks.

[14] Ms. Kelly is concerned about how residential development on the lots in the vicinity of their two licensed pit areas will hinder their current and/or future operations. She told the Board that while there is limited excavation taking place at the current time, they are hopeful that an increased supply demand in the future will lead to an expansion of their pit operations.

[15] In this regard, she contends that once these lots are developed with homes, the future occupants will start launching complaints about aggregate haulage truck traffic and vibration, dust and noise nuisances as well as environmental issues such as well contamination.

According to the OMB, the Provincial Policy Statement (PPS) does not preclude and/or outright prohibit development within "Areas of Influence." Rather, the PPS merely stipulates that new development will only be permitted subject to certain criteria being met:

s. 2.5.2.4 Mineral aggregate operations shall be protected from development and activities that would preclude or hinder their expansion or continued use or which would be incompatible for reasons of public health, public safety or environmental impact. Existing mineral aggregate operations shall be permitted to continue without the need for official plan amendment, rezoning or development permit under the Planning Act. When a license for extraction or operation ceases to exist, policy 2.5.2.5 continues to apply.

2.5.2.5 In known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if:

*c) **issues of public health, public safety and environmental impact are addressed**. [emphasis added]*

The Legal Lot of Record in dispute before the OMB was approved by consent in 1985, and predated the issuance of an MNR (Ministry of Natural Resources) licence for the nearby Kelly pit in 1993.

In dismissing the appeals against By-law No. 2014-07 (s. 5.35.1), based on the uncontested evidence of Mr. Fuhrman, the planner representing the municipality, the OMB decided that,

> *[35] In the current case, there was not tangible scientific evidence before the Board which could be seen to give cause for concern that the public health and/or safety was at risk, or that the environment would be adversely impacted.*

There is no reference to the 2013 Supreme Court of Canada ruling, which upheld the conviction of Castonguay Blasting Co.[55] for failing to notify the Ministry of the Environment of a blast at the Marmora Rock Cut quarry that launched flyrock debris off site, causing damage to private property. The Supreme Court of Canada held that

> *[39]* ***The adverse effects were not trivial. The force of the blast, and the rocks it produced, were so powerful they caused extensive and significant property damage, penetrating the roof of a residence and landing in the kitchen. A vehicle was also seriously damaged. The fly-rock could easily have seriously injured or killed someone****.* [emphasis added]

As this relevant and material information was either intentionally or unintentionally not presented to the Board, and, given that flyrock is an inevitable by-product of blasting rock, an ultrahazardous activity, with flyrock having the potential to damage property and injure or kill someone within 500 metres (or more) from the blast, the Board might have decided differently.

> *[In Castonguay,] [n]o expert witnesses were needed to prove the nature of the contaminant (the rocks were a solid), the adverse effects (damage to property, impairment of the safety of any person), or the cause of the adverse effects (the blast sent the fly rock through the air and the damage was caused by the impact of the rocks hitting the home and vehicle). If it looks like a duck and quacks like a duck, the courts are likely [to] find it's a duck—no expert necessary [p. 474].*[56]

Sensitive receptors include lots with "as-of-right" zoning to permit residential use, and the municipality had a legal duty to protect the development rights of the unimproved lot created in 1985 by imposing a setback requirement on the offending Kelly pit which was not approved until 1993.

According to the Environmental Guidelines of the Victoria State Government,[57] when there is a "Surrounding land use change," involving legally approved housing or other sensitive sites near an operational mine or quarry, it is the owner of the mine or quarry who must change its blasting practice and provide the necessary setbacks to safeguard the environment and the public, as described in Section 4.2:

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[55] *Castonguay Blasting Ltd. v. Ontario (Environment)*, 2013 SCC 52 (CanLII), [2013] 3 SCR 323, <https://canlii.ca/t/g1038>, retrieved on 2021-07-22.

[56] Ingleson, A., "Environment in the Courtroom," *University of Calgary*, 2019-01, https://prism.ucalgary.ca/bitstream/handle/1880/109483/9781552389867_chapter34.pdf?sequence=36&isAllowed=y.

[57] "Ground vibrations and airblast limits for mines and quarries," *Victoria State Government*, https://earthresources.vic.gov.au/legislation-and-regulations/guidelines-and-codes-of-practice/ground-vibration-and-airblast-limits.

> ***In cases where the separation distance is reduced as new sensitive sites are developed closer to an existing mine or quarry, the existing vibration and airblast criteria will be applied to the new properties***.
>
> ***This means that the encroachment of legally approved housing or other sensitive sites will impose restrictions on operating mines and quarries. Mining and quarrying operators should therefore ensure that they are aware of proposed new development***. [emphasis added]

Therefore, it behooves a proponent of an application for a new or expanded quarry to identify all existing legal "as-of-right" development lots when taking into account applicable separation distance requirements.

Complaints of Cracking Concrete, Silica Dust and Inaccurate Monitoring of Ground Vibrations at Blasting Quarry Ignored

Blasting operations at a quarry in Brisbane operated by Mount Coot-tha have come under fire from local residents[58]

> *Electrical engineer Phil Best, chairman of the Mount Coot-tha Local Residents action group, has spent years investigating the effects he believes the nearby Brisbane City Council-owned quarry is having on his house.*
>
> *"We have had blasts that have shaken the house for 30 seconds," Mr Best said.*
>
> *"How can you sleep when you know this is happening to your home, concrete slabs cracking - some had more than 100 cracks in their house - stuff like that?*
>
> *"This is very serious stuff and we don't have the money for a lawyer or the energy to go down that road."*
>
> *Greens MP Michael Berkman, whose Maiwar electorate includes the western Brisbane suburb, is calling on Environment and Science Minister Leeanne Enoch to direct her department to investigate the residents' concerns.*
>
> *"It is my view that the residents have raised significant and legitimate concerns with the way blasting is done at Mount Coot-tha and vibrations are monitored," he said….*
>
> *The council insisted the quarry conducted "a maximum of two blasts per month, with each blast lasting less than 0.6 of a second."*
>
> *Residents concerned with the quarry's operating parameters have made a host of complaints to both the council and the Department of Environment and Science responsible for its monitoring.*
>
> *"On every 10th blast the quarry is permitted to go as strong as they like, which is despicable," said Mr Best.*
>
> *"We had to start monitoring near the house because one of the glass panels exploded (on the balcony) after a blast.*
>
> *In October 2018, residents submitted a major complaint to the department claiming vibration data had been misrepresented due to the location of sensors away from homes and the use of shock-absorbing material.*
>
> *"A measuring device on top of shock absorbing material won't give you an accurate reading of what is actually happening on the ground," civil and structural engineer Roy Saint said.*

[58] Walker, Sabrina. "Mount Coot-tha residents fighting quarry over house and health concerns," *brisbane times*, June 30, 2019, https://www.brisbanetimes.com.au/national/queensland/mount-coot-tha-residents-fighting-quarry-over-house-and-health-concerns-20190614-p51xxl.html.

*"**What we noticed is some of the readings done were done with probes in soft material and it was felt the opportunity was taken by the operators of the quarry to blind the results**."*

Applied statistician Clancy Birrell, who on a pro-bono basis investigated blasting data from January 2001 to March 2017, obtained through a right to information request, found differences in vibrations outside BCC monitoring locations versus inside homes.

He found the amplification felt in homes was about 2.5 times higher than the BCC locations.

Mr Best was furious when the department refused to act on the concerns beyond recommending the council lower blasting limits below legal compliance, which the council declined to do.

***"We had proven data corruption and it wasn't our data it's BCC data, but they didn't investigate data prior to 2016," Mr Best said**.*

*"**Major accusations contained in complaint regarding misrepresentation of blast vibrations remain ignored and totally unanswered**."* [emphasis added]

A DES spokesperson said the concerns had been fully investigated and the department did not intend to take any further action.

A council spokesperson said blasts were monitored by an independent blasting expert for compliance at multiple locations including residential property boundaries.

Mr Best has taken his complaint to the Ombudsman for review.

"The local people are suffering, we want to live without fear of our house being shaken to pieces," he said.

Students Injured and Structures Damaged by Blasting (Vibrations and Airblast) at Nearby Quarry

On December 18, 2020, blasting at a quarry in Mabuye, Mpigi district, Uganda damaged many structures and left 13 school children unconscious and hospitalized, three in critical condition.[59]

Kaki Developers, a mining company with a quarry in Mabuye, Mpigi district, has agreed to compensate victims that were affected by stone blasting last Friday [Dec 18, 2020].

***The incident left at least 13 school children unconscious and hospitalised and many structures damaged**.* [emphasis added]

Herbert Lubega, the director of the company, said they are ready to compensate all residents who were affected during stone blasting activities the company has been carrying out in the quarry

"We apologise to the community for the inconveniences and damages to their property and life. We will also meet medical bills for the students who were hospitalised as a result of stone blasting," he said…

Yusuf Lusiba, the director of Lumuza High School, said the stone blasting left at least 13 female students hospitalised, after suffering from shock….

The incident took place at around 2:30pm, hours after the local village leaders had put announcements on a local radio station warning the residents near the quarry to move at least 4km away from the quarry.

[59] Ssekidde, Simon. "Students affected by stone blasting to be compensated," *NewVision*, Dec 20, 2020, https://www.newvision.co.ug/news/1535767/students-affected-stone-blasting-compensated.

The stone quarry is located a few metres away from the school….

The school director of studies, Muzafaru Wamala, said they had to rush the affected students to Rubaga Hospital, St Monica Health Centre and Mpigi Health Centre IV.

***"Immediately they started stone blasting, female students lost their consciousness and started falling down one by one. Three students were referred to Rubaga Hospital in critical condition**," Wamala said.* [emphasis added]

Some of the affected students were identified as Priscilla Namutebi, Senior Four, Edith Nambi, Senior Six, Hasifah Nangoobi, Senior Six and Joan Nansamba of Senior Four….

Edith Nambi, a Senior Four student who was rushed to St Monica Health Centre, said she woke up only to find herself in hospital….

John Kayanja, a resident of Mabuye village, said his house has developed cracks and his only cow also died following the stone blasting.

***Lawrence Sseruwagi, the Luvumbula village chairperson, said he had received many reports of residents whose houses either developed cracks or got damaged as a result of stone blasting**….*

Dangers Due to Blasting Projectiles (Flyrock)

According to a January 31, 2003 Technical Circular (Cir. No. 2 of 2003) issued by Director-General Mine Safety (DGMS), India, projectiles (flyrock) are a major source of accidents in below ground and opencast mining:[60]

Enquiry into…[an] accident revealed that in an open cast coal mine, overburden had been kept dumped against the free face of OB bench, 12 No. first row of holes were left uncharged because of spontaneous heating in the seam below, 17 holes of 150mm 6.5m Depth drilled in 7m x 5m Pattern (spacing & burden) charged with 75 kg/hole and 42 holes of 6.5m depth 250mm dia drilled in 6m x 6m pattern charged with 130 kg/hole were blasted.

***The projectiles [flyrock] ejected due to blasting travelled for a distance of about 412m in the reverse direction away from the free face and hit a mechanical supervisor**. The enquiry further revealed that the deceased had taken proper shelter in a blasting shelter but had come out of the shelter immediately on hearing to the sound of blast and was subsequently hit by the projectiles. [emphasis added]*

In the interest of safety, the DGMS recommended that the danger zone be increased from 300 metres to 500 metres, with onsite quarry personnel taking cover in substantially built shelter during blasting.

(1) In the interest of safety to treat all the places within a radius of 500m of the place of firing as the danger zone, all persons who are required to remain within the danger zone at the time of blasting should take protection in substantially built shelter.

[60] https://elibrarywcl.files.wordpress.com/2015/02/dgms-cir_02_03-blasting-projectiles.pdf

Benefits of Mandatory Minimum Setbacks Applied to Blasting Quarry Operations

Appropriate mandatory minimum setbacks imposed on new and expanding blasting quarry applications, provincially and municipally, protect onsite quarry equipment and employees, and eliminate the potential for damage to private third-party personal and real property from vibration, airblast and flyrock, and prevent

- destabilization of existing Settlement Areas
- road traffic accidents associated with the truck hauling of aggregate
- the release of fugitive dust (must be mitigated onsite)[61]
- soil erosion, subsidence and sinkholes (offsite)
- adversely affecting the quantity and quality of private third-party wells (e.g. residences, farms, businesses)
- adversely affecting the health and safety of human and non-human life
- adversely affecting the quality of human and non-human life
- adversely affecting the sustainability of agricultural lands (e.g., specialty crops, organic farming)
- adversely affecting the natural environment (i.e., air, land and water – Ontario EPA)
- diminishing the use and enjoyment of public property (e.g., parks, campgrounds, trails, roads/highways)
- adversely affecting the use and enjoyment of private third-party real property (e.g., residences, farms, businesses)
- adversely affecting the value of private third-party real property (e.g., residences, farms, businesses)
- adversely affecting a growing 24-hour stay-at-home live and work economy occasioned by the coronavirus (COVID-19)
- <u>complaints and lawsuits (e.g., trespass, nuisance, emotional distress) from nearby homeowners, farmers and business owners, which would only increase as more people are forced or choose to work from home</u>

Setbacks are a quintessential planning function, and to paraphrase Eloranta,[62] past president of the International Society of Explosives Engineers (ISEE), when it comes to blasting quarry operations, there are only two choices:

> ***Don't blast in a location that threatens public safety or adopt the safety measures required [i.e., impose adequate setbacks on the quarry operation]****…*

[61] "3.0 Prescribed Conditions that Apply to Category 2 [Aggregate] Licences,"

[62] Fischenich, Mark. "Expert: Flyrock from any blast 'unacceptable,' *The Free Press*, Oct 21, 2017, https://www.mankatofreepress.com/news/local_news/expert-flyrock-from-any-blast-unacceptable/article_8ad31cf8-b5cf-11e7-bf58-c3cdd328cf7f.html.

Preventing the Potentially Deadly Consequences of Flyrock: Mandatory Minimum Setbacks Required (Revised 31-Oct-2021)

Tony Sevelka, AACI, P.App, MAI, AI-GRS, SREA, FRICS (Contact: info@intval.com)

Flyrock is an ever-present danger wherever blasting occurs, and, therefore, *flyrock* must be dealt with proactively and explicitly by the municipal/regional planning authorities as part of an application to permit a blasting quarry operation.

> ***"Flyrock…needs to be considered before…[an accident] happens [p. 13]," an approach which is consistent with the precautionary principle.***[1]

> ***Flyrock is one of the most contentious issues in bench blasting. Unlike ground vibrations, flyrock has the propensity to cause fatality and severe injuries. Although the kinematic equations present a basis for the estimation of flyrock distance, these suffer from the drawback of ignoring the post-release effects of trajectory motion in air. Predictive models that are based on such equations not only suffer from this anomaly, but also fail in flyrock distance prediction due to the gross approximations of initial velocity calculations and shape of the fragments*** (Raina et al., 2015)***.***[2]

Flyrock is characterized as follows:

> *'Flyrock' is defined as 'blasted material cast into the air, or traveling along the ground, that is cast from the blasting site more than half the distance to the nearest dwelling, public building, school, church, commercial, community or institutional building; or any occupied structure; or is cast beyond the permit boundary [p. 1].*[3]

> ***Flyrock events historically have not been limited to blasting operations within the distances which require the submission and approval of an 'anticipated blast design'…prior to blasting. Rather, flyrock events occurred and impacted dwellings, vehicles, persons, animal life, and other physical structures thousands of feet from the blast site resulting in death and the destruction of property [p. 1].*** [emphasis added]

> *…[F]lyrock in blasting operations has a major impact on the external environment…due to the hazards involved and is more significant than vibrations and airblast….[E]ven if it is normal practice in these zones to take into account the impact of possible vibrations and even the effects of airblast when modeling the project, flyrock risks are not dealt with in initial studies, other than by way of integrating general safety distances. These risks are only sometimes taken into account much later in the operation and most often, following an accident or significant flyrock being recorded externally [offsite] [p.549].*[4]

> *Flyrock can be as large as a car. It is propelled with great force. Flyrock may come from high in the air, roll down a hillside, or come straight at you like a bullet. That is why the blaster places guards at*

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1 Jackson, Brett Christopher, "Total Cost Optimization For Contour Blasting In The Appalachia Region," (2015). *Theses and Dissertations-Mining Engineering. 20*. https://uknowledge.uky.edu/mng_etds/20.

2 Avtar K. Raina, V.M.S.R. Murthy and Abhay K. Soni, "Flyrock in surface mine blasting: understanding the basics to develop a predictive regime,", *Current Science,* Vol. 108, No. 4, 25 February 2015: 660-665, https://www.currentscience.ac.in/Volumes/108/04/0660.pdf.

3 "Reclamation Advisory Memorandum," https://eec.ky.gov/Natural-Resources/Mining/Mine-Permits/RAMS/RAM140.pdf. "During calendar year 2007, the Commonwealth of Kentucky had a [known] total of thirteen (13) flyrock events on surface coal mining sites, including one (1) that resulted in a fatality. To date [July 18] there have been nine (9) [known] flyrock events, including one (1) that resulted in a minor injury that very easily could have resulted in a fatality."

4 A. Blanchier, "Quantification of the levels of risk of flyrock," Rock Fragmentation by Blasting: The 10th International Symposium on Rock Fragmentation by Blasting, 2012 (Fragblast 10); Leiden: 549-553.

entry roads around the area where rocks might fly—to keep people out and protect workers from death and injury. Yet people have still been killed inside [and outside] the blast area [p. 7].[5]

Pearson et al. [1994] referenced flyrock weighing approximately three tons [6,000 pounds] thrown to a distance of 980 ft [299 metres].[6] [emphasis added]

Flyrock [from surface mining blasting operations] contributes about 68% of total injuries worldwide.[7] [emphasis added]

The designated blast zone or blast area is confined within the boundary of a quarry operation, and all of the *adverse effects* associated with blasting must remain or be contained on site:

"designated blast area" includes the danger area, which is the zone in which there exists a possibility of hazard to a person or property from flyrock, fume, air blast or ground vibrations, and is the area where the blaster has made arrangements to evacuate all persons whose safety might be threatened by the blasting operation. (Province of Newfoundland and Labrador, Department of Natural Resources, https://www.gov.nl.ca/iet/files/Quarry-Permit-Standard-Terms-Conditions.pdf)

- Proponent-driven Blasting Impact Assessments (BIAs) prepared in Ontario do not address *flyrock* in the hypothetical estimation of the designated blast area, as the BIA is prepared solely for the benefit of the proponent, and is strictly confined to a superficial (generic) analysis of airblast and ground vibration under static environmental conditions, above and below ground. (The proponent has no legal right of trespass to conduct or commission any investigations, whatsoever, over privately owned third-party real property.)

- A hypothetically determined blast area makes no provision for *safety factors* to protect onsite equipment from damage (safety factor of 2), and quarry employees from injury or death (safety factor of 4), and ignores entirely land use incompatibility of adjoining public and private third-party real property, and the deleterious effects and potentially deadly consequences of blasting on those who live, work, play (e.g., golf, ski, fish, hike, cycle) or drive/walk in the surrounding area.

"*Flyrock* is an integral part of blasting. However, *flyrock* that is projected past a defined safety [blast] zone is not acceptable:

It is well known that rock and/or debris can be thrown over a kilometer [1,000 metres] from the blast site, and in a recent case rocks travelled approximately 1.3 kilometres [1,300 metres] (Explosives information bulletin no. 69 I 27 February 2009 I Version 1)[8] [emphasis added]

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[5] "Tool Box Lesson A – What is Flyrock?" NIOSH, https://www.cfins.com/wp-content/uploads/2019/01/blasting-safety-toolbox-complete.pdf.

[6] T. S. Bajpayee, Harry C. Verakis and Thomas E. Lobb, "An Analysis and Prevention of Flyrock Accidents in Surface Blasting Operations," https://www.cdc.gov/niosh/mining/UserFiles/works/pdfs/apfasbo.pdf.

[7] Nirlipta P. Nayak, Abhinav Jain and Saubhagya Ranjan Mahapatra, "Application of Mine Excellence software in flyrock prediction & mitigation," *Materials Today*, © 2021, Application of Mine Excellence software in flyrock prediction & mitigation - ScienceDirect.

[8] https://www.rshq.qld.gov.au/safety-notices/explosives/flyrock-incidents2.

As reported in the 2014 issue of the *Journal of Rock Mechanics and Geotechnical Engineering*, *flyrock* is an inevitable consequence of blasting rock and can never be entirely eliminated:

> *Due to the explosive force, rock fragments are propelled and thrust high into the air and beyond the safety limit of [the] blast area, thus termed as "flyrock". This is mainly due to the flaws presented in the blast design and also due to the misinterpretation of rock mass behavior. The phenomena of flyrock are always uncontrolled and can never be brought down to zero [p. 26].*[9] [Flyrock launched beyond the designated blast area is sometimes referred to as "wild flyrock."]

According to the Mine Health and Safety Council (MHSC) of South Africa, *flyrock* is the ultimate *adverse effect*, and must be avoided at all costs:

> ***Human response to flyrock is generally extreme. Apart from any consideration of damage, it is the only blasting-related hazard that can cause serious injury and death. It is the ultimate adverse effect of blasting and must be avoided at all costs.***[10] [Milestone 4, p. 31] [emphasis added]

As *flyrock* is an inevitable and uncontrollable by-product of quarry blasting,[11] and is not to leave the site, according to the Ontario Aggregate Resources Act (ARA), mandatory minimum setbacks are the only known remedy that can effectively eliminate *flyrock* from being launched off-site.

> On January 1, 2022, a licensee and permittee shall take all reasonable measures to prevent fly rock from leaving the site during blasting if a sensitive receptor [often code for human target] is located within 500 metres of the boundary of the site. (O. Reg. 466/20, s. 2(2))

An appeal before the Supreme Court of Yukon (2012)[12] involved two *flyrock* incidents, where *flyrock* debris caused damage to a number of houses in the Lobird subdivision as far as 350 metres from the blast site, and penetrated the roof of one house, landing in the living room (Flyrock 120 – Nov 1, 2007 and May 6, 2008).[13] The expert blaster that testified on behalf of the Director of Occupational Health and Safety made the startling comment:

> ***Had it not been for the fly rock incident,…he would have considered the blast a success [para. 23].***

This is akin to saying "The operation was a success, but the patient died!"

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[9] https://intval.com/articles/Flyrock-and-Other-Impacts-from-Quarry-Blasting-Operations.pdf.
[10] https://mhsc.org.za/sites/default/files/public/research_documents/SIM140901%20Final%20Report.pdf.
[11] "There was…evidence that 'the fly rock' is uncontrollable and results in making unavailable a large area of the petitioner's land by its inability to conduct blasting operations within 800 feet [244 metres] of the new turnpike, para. 435]," *Lee Lime Corp. v. Massachusetts Turnpike Authority*, 337 Mass. 433 (1958) 149 NE 2d 905, https://scholar.google.ca/scholar_case?case=8453729559483718978&q=flyrock&hl=en&as_sdt=2006.
[12] *Director of Occupational Health and Safety v. Government of Yukon, William R. Cratty and P.S. Sidhu Trucking Ltd.*, 2012 YKSC 47 (CanLII), <https://canlii.ca/t/fs6vt>, retrieved on 2021-10-23
[13] Waddell, Stephanie. "Blasting charges made public; Lang declines all discussion," *Whitehorse Daily Star*, May 8, 2009, https://www.whitehorsestar.com/News/blasting-charges-made-public-lang-declines-all-discussion.

Minimum Clearance Distance as Safety Zone Against Flyrock Based on Recorded Flyrock Distances and Experimental/Theoretical Estimation

According to GEO REPORT No. 260, Halcrow China Limited, 2002,[14] separation distance (setbacks) is the only totally effective safety measure against *flyrock*:

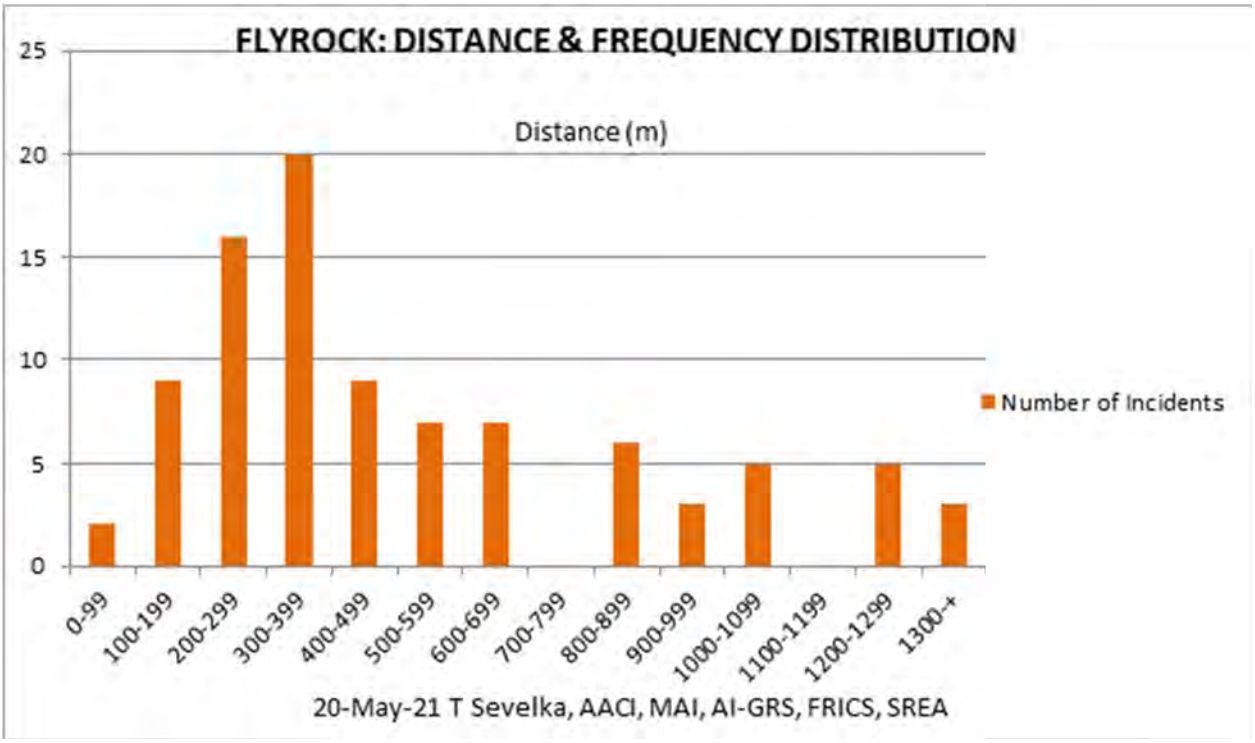
> *The only totally effective safety measure [against flyrock] is a minimum clearance distance, acting as a safety zone. In order to determine the required minimum clearance distance, it is necessary to ascertain the 'flying distance', (the distance to which flyrock may be thrown).* ***The available [flyrock] data is of two types: reported instances and experimental/theoretical estimation****. [emphasis added]*
>
> - **Recorded instances**. The data on recorded flyrock projection is based on published HSE and Mines & Quarries Division of GEO data. Both indicate significant numbers of rocks passing beyond 200 m. Very few (4 out of 80, or 5%) travelled beyond 300 m. Only one exceeded 450 m, and this travelled to 800 m. **It should be noted that these numbers are the minimum number that occurred, being those that were reported. Numerous incidents at shorter ranges (up to 500 m) may not have travelled outside the quarry boundary or may not have caused injury and therefore were not treated as reportable incidents. In the UK, under-reporting by factors of 5 to 10 are considered possible below 500 m (Davis, 1995)**.
> - [In the United Kingdom, over a five-year period, 85 flyrock incidents had been reported and documented: 25 incidents (29%) were between 200 and 300 metres; 15 incidents (17%) were between 300 and 500 metres; 5 incidents (6%) were between 500 and 700 metres; and only one incident (1%) exceeded 700 metres. Overall, 95% of the analyzed flyrock incidents occurred within 600 metres. p. 26[15]]
> - **Experimental data**. Research on flyrock was undertaken by the Swedish Detonic Research Foundation (Lundborg et al., 1975). It was summarized in more accessible form by Hoek & Bray (1981) in their textbook "Rock Slope Engineering". It has been established that maximum 'flying distance' is about 540 m for a 200 m diameter (about 15 kg) block. For fragments of 75 to 100 mm size (about 2.5 kg) the maximum range is 410 to 470 m.
>
> **From the foregoing, it is apparent that the only absolute guarantee for safety from flyrock is a large minimum clearance distance, the size of which depends on the blasthole diameter in use. The Safety Zone would need to extend 400 to 600 m from the blast**. [emphasis added] [pp. 182-83]

A more recent study of discovered *flyrock* incidents undertaken by Sevelka (2021), where the *flyrock* distances are known, resulted in an analysis of 92 *flyrock* incidents. The results of the *flyrock* study, the most comprehensive and largest known of its kind, are as follows:

[14] This report was prepared by Halcrow China Limited in August 2002 under Consultancy Agreement No. GEO 10/98 for the sole and specific use of the Government of the Hong Kong Special Administrative Region, https://www.cedd.gov.hk/filemanager/eng/content_475/er260links.pdf.

[15] https://intval.com/articles/Flyrock-and-Other-Impacts-from-Quarry-Blasting-Operations.pdf.

Analysis of Flyrock Travel Distances



An analysis of 92 *flyrock* incidents, where the distance from the blast is known, indicate that 91% (84) of the *flyrock* incidents occurred within 1,099 metres, and 97% occurred within 1,299 metres.

The number of *flyrock* incidents within each interval, starting at between 300 and 399 metres, and the average distance travelled within each interval are summarized as follows:

- 20 (22%) of the flyrock incidents occurred between 300 and 399 metres (330 metres avg)
- 9 (10%) of the flyrock incidents occurred between 400 and 499 metres.(446 metres avg)
- 7 (8%) of the flyrock incidents occurred between 500 and 599 metres (515 metres avg)
- 7 (8%) of the flyrock incidents occurred between 600 and 699 metres (622 metres avg)
- 6 (7%) of the flyrock incidents occurred between 800 and 899 metres (802 metres avg)
- 5 (5%) of the flyrock incidents occurred between 1200 and 1299 metres (1225 metres avg)
- 3 (3%) of the flyrock incidents occurred over 1300 metres (2307 metres average)

At 80%, which accounts for the first 74 *flyrock* incidents in ascending order, *flyrock* reached a distance of 800 metres, and, at 90%, which accounts for the first 83 *flyrock* incidents in ascending order, *flyrock* reached a distance of 1,020 metres.

On the basis of the most recent study of *flyrock* incidents (Sevelka, 2021), the designated blast area would have to be approximately 1,200 metres to effectively prevent *flyrock* from leaving the boundaries of a blasting quarry site, equivalent to a 1,200-metre setback.

Examples of Flyrock's Deadly Consequences For Sensitive Receptors (i.e., Human Targets)

Listed below is a sample of *flyrock* incidents at different blasting quarries in various geographic locations, which have killed onsite quarry employees, offsite residents while in or outside their homes, off-site employees and customers in places of business, children in schools, pedestrians while walking near quarries, and occupants in vehicles on roads near quarries.

- **Flyrock 6:** On March 22, 2016, a blast at a quarry launched *flyrock* debris 366 metres that penetrated a pickup truck striking and killing 42-year old Tracy Hockemeier, a quarry employee positioned 366 metres from the blast and preventing others from entering the blast area.
- **Flyrock 12:** On July 19, 2013, a blast at a quarry showered *flyrock* debris as far as 1,000 metres that damaged 18 cars and 14 factories; injured 10 workers and residents in a housing estate; and struck and killed a factory worker in his 30s in a factory penetrated by numerous rocks at a distance of 500 metres.
- **Flyrock 34:** On June 4, 1993, a blast at a surface mine launched a large amount of *flyrock* debris approximately 91 metres that struck a car on Interstate 75, Tennessee, and 16-year old Brian Agujar, a passenger in the car driven by his parents, was killed as a result of the *flyrock* impact. The blaster was sent to prison for five months. (Prior *flyrock* incident occurred in April 1992.)[16]
- **Flyrock 36:** On July 11, 1990, a blast at a quarry launched *flyrock* debris 283 metres that struck a resident who was mowing grass on his property, who later died on July 17, 1990 from head injuries.
- **Flyrock 38:** On April 5, 2017, a blast at a quarry launched *flyrock* debris 280 metres that struck and killed the blaster's helper.
- **Flyrock 40:** On December, 21, 1999, a blast at a quarry launched *flyrock* debris that struck 32-year old Lee Messner, a quarry equipment operator, at 244 metres, who subsequently died from his internal injuries, with *flyrock* debris also damaging a building at 457 metres from the blast. Messner left behind a wife and one child. (Prior *flyrock* incident occurred in 1996.)[17]
- **Flyrock 41:** On August 15, 2019, a blast at a quarry launched *flyrock* debris, some of which bore through the roof of a home and struck and killed 36-year old Shupikai Chitsana while in her kitchen, and her aunt was also struck by *flyrock*, but she survived. Shupikai leaves behind her five children and husband.

[16] Courtney W. Shea and Dennis Clark, "Avoiding Tragedy: Lessons To Be Learned From A Flyrock Fatality," © 2020, *International Society of Explosives Engineers*, https://www.osmre.gov/resources/blasting/docs/Flyrock/1993SugarRidgeFatality.pdf.
[17] MSHA - Metal and Nonmetal Mine Fatal Accident Investigation Report: 12/21/1999.

- **Flyrock 48:** On July 15, 2015, a blast at a quarry launched *flyrock* debris 200 metres that struck and killed a factory worker, and seriously injured two others. *Flyrock* debris also struck a building at 50 metres, and damaged and destroyed several vehicles 150 metres from the blast site.
- **Flyrock 68:** May 27, 2020, a blast at a quarry launched *flyrock* debris that struck and killed 10-year old M. Nanhini, and that struck and injured her brother Soundarrajan.
- **Flyrock 74:** On July 16, 2007, *flyrock* fragments from a quarry blast were launched 483 metres and struck and killed 40-year old Bobby Messer, a quarry mechanic, and damaged the mechanic's truck. Messer is survived by his wife and three children.
- **Flyrock 86:** On December 4, 2013, a blast at a quarry launched *flyrock* debris, including a 96-pound boulder that struck and killed 63-year old Stephen Hetzler, an experienced blaster, standing 47 metres from the blast. Investigators determined the *flyrock* was travelling approximately 400 miles per hour (644 kilometres per hour).
- **Flyrock 94:** On December 13, 2017, a blast at a quarry showered *flyrock* debris over an area of 800 metres, striking and killing 71-year old Ronald Sutherland (an experienced blaster), injuring five people, wrecking 10 vehicles, significantly damaging 14 houses and causing minor damage to 20 other houses.
- **Flyrock 100:** One July 16, 1997, a blast at a quarry launched one employee, Skip Sibley, over a quarry ledge, leaving him seriously injured with face and chest burns, and another employee, Joel Kanute, had his body impaled by *flyrock* debris, killing him instantly. Both were experienced blasters.
- **Flyrock 103:** In 2015, a blast at a quarry launched *flyrock* debris that struck and killed a baby on her mother's back, and "the child was ripped in half" by the force of the impact from the flying rock. The baby's mother and a motor rider were also struck by *flyrock* and sustained injuries.[18]
- **Flyrock 104:** On April 12, 2007, a blast at a quarry launched *flyrock* debris 300 metres that struck and killed a 12-year old boy standing in his courtyard.
- **Flyrock 114:** On February 28, 2021, a blast at a quarry in Senemal village of Lakhanpur Block, launched *flyrock* debris that struck 36-year-old Harekrishna Bhoi, a supervisor at the quarry. Bhoi died after being struck on the head by *flyrock* debris.[19]

[18] "Joma residents protest as CP's quarry operations kills baby," *3News*, August 15, 2015, Joma residents protest as CP's quarry operations kills baby | 3NEWS.

[19] "1 killed in Jharsuguda quarry blast," *the pioneer*, March 3, 2021, https://www.dailypioneer.com/2021/state-editions/1-killed-in-jharsuguda-quarry-blast.html.

- **Flyrock 121:** On September 19, 2011, a blast at a quarry near Perne in India, launched *flyrock* debris that struck 18-year-old Balu Namdeo Kolpe, a sheppard who was tending his sheep. Kolpe was struck in the head and "died on the spot."[20]

- **Flyrock 153:** On November 19, 2017, a blast at a quarry in Katombola, Southern Province, launched *flyrock* debris 50 metres that struck and killed an 11-year old boy on the spot (ripping his stomach, cutting his head and breaking his ribs) and seriously injured three other children, aged four and seven.[21]
- **Flyrock 154:** On May 29, 2021, a blast at a quarry in Chittoor, launched *flyrock* debris 500 metres that struck and killed 25-year-old Jakir, a daily wager who had just completed loading mangoes into a trailer at a mango orchard abutting the quarry.[22]
- **Flyrock 155:** Sometime in the early 1990s, a blast at a quarry in Coboconk, Ontario, launched *flyrock* debris that penetrated the roof of a man's home, striking and killing the homeowner. A Coroner's Inquest followed. (Source: Retired Legal Counsel. This is the same *flyrock* incident cryptically alluded to during the MOE investigation of the two *flyrock* incidents at the Pakenham Quarry in 2009.)

- **Flyrock 158:** On February 6, 2000, a blast at the Makkah Quarry, Saudi Arabia, launched *flyrock* debris that showered a nearby shopping district, killing an Egyptian passer-by and injuring five others.[23]

- **Flyrock 159:** On June 21, 2021, a blast at a quarry in Thrissur, India, launched *flyrock* debris that struck and killed Abdul Naushad, the brother of the quarry owner, injured five others, and damaged several houses.[24]

- **Flyrock 160:** On March 14, 2018, a blast at a quarry in Kiyuni Sub County launched *flyrock* debris that penetrated a public school at a distance beyond 250 metres, and struck Sylvia Gwoliranye, a 14-year-old pupil at the school. Sylvia was struck in the head by the *flyrock* while seated in class, and eventually died after losing a lot of blood.[25]

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[20] "Stone from quarry blast kills 18-year old," *The Times of India*, Sept 21, 2011, https://timesofindia.indiatimes.com/city/pune/stone-from-quarry-blast-kills-18-year-old/articleshow/10058714.cms.

[21] Funga, Mukosha. "Quarry flying stone kills nearby juvenile," *News Diggers*, November 20, 2017, https://diggers.news/local/2017/11/20/quarry-flying-stone-kills-nearby-juvenile/.

[22] Pradesh, Andhra. "One killed in quarry blast in Chittoor," *The Hindu*, May 29, 2021, One killed in quarry blast in Chittoor - The Hindu.

[23] "One Killed, Five Injured in Makkah Quarry Blast," *Kuwait News Agency (KUNA)*, 06/02/2000, https://www.kuna.net.kw/ArticlePrintPage.aspx?id=1058118&language=en.

[24] "One killed, five injured in quarry blast in Thrissur," *Kaumudi Online*, 21 June, 2021, https://keralakaumudi.com/en/news/news.php?id=576544&u=.

[25] "Stone from quarry hits, kills pupil inside class," *Daily Monitor*, March 15, 2018, https://www.monitor.co.ug/uganda/news/national/stone-from-quarry-hits-kills-pupil-inside-class-1745402.

- **Flyrock 161:** On September 4, 2020, a blast at a construction site at Gochas in the Hardap region launched *flyrock* debris that struck 50-year-old Anna Ida Jaars in the head, killing her while sitting outside a house, at a distance of 700 metres from the bast site.[26]

- **Flyrock 162:** On March 27, 2020, a blast at KTH Quarry in Kampong Speu Province launched a 5 kg rock that penetrated the roof of an onsite office, more than 70 metres from the blast site, and struck 20-year-old Chhoeun Sopheak, a company administrator, who succumbed to his injuries while being transported to a hospital.[27]

- **Flyrock 163:** On May 27, 2016, a blast at a stone quarry at Gaurhari village of Mahoba district, launched *flyrock* debris that showered and killed four quarry labourers, and critically injured one.[28]

As noted, of the 163 discovered *flyrock* incidents, 26 incidents of *flyrock* ended in loss of life (29 people were killed), resulting in a "kill" rate of 16%. An additional 36 people were injured in the 26 *flyrock* incidents that resulted in loss of life.

[26] Cloete, Luqman. "Family wants redress after flying rock kills woman," *namibian*, Sept 9, 2020, https://www.namibian.com.na/204296/archive-read/Family-wants-redress-after-flying-rock-kills-woman.
[27] "Office Worker Killed After Quarry Blast," *Cambodia News English*, March 28, 2020, https://cne.wtf/2020/03/28/office-worker-killed-after-quarry-blast/.
[28] Xinhua. "Blast inside stone quarry kills 4 in India," *The Citizen*, May 27, 2016, https://www.citizen.co.za/news/news-world/1135041/blast-inside-stone-quarry-kills-4-in-india/.

Setbacks in Land Use Planning and Their Function

In land use planning, a setback is the minimum distance which a building or other structure must be setback from a street, road or highway, a river or other stream, a shore or flood plain, or any other place deemed to need protection. Other things such as fences, landscaping, septic tanks, and various potential hazards (e.g., blasting quarry operations) or nuisances (e.g., noise, odour) are regulated and prohibited by minimum setbacks for reasons of public policy (e.g., health, safety, welfare, privacy and environmental protection).

Setbacks are important in preventing (or containing onsite) the *adverse effects* (Provincial Policy Statement 2020, p. 139) associated with blasting quarry operations:

a) impairment of the quality of the natural environment for any use that can be made of it;
b) injury or damage to property or plant or animal life;
c) harm or material discomfort to any person;
d) an adverse effect on the health of any person;
e) impairment of the safety of any person;
f) rendering any property or plant or animal life unfit for human use;
g) loss of enjoyment of normal use of property; and
h) interference with normal conduct of business.

Flyrock debris is known to have the potential to cause all of the above-noted *adverse effects*, and *flyrock* launched offsite onto privately-owned third-party property constitutes actionable "trespass."

The *working-from-home* and *home-based* economy spawned by the COVID-19 pandemic means that more residents and occupants of home-based businesses[29] in communites surrounding existing or new blasting quarry operations will be subjected to the potential *adverse effects* of *flyrock* on an on-going and uninterrupted basis.

> *The COVID-19 pandemic has changed the work location of thousands of Canadian workers. From April 2020 to June 2021, 30% of employees aged 15 to 64 who worked during the Labour Force Survey (LFS) reference week had performed most of their hours from home. In contrast, about 4% of employees did so in 2016.*
>
> *Of all Ontario workers—employees and self-employed—aged 15 to 64 who were working during the LFS reference week, 37% worked from home from April 2020 to June 2021.* [30]

According to the *Cessnock Development Control Plan* (2010) for the Cessnock City Local Government Area (LGA),[31] policies addressing *encroaching development* and *separation distances* have been implemented to eliminate or avoid land use conflicts.

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[29] For example, the Town of Caledon restricts *home occupation* to "no more than 25% of the *dwelling unit* area" and "permits one additional employee." "Home Occupation means an occupation or business which is conducted entirely within a *dwelling unit* and which is clearly subordinate or incidental to the principal use of the dwelling unit for residential purposes." (Section 3-17, revised October 23, 2019)

[30] "Working from home: a new experiment for many Canadian workers." 2021-08-04, https://www150.statcan.gc.ca/n1/daily-quotidien/210804/dq210804b-eng.htm.

Where an application is received which is likely to result in a conflict with existing or likely future adjoining land uses, it will be the responsibility of the 'encroaching development' to provide the recommended buffer areas or satisfactorily reduce or remove the conflict through some other approved method. [emphasis added]

It will be generally required that where a physical separation is required it will be located on land in the ownership or control of the owner or operator of the encroaching development *[4.2.4].* [emphasis added]

Minimum separation distances refer to a measurement from the offending development to the property boundary of the affected land use unless otherwise stated [4.2.5].

Appropriate site selection can avoid or reduce many of the environmental problems associated with proposals and:

- reduce the need for technically based environmental mitigation measures and on-going management measures;
- result in substantial savings in establishment and operational costs;
- reduce levels of public concern; and
- avoid potential delays in approval processes

Site selection should therefore be based on the following principles:

- is the land use permissible in the zone?
- are environmentally sensitive areas avoided?
- is the use compatible with nearby land uses?
- do initial site investigations indicate that the site is fundamentally suitable for the use proposal?

This is an essential step in locating developments which require buffers, and applicants may be required to provide an analysis of a number of sites to justify the preferred location, should that site not meet minimum separation guidelines [4.2.6].

While compliance with the separation distances will assist in reducing conflicts, it will not guarantee that no conflict will occur, or that the proposal will be acceptable *[4.2.8].* [emphasis added]

Quarries – Potential Conflicts
Potential conflicts include noise, dust, vibration, blast over-pressure, fly-rock from blasting, disruption and contamination of ground and surface waters. Potential for significant visual impact. Impacts on vegetation and habitat from clearing.

- ***Minimum self-contained buffer of 1000 metres from Category A [Sensitive Land Uses]…****, which warrant protection from amenity reducing off-site effects from other land uses [e.g., Quarry]. These include all dwellings, caravan parks, community facilities, hospitals, pubs, serviced apartments, restaurants, schools, tourist facilities, seniors housing or other place of permanent or temporary occupation.* [emphasis added]

[31] Part C: General Guidelines, Chapter 4: Land Use Conflict and Buffer Zones, file:///C:/Users/Windows%207%20PC/Downloads/Land-Use-Planning- -Cessnock-DCP-2010- -C4-Land-Use-Conflict-and-Buffer-Zones- -CCC-website-doc%20(2).pdf.

Setback requirements prohibiting quarrying uses, regardless of whether blasting is involved, are traditional land use regulations within a municipality's/planning board's jurisdiction. [32]

Municipal Setbacks and General Welfare Provisions – Case Law Commentary

The following commentary with respect to the powers enjoyed by municipalities under municipal jurisdiction appeared in a September, 2010, Webinar presented by Laura Bowman, Staff Counsel, Environmental Law Centre:[33]

> *An early municipal jurisdiction case over gravel pits was Uxbridge Township v. Timber Brothers Sand and Gravel Ltd., [1975].[34] In that case the Ontario Planning Act explicitly provided for the power for municipalities to make bylaws prohibiting pits and quarries in certain areas. Uxbridge Township had imposed a bylaw providing land uses and residential setbacks for pits and quarries. A further bylaw regulated the operation of pits including rehabilitation and safety requirements.*
>
> *The court interpreted this to allow only the prohibition of new pits, not the regulation of existing ones. The court considered that the Municipal Act in Ontario provided the power to regulate the "operation" of pits and quarries. The operator challenged an Uxbridge Township bylaw on (among other grounds) the basis that the province already regulated quarry rehabilitation and setbacks. The court found that the Municipality could provide additional setbacks:*
>
> > **The provincial legislation does no more than set the minimum set-back requirements or standards and in no way attempts to restrict the right of a municipality to enhance these standards**. This the municipality may do provided it acts within its delegated legislative powers and does not enact provisions in by-laws which are inconsistent with statutory provisions. [emphasis added]
>
> *The court held that municipal setbacks that were less than those provided for in provincial legislation, were invalid. The court allowed an injunction against the pit based on the other portions of the gravel regulation bylaw.*
>
> *The case was referenced by the Supreme Court of Canada in Spraytech* [2001][35] *specifically for the proposition that municipalities may regulate the environment more than the province does.*
>
> *The SCC went on to hold that general welfare provisions in municipal statutes, including in Alberta, authorize environmental regulation within a municipality relating to pesticides, notwithstanding the existence of provincial laws relating to the same subject.*

A proponent seeking municipal planning approval of an application to permit a new or expanding blasting quarry is responsible for ensuring *flyrock*, a common underreported occurrence (Davis 1995), does not injure or kill onsite quarry employees or leave the boundaries of the site and cause harm to the environment and injure or kill human and non-human life offsite.

In *City Sand and Gravel Limited v. Newfoundland (Municipal and Provincial Affairs)*, 2007,[36] in which the quarry operator had leased land restricting quarry operations to the leased

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[32] *Tinicum Township v. Delaware Valley Concrete*, 812 A. 2d 758 (2002), Commonwealth Court of Pennsylvania, para. 764, https://scholar.google.ca/scholar_case?case=15752167703902735334&q=flyrock+and+%22setbacks&hl=en&as_sdt=2006.

[33] https://elc.ab.ca/media/7529/GravelPitsHandout.pdf.

[34] [1975] O.R. (2d) 484 (Ont. C.A.) Leave to appeal to Supreme Court of Canada Dismissed.

[35] 114957 Canada Ltee (Spraytech, Societe d'arrosage) *v.* Hudson (Town) 2 S.C.R. 241, 2001 SCC 40.

land, the Supreme Court of Nova Scotia upheld the trial court's finding that creation of an (external) buffer zone "would not authorize City Sand to eject fly-rock outside the quarry site and onto land comprising the buffer zone [para. 42]."

> *[38] The quarry operation, apparently conducted in compliance with the requirements of regulatory authorities, involving blasting of rock face with the resultant inherent danger of fly-rock. Throughout the relevant period, the successive quarry leases under which City Sand derived its rights forbade quarrying within 300 meters of a residential development without ministerial approval. City Sand understood from discussions with the Department of Mines and Energy, which issued the quarry leases, that there was a buffer around the quarry site. However,* ***the quarry leases did not confer upon City Sand rights over property outside the quarry****.* [emphasis added]

On May 20, 1988, a blast at the quarry launched *flyrock* debris offsite, which landed in the buffer zone, and resulted in complaints from nearby residents. A second *flyrock* incident occurred on July 3, 1998, causing damage to one resident's garage and the roof of another resident's house in the nearby Jane Heights subdivision.

> *The buffer zone, by definition, is a neutral area designed to separate, in this instance, two inconsistent and adjoining land uses. From an occupational health and safety perspective, it is a safety mechanism in the sense that should fly-rock or debris be ejected from the quarry site, as a result of blasting or other techniques, the likelihood of injury or damage to others is minimized. No evidence was placed before me to suggest the buffer zone is an area of usage to the plaintiff, that is, granting plaintiff [City Sand and Gravel Limited] permission, in its operations, to eject rock or debris into this area and outside the boundaries of its leasehold realty property [para. 56].*[37]

The implication of the trial court's observations is that the only way for a quarry operator to prevent *flyrock* from leaving the site is for the quarry operator to provide its own internal safety buffer, the equivalent of a setback. By 1996, it become clear that a 300-metre buffer for a blasting quarry was inadequate, and in 1996 the Department of Municipal and Provincial Affairs, in its conditions for approval of a blasting quarry, required a buffer zone of 1,000 metres from a cottage or residence.

In 2014, Austin Powder Ltd. pleaded guilty before the Justice of the Peace for failing to report to the Ministry of the Environment (MOE) "discharging flyrock" that resulted in off-site environmental impacts from blasting at the 98-acre Pakenham Quarry, licenced by Ministry of Natural Resources on March 22, 2006.

> *Austin Powder Ltd. and Keith Taylor…at Pts E1/2 26 & 27, Concession 9, Township of Lanark did commit the offence of discharging or causing or permitting the discharge of a contaminant, to wit fly rock from quarry blasting operations, into the natural environment which caused or was likely to cause an adverse effect contrary to Sec. 14 (1) of the Environmental Protection Act, R.S.O. 1990, c. E. 19, as amended, thereby committing an offence under Sec 186 (1) of the said Act.*

On July 20, 2009, and, again, on July 23, 2009, blasting at the Pakenham Quarry launched *flyrock* off-site. (The July 23, 2009 flyrock incident also struck the onsite quarry scale house

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[36] *City Sand and Gravel Limited v. Newfoundland (Municipal and Provincial Affairs),* 2007 NLCA 51 (CanLII), <https://canlii.ca/t/1sfnv>, retrieved on 2021-10-03. Leave to appeal to the Supreme Court of Canada denied.

[37] *City Sand and Gravel Ltd. et al. v. Newfoundland (Minister of Municipal and Provincial Affairs)*, 2005 NLTD 67 (CanLII), <https://canlii.ca/t/fwvrv>, retrieved on 2021-10-03.

230 metres from the blast, which Austin Powder Ltd. failed to report to the Ministry of Labour.)

> *According to the press release the official version of events is as follows: "In the first incident,[July 20, 2009] a small rock struck a worker at a neighbouring business on the arm. In the second incident, [July 23, 2009] rocks were observed flying well beyond the control area. A [quarry] scale house located 230 metres from the blast was struck by a number of rocks.*
>
> *Two [civilian] vehicles [occupied by passengers] held at a controlled stop along nearby Young Road on the edge of the quarry property located about 300 metres from the blast were also struck by rock resulting in extensive damage. There were no injuries even though the blast damaged property and impaired the safety of people."*[38]

During the MOE investigation (Case File Number: 2283-83MN69), Explotech Engineering, retained by MOE in response to the July 23, 2009 *flyrock* incident, testified and concluded even though "it appears that blast procedures were followed and that while not probable, the potential exists for a recurrence," and "strongly recommend[ed]" the "hazard zone" (i.e., safety zone, the equivalent of a setback) be increased to 500 metres:

> *"We strongly recommend that the hazard zone be increased to 500m when firing any future blasts.* (Source: Explotech Report, September 25, 2009)*"*

Despite Explotech stating that "**while not probable the potential for [flyrock] reoccurrence exists**," unbeknownst to Explotech, only three days earlier on July 20, 2009, another flyrock incident had occurred at the Pakenham Quarry.

In a follow-up July 16, 2010 report prepared by Explotech, in response to the first *flyrock* incident of July 20, 2009, Explotech concluded that

> *A review of the video of the July 20, 2009 blast clearly shows flyrock rifling from the toe area in two areas along the face of the blast. Based on additional witness and video evidence, it is our opinion that Austin Powder staff had to have been or ought to have been aware of flyrock being projected beyond the quarry boundaries. It is further evident that Austin personnel failed to verify that flyrock did not cause damage and failed to review their blasting procedures to ensure that the potential for flyrock was eliminated in subsequent blasts.*
>
> *…[T]he incident of July 20, 2009 should have served notice to Austin employees that the safety zone [i.e., setback] was not sufficient and that a review of the drilling and blasting operation was required.*

Both the blasting company, Austin Powder Ltd., and the quarry owner, Thomas Cavanagh Construction Ltd., argued unsuccessfully in their defence of not being aware of the reporting requirements under the Environmental Protection Act:

> *Statements from company officials for both Thomas Cavanagh Construction Ltd. and Austin Powder Ltd. confirmed that they did not report the said incidents, had no knowledge that fly rock constitutes a contaminant or, that fly rock incidents, which may cause an adverse effect must, be reported to the Ministry of the Environment.*

Flyrock is an uncontrollable and inevitable by-product of blasting, as confirmed by Keith Taylor, General Manager, Austin Powder Company Ltd:

> ***90% of fly rock incidents are "unexplainable."*** [emphasis added]

[38] Dunn, Derek. "Company guilty of Pakenham blasting mishap," *Arnprior Chronicle-Guide*, May 08, 2014.

Adverse Effects: Thirteen Homeowners Near A Blasting Quarry Bought Out By Quarry Owner (January 26, 2021)

A search of rural residential property sales over a number of years (1991-2010) near the Acton Quarry[1] in Halton Hills, a quarry blasting below the water table, now operated by Dufferin Aggregates[2] through a series of changes in corporate ownership, uncovered acquisitions of fourteen (14) rural residential properties on Third Line, including one vacant building lot, by owners of the Acton Quarry.

None of the 13 residences and one vacant building lot were purchased on the open market, as evidenced by the absence of any "for sale" MLS listings[3] corresponding to the date each property was purchased by the then owner of Acton Quarry. In 8 of the acquisitions, the quarry operator's true identity was concealed through the use of numbered companies, and one company with the delightful name "Snowfarm Ltd." The 14 transactions are summarized as follows.

Address	PIN	Lot Dimensions	Lot Area (sf)	Sale Date	Sale Price	Vendor	Purchaser	Demolished
11759 Third Line	25017-0077	160' x 400'	63,647	8-Jan-10	$468,000	Watson	Snowfarm Limited	
11749 Third Line	25017-0078	160' x 400'	63,712	8-Jan-10	$495,000	McEachern	Holcim (Canada) Inc.	
11998 Third Line	25017-0005	100' x 200'	19,913	29-Dec-06	$410,000	Harris, Oliver	St. Lawrence Cement Inc.	
11992 Third Line	25017-0006	122' x 200'	24,305	29-Jan-07	$656,500	Locke	St. Lawrence Cement Inc.	
11988 Third Line	25017-0007	100' x 200'	19,913	28-Dec-00	$232,000	MacNeil	Blue Circle Canada Inc.	2010-2015
11978 Third Line	25017-0008	125' x 200'	24,897	28-Dec-00	$224,000	Bradbury	Blue Circle Canada Inc.	2015-2017
11970 Third Line	25017-0009	125' x 200'	24,897	28-Mar-91	$359,000	Vander Eyken	St. Lwrence Cement Inc.	2015-2017
12723 Third Line	25005-0030	203' x 226'	38,600	27-Mar-08	$683,333	French	764296 Ontario Ltd.	2017-2019
Third Line	25005-0029	125' x 242'	31,980	23-Oct-08	$300,000	Coxe	747752 Ontario Ltd.	
12759 Third Line	25005-0028	125' x 269'	35,359	27-Mar-08	$683,333	Henderson	764296 Ontario Ltd.	2017-2019
12763 Third Line	25005-0027	125' x 296'	38,729	27-Mar-08	$683,333	Pettipher	747752 Ontario Ltd.	2017-2019
12765 Third Line	25005-0026	125' x 323'	42,108	27-Mar-08	$658,133	Hotham, Osborne	764296 Ontario Ltd.	2017-2019
12771 Third Line	25005-0025+	157' x 364'	51,473	27-Mar-08	$683,333	Kirkwood	747752 Ontario Ltd.	2017-2019
12775 Third Line	25005-0138	425' x irreg	159,618	27-Mar-08	$733,333	Coxe, et al	764296 Ontario Ltd.	2017-2019

Aerial views and other data sources reveal that ultimately 9 homes of the 13 improved properties on Third Line bought out by Acton Quarry have been demolished: 1 dwelling (2010-2015), 2 dwellings (2015-2017), and 6 dwellings (2017-2019).

According to the scaling function provided by the Toronto Real Estate Board (TREB), at the time each homeowner of the 14 properties (13 rural residences and one vacant building lot) was bought out by the then corporate owner of the Acton Quarry, the closest distance from the quarry pit to each of the three Sub-Groups of sales (shown on the attached aerial sketch – Appendix A) was approximately:

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[1] See the destruction of the terrain and stagnant water ponds at the Acton Quarry on the August 5, 2014 YouTube video, https://www.youtube.com/watch?v=nJd6j2K2754.

[2] "Dufferin Aggregates purchased Acton Quarry in November 2001. With 3.47 million tonnes annual production, this quarry is ranked 5th in Canada in 2001." http://www.geologyontario.mndm.gov.on.ca/mndmfiles/mdi/data/records/MDI40P09SE00002.html.

[3] A search of Toronto Real Estate Board (TREB) and Oakville, Milton & District Real Estate Board did not uncover any MLS listings for any of the 14 transactions at the time each homeowner was bought out.

- Sub-Group (7 sales) 750 feet (229 metres) from quarry pit
- Sub-Group (5 sales) 2,100 feet (640 metres) from quarry pit
- Sub-Group (2 sales) 4,950 feet (1,509 metres) from quarry pit

Typically, an appraisal would be commissioned for each residential property, accompanied by **instructions from the quarry owner to the appraiser to ignore the impact of the quarry operation on the market value**, with each property owner required to sign a confidentiality agreement as a condition of sale.

Implicit in the concept of ***Market Value***[4], defined as follows, is that the purchaser is reasonably knowledgeable or well advised. However, the vendor will virtually always be more knowledgeable than the purchaser.

> *The most probable price, as of a specified date, in cash, or in terms equivalent to cash, or in other precisely revealed terms, for which the specified property rights should sell after reasonable exposure in a competitive market under all conditions requisite to a fair sale, with the buyer and seller each acting prudently, knowledgeably, and for self interest, and assuming that neither is under undue duress.*

Angela MacNeil, the owner of 11988 Third Line, was bought out by Blue Circle Canada Inc. (ASO: David Marsh) on December 28, 2000, for $232,000 (all cash), a home which Angela MacNeil purchased on December 30, 1998, for $209,000 from the Russell family, who had acquired the property on November 25, 1988, for $189,000.

The adverse effects endured by the Russell family while residing near the Acton Quarry for approximately 10 years were expressed in testimony (Witness Statement) at an OMB hearing (LPAT PL170688), which commenced May 21, 2019, involving another quarry, blasting below the water table, proposed some 1,500 metres from their present residence in Guelph Eramosa.

> *My family and I lived on 3rd Line Acton, south of 22nd sideroad from [November 25,] 1988 to 1999 [December 30, 1998]. When we moved into the house, the Acton Quarry was an established operation that was bounded on the south side by 22nd sideroad which meant that our house was about 1,100m from the quarry….However, the quarry did expand south of 22nd sideroad a few years after….which brought with it several new challenges but the key ones that I am addressing here are the property damage and consequential property devaluation.*

As to the extent of the adverse effects endured by the Russell family over the period of 10 years while residing near the Acton Quarry, they consisted of the following:

- *[B]lasting shockwaves were very evident at the house. One could feel the whole structure move as the shockwave passed. I vividly recall the first time I personally experienced the blasting shortly after moving in. I was on vacation (and so at home at the regular daily noon hour blasting) and sitting on the garage floor working on my car. For an instant, as the shockwave passed, I felt weightless, almost as though I left the ground!*

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4 *The Appraisal of Real Estate, Third Canadian Edition,* Appraisal Institute (US) and the Appraisal Institute of Canada (2010))

- *[T]his blasting was daily at the time, and so my wife and three pre-school children experienced that same shockwave effect every day.*
- *My house eventually started to display significant symptoms that I would believe were a direct result of the repeated mechanical shocks [from everyday blasting]. At first they were relatively minor such as cracks in window frames and some cracks in the drywall. Eventually, the symptoms became more serious.*
- *Following the expansion of the quarry south of 22nd sideroad, cracks started to propagate across the concrete floor of the garage and basement. The house then developed a crack through both of the masonry walls on the south wall of the structure (this was the largest section of the structure above ground). This grew…[to] be a ½" crack that extended diagonally both on the interior structural masonry as well as the exterior cosmetic masonry. The two cracks propagated at 90 degrees to each other suggesting that they were not just due to simple subsidence (note that the house had been there for approximately 20 years already so the foundation would reasonably be considered as very stable).*[5]

When the Russell family discussed the damage to their home with representatives of the Acton Quarry, the quarry operator denied any responsibility, claiming that

> *There was no proof that the cracks were related to the blasting as I had not had the foresight to have my house monitored with accelerometers and recorders [which provide less than reliable measures of damage when a property is exposed to repeated blasting]. [underscoring added]*

And, yet, in December 2000, only two years after the Russell family had sold their home to Angela MacNeil in December 1998, the quarry operator (Blue Circle Canada Ltd.) acquired the property, along with the abutting home at 11978 Third Line, both of which were subsequently demolished by the owner of Acton Quarry.

A representative of Dufferin Aggregates, when asked at a December 10, 2012 public meeting[6] by a resident whether an inventory of any issues with houses near the quarry had been recorded when Dufferin Aggregates acquired Acton Quarry in November 2001, responded as follows:

> *The public is repeating concerns that existed over 10 years ago and many homeowners in the area bought homes when they knew a quarry was present. He believes those complaining should show proof that cracks in foundation happened due to recent Acton Quarry operations. He explained it is*

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[5] As ruled by the appellate court in *Civil Construction Company Limited v. Frederick Leon (1st Respondent)*, [and other Respondents], Civil Appeal SCA 36/2016), "[i]n my view the 1st Respondent's evidence, in accordance to the theory of '*la causalite adequate*' [adequate causation], that the cracks started to appear in their houses only after the quarry started its operations and that after about 20-25 years after the houses had been built makes it obvious that it was the vibrations caused by blasting and movement of heavy machinery that contributed materially to the damages. That in my view was sufficient evidence to establish the link and proximity between the acts of Appellant and the damage caused to the Respondents property, even without any expert evidence. That in my view was sufficient evidence to establish the link and proximity between the acts of Appellant and the damage caused to the Respondents property, even without any expert evidence. This in my view is where the common law doctrine of '*Res ipsa loquitor*' (The thing speaks for itself) applies." https://seylii.org/sc/judgment/court-appeal/2018/33/CCCL%20v%20Leon%20%26%20Ors%28Twomey%29Judg.14.12.18.pdf

[6] https://www.dufferinaggregates.com/wp-content/uploads/2020/06/Meeting-Minutes-20.pdf.

> *likely the cracks occurred well before Dufferin Aggregates came into the town p. 5].* [underscoring added]

This offensive reverse onus on homeowners residing near quarries blasting below the water table to prove damages to their residences is a classic tactic of quarry owners. Repeated blasting, coupled with dewatering,[7] is known to cause environmental and structural damage, and compromise the health, safety and welfare of nearby residents, pets and wildlife. Blasting is an ultrahazardous activity held to strict liability.

All of the homes surrounding the quarry were built at different times, using different building materials, presumably in compliance with the building codes prevailing at the time each home was built. Accordingly, there is no uniform intensity of blasting that each residence can withstand. The homeowners are not under any legal obligation to ensure that their homes are constructed to a (fortress) standard that would withstand the impacts of repeated blasting using powerful explosives.

By ignoring residents' complaints of property damage, the only effective remedy available against a quarry owner is costly litigation, which may be dragged out by the quarry operator for years, with an uncertain outcome, even with the benefit of strict liability and a favourable "more probable than not" burden of proof. This is one more reason why the precautionary principle should be applied, and an abundance of caution exercised, when a municipality considers the locational characteristics of an application for a new quarry blasting below the water table, or expansion of an existing quarry blasting below the water table.

Any semblance of community life along Third Line near the Acton Quarry has all but been obliterated, as only a few homes remain standing. The few remaining homes on Third Line near the Acton Quarry are not readily marketable or mortgageable on typical terms and conditions, and homeowner insurance may be difficult or costly to obtain, especially if previous damages have been claimed, leaving Acton Quarry as the only viable buyer. Of course, there is always the possibility of selling one of the few remaining homes on Third Line to an unsuspecting purchaser with no knowledge of the *adverse effects* associated with residing near a quarry blasting below the water table.

Buying a home with an awareness of a quarry nearby does not imbue the typical purchaser with an understanding of all the adverse effects of a quarry blasting below the water table

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[7] 6th Annual Georgia Environmental Conference, Savannah, Georgia, August 25, 2011, Limestone Conditions With Pit Dewatering, USGS Open-File Report OF-010484, Worst-Case: 1) WATER TABLE lowered by quarry dewatering. 2) SPRING no longer receives groundwater discharge. 3) WETLANDS dried up & destroyed. 4) CAVITIES & PIPES form in the soil where groundwater support is lost. 5) SUBSIDENCE of the land occurs. 6) COLLAPSE SINKHOLE after soil falls into an underlying cavity. 7) STREAM dries up. 8) RIPARIAN WOODLANDS destroyed., Slide 22, https://citizensagainstmining.org/wp-content/uploads/2017/04/Quarry-Effects-by-Leggette-Brashears-and-Graham.pdf.

or as to how long the quarry will remain operational.[8] Many questions would need to be answered:

- Was the purchaser informed of the adverse effects of living near the quarry by the realtor (or was the realtor as uninformed as the purchaser) before purchasing the property?
- Was the purchaser aware of how often blasting would occur at the quarry, and that blasting is an ultrahazardous activity?
- Was the purchaser aware that operations at the quarry, including blasting, could interfere with family use of outdoor amenity space?
- Was the purchaser giving implied consent to the quarry operator to compromise the health, safety and welfare of their family, pets and livestock?
- Was the purchaser advised of the health risks of exposure to silica dust,[9] a by-product of quarry operations, to their family, pets or livestock?
- Was the purchaser advised of the dangers of *flyrock*, an inevitable by-product of blasting rock, and considered the ultimate adverse effect (most people have never heard of *flyrock*, a closely guarded dirty little secret of the aggregate industry and its explosives engineers)?
- Was the purchaser giving implied consent to the quarry operator to cause future damage to their property?
- Was the purchaser aware that it is prudent to have a well water pumping test of their own conducted?

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[8] Labelling a quarry operation as in "interim" land use is extremely misleading, as a quarry can theoretically remain operational in perpetuity, and where aggregate extraction occurs below the water table, there is no prospect of rehabilitating the excavated pit to a productive economic use.

[9] "Crystalline silica has been classified as a human lung carcinogen, and can cause serious lung disease and lung cancer. It only takes a very small amount of respirable silica dust to create a health hazard. One of the dangerous effects of silica exposure is a disease called silicosis, which can be contracted after just a few months of high exposure. Silicosis occurs when silica dust enters the lungs and causes the formation of scar tissue, reducing the lungs' ability to take in oxygen. There is no cure for silicosis, and cases can be disabling or even fatal." https://www.concentra.com/resource-center/articles/what-is-silica-and-why-is-it-dangerous/. [underscoring added] "Environment Canada (2011) reports generally do not indicate the existence of any wide-spread significant concern about airborne crystalline silica exposures to the general public. (Not: "general public", as the term is used here, means individuals not living near an identified source of crystalline silica emissions.). However, US EPA (1996) stated that "some potential exists for environmental silicosis to human populations". Exposures of potential concern may be more likely if populations are close to large sources of uncontrolled emissions. p. 16, Silica Study August 30, 2011." https://dnr.wi.gov/files/PDF/pubs/am/AM407.pdf. "Based on annual concentration of 10 microgram/m^3 – 85 premature deaths in Oakville attributable to $PM_{2.5}$ pollution every year; More of other outcome documented in health effects studies…for every microgram/m^3 **reduced** – 8 fewer deaths. Slide 4 (Source: ICAP 3.), See Common "errors" by Industry Consultants, p. 20". Impact Assessments for Quarries: Protecting the Public, January 22, 2020, Franco DiGiovanni, PhD LEL, Senior Project Manager – Atmospheric Services East, Hemmera. https://d3n8a8pro7vhmx.cloudfront.net/wellingtonwaterwatchers/pages/902/attachments/original/1580084654/Reid_Road_Reservoir_Quarry_-_Air_Quality_-_Jan_22_2020_webinar_-_versn_3.pdf.

- Was the purchaser aware that there was a potential for an impact on the quantity of their well water? (CMHC requires a water flow of ≥ 3 gallons per minute for 2 hours and a government tested well sample)
- Was the purchaser aware that it is prudent to retain a structural engineer to ascertain the structural integrity of the home?
- Where and when would the quarry operator expect the average purchaser to ascertain if there were prior insurance claims?
- Was the purchaser aware that the quarry operator would be expanding its operations, and exposing the family to further adverse effects?
- Where and when would the quarry operator expect the average purchaser to gain the expertise to understand the highly technical aspects and dangers associated with operating a quarry blasting below the water table before making an informed decision to purchase a home near a quarry?
- Should visiting relatives and friends, and home repair and property maintenance workers (lawn grooming and snow removal) of purchasers of homes near a blasting quarry be expected to be aware of the adverse effects to which they are being exposed? Is there a legal duty on the part of the homeowner to advise these people of the potential adverse effects to which they are being exposed and are these visitors covered under the homeowner's liability insurance, especially if there is a previous claim?
- Should patrons or guests of nearby sensitive land uses (or activities) such as a park, golf course, convention centre, hotel or motel, restaurant, service station, daycare centre, school, place of worship, etc., be informed by the business or institutional owner of the potential adverse effects of the blasting quarry? Is there a legal duty on the part of the business or institutional owner to advise patrons and guests of the potential adverse effects to which they are being exposed and are these visitors covered under the property owner's liability insurance, especially if there is a previous claim?

Considering the significant amount of time (steep learning curve) and cost to be incurred by a prospective homeowner to properly and adequately address the concerns identified in the acquisition of a property near a quarry blasting below the water table, and discounting the asking price accordingly, the potential pool of buyers becomes virtually non-existent.

<u>When access to important information is asymmetrical, resting solely in the possession of the vendor (property owner or agent), a prospective homeowner is rendered incapable of making an informed decision, and overpays</u>.

> ***Uninformed buyers overpay, particularly when purchasing complex assets whose values are difficult to accurately quantify (Carlin et al., 2013). Uncertainty over value creates market environments that allow asymmetric information price effects to persist (Kelly and Ljungqvist, 2012)….Home buying is an area where the ability of households to gather and effectively use market information can have profound effects on housing decisions, through***

> ***both the choice of mortgage product and the purchase transaction itself [p. 1]***.[10] [emphasis added]

According to the Provincial Policy Statement, 2020, p. 39,[11] **Adverse effects**: as defined in the *Environmental Protection Act*, means one or more of:

a) impairment of the quality of the natural environment for any use that can be made of it;
b) injury or damage to property or to plant or animal life;
c) harm or material discomfort to any person;
d) an adverse effect on the health of any person;
e) impairment of the safety of any person;
f) rendering any property or plant or animal life unfit for human use;
g) loss of enjoyment of normal use of property; and
h) interference with [the] normal conduct of business.

Flyrock meets the Ontario EPA definition of contaminant, and the *adverse effects* of *flyrock* are not trivial.[12] In *Castonguay Blasting Ltd. v. Ontario (Environment)*, 3 SCR 323, 2013 SCC 52 (CanLII), the Supreme Court held that "the flyrock could easily have seriously injured or killed someone."

The residents of the community near the Acton Quarry have been exposed to a number of potential short- and long-term *adverse effects* including *flyrock,* and there is a diminished sense of community as most of the homeowners along Third Line have been bought out by the Acton Quarry operator/owner.

As noted from public records, Dufferin Aggregates (owner of the Acton Quarry since November 2001) subsequently bought out 11 nearby homeowners, and, in 8 of those acquisitions, the identity of Dufferin Aggregates was concealed through the use of numbered companies, including one named "Snowfarm Limited."

Additional adverse impacts attributed to the quarry operation by the Russell family included:

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[10] Arno J. van der Vlist and Geoffrey Turnball, "Uninformed house buyers and foreclosures," *Working Paper 1503*, June 2015, https://www.researchgate.net/profile/Arno_Vlist/publication/291103181_Uninformed_house_buyers_and_foreclosures/links/569e135608ae16fdf07b73fe/Uninformed-house-buyers-and-foreclosures.pdf?origin=publication_detail.

[11] Provincial Policy Statement, 2020, Under the *Planning Act*, https://files.ontario.ca/mmah-provincial-policy-statement-2020-accessible-final-en-2020-02-14.pdf.

[12] The EPA "land Use Compatibility Definitions" defines "**Trivial Impact**" as "present or predictable contaminant discharges which are or are likely so minor that there would not be an "adverse effect." Wherever and whenever rock blasting occurs (i.e., proposed blasting quarry), "flyrock" is inevitable.

- *Inaccessibility to 22nd Sideroad due to the 3rd Line being closed by quarry workers due to the risk of rocks [i.e., flyrock][13] landing on the 3rd Line road during the blasting.*
- *The congestion caused by trucks lining up for the opening of the quarry in the early morning. These stationary, large vehicles caused safety issues due to road constrictions and visibility issues for other motorists.*

As to the diminution in the value of the Russell family home while they retained ownership, the Russell family had this to say:

- *When we sold our house [on December 30, 1998, for $209,000], we realized an 11% appreciation in the [acquisition] price [of $189,000 paid on November 25, 1988] in nominal dollars [which amounts to an [insignificant] average annual rate of increase of 1.04758% over a period of 10.10 years.]*
- *During the time [10.10 years] that we lived there, the consumer price index moved up by 35%....When adjusted for inflation, our property declined in real value by 24% despite all our significant upgrades to the property and the fact that the presence of the quarry would have already been factored into the price we paid initially [but the expansion of the Acton Quarry brought the Russell family home closer to the quarry].*[underscoring added]
- *In reality, the loss [in property value] was probably much worse if the performance was to be compared to an appropriate housing index given that Acton was a growing community at the time [the property was sold on December 30, 1998].*
- *The direct and indirect influences of the quarry operations led to a further deterioration to the neighbourhood such that my old property [11988 Third Line] today is now gone following a series of degradations that ultimately led to the house being no longer fit for habitation….In fact, 6 [now 9] of the 13 houses along the road where we lived are…no longer there or are uninhabitable.* [underscoring added]

The diminution in property values is always a major concern expressed by residents living near existing pits or quarries, or living near proposed pits or quarries, a sentiment conveyed by the Town of Caledon in a January 22, 2014 submission to the Standing Committee on General Government Report on the Review of the Aggregate Resources Act.[14]

> ***8. Reduction in value of neighbouring properties***
> *An issue which is raised by the public at all municipal meetings for aggregate operations is the impact on the value and rnarketability of neighbouring properties. At one of Caledon's public meetings for an aggregate pit, a resident provided evidence confirming that the Province of Ontario's Municipal Property Assessment Corporation {MPAC) has recognized the impact on property value by providing a 10% reduction in assessment to a landowner due to proximity of the property to an aggregate pit.*
>
> *The Town of Caledon undertook a study which included property value impact to support its position with respect to a quarry application. However, no detailed economic studies have been done. The Province should undertake a comprehensive study on the impact of new aggregate pits*

[13] "Flyrock" is the ultimate adverse effect, and is defined by the National Institute for Occupational Safety and Health (NIOSH) as "any debris that lands outside the designated blasting area. It can vary in mass from marble-sized to car-sized and can be incredibly dangerous and potentially fatal." Wherever there is blasting of rock, flyrock can occur, and be propelled distances exceeding 1,000 metres. No matter how well a blast is executed the consequences of flyrock are unpredictable.

[14] https://www.peelregion.ca/council/agendas/pdf/rc-20140213/communication-ma-b3.pdf.

> *on neighbouring property values. This study by the Province should form part of the criteria for the ARA licence and Planning Act approval. [p. 7]* [underscoring added]

At a 2015 Town Board public meeting of the Town of Nassau,[15] evidence was presented by Professor Hite relating to the impact of a proposed quarry blasting below the water table, on the value of nearby residential properties:

- 12 residential parcels within 500 feet (152 metres) of the proposed quarry,
- 22 residential parcels at 1,000 feet (305 metres),
- 26 residential parcels at ¼ mile (402 metres), and
- 291 residential parcels within 1 mile (1,609 meters).

At 2.6 people per household (pph), that equates to 756 people (291 × 2.6 pph) or about 15% of the Town's population lives within 1 mile (1,609 metres) of the proposed quarry. [p. 80]

> *That analysis of property value impacts (The Impact of Hard Rock and Gravel Mines on House Prices in Upstate New York) applied a scientific model (Hedonic Price Model) to analyze the effect of mining operations on house values. This study used a large dataset on housing sales in areas surrounding three industrial stone mines and one sand/gravel mine in Columbia, Saratoga, and Rensselaer counties…. **Hite's study concludes that mine operations are a disamenity that would have a negative impact on property values ranging from a 7.5% to 36% discount**. Related to these discounts, she concludes (page 12) that 'These discounts are statistically significant at the 99+% level; such a high degree of significance leads us to conclude that, without a doubt, the quarry that Troy Sand & Gravel Co., Inc., proposes to develop and operate in the Town of Nassau, Rensselaer County, New York, will have a deleterious financial effect on existing homeowners [p. 72].'* [bold added]

Had the residents of the Town of Nassau been aware or made aware of the proposed blasting quarry, they would have bought property elsewhere, and if the quarry were to be established the homeowners contend they would have difficulty selling their homes or be unable to sell their homes or develop additional residences.

> *…[T] he Town has received numerous affidavits from residents that indicated that they would not have considered buying property in Nassau had they known about the mine [quarry], that they would sell their property, or that they are concerned they will never be able to sell their property. The public record contains an abundance of information from landowners who feel that they will have difficulty in selling their properties if the mine is in operation, and that it will deprive them the ability to sell or develop additional residences on land already owned [p. 72].*

On March 19, 2009 Dufferin Aggregates submitted Official Plan and Zoning By-law Amendment Applications to the Town of Halton Hills[16] to permit expansion of the Acton Quarry by 124.4 hectares (307.4 acres) with an extraction area of 99 hectares (244.6

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[15] Resolution of the Town Board of the Town of Nassau Decision on the Troy Sand & Gravel Special Use Permit Application, Resolution No. 17, September 1, 2015.

[16] Town of Halton Hills, Report PDS-2014-0028, May 30, 2014, http://webaps.halton.ca/Planning/Dufferin%20Aggregates%20Acton%20Quarry/Town%20of%20Halton%20Hills/Town%20of%20Halton%20Hills%20Staff%20Report%20May%2030,%202014.pdf.

acres), subsequently revised (June 2012) to 90.6 hectares (223.9 acres) and 66.5 hectares (164.3 acres), respectively.

It probably is no coincidence that Acton Quarry bought out 7 residential properties (including one vacant building lot) on Third Line in 2008 (March and October), and further 2 residential properties in 2010 (January), presumably to silence justified opposition to the proposed quarry expansion from those homeowners already adversely effected by the activities at the blasting Acton Quarry.

Dufferin Aggregates retained Golder Associates Ltd. (Golder) to prepare a Blasting Impact Assessment report (November 2008), a copy of which was obtained from the internet. The report does not include an assessment of the risk of *flyrock*, let alone even mention the word *flyrock*.

> ***Human response to flyrock is generally extreme. Apart from any consideration of damage, it is the only blasting-related hazard that can cause serious injury and death. It is the ultimate adverse effect of blasting and must be avoided at all costs.***[17] [Milestone 5, p. 31] [emphasis added]
>
> ***A rock that lands harmlessly in a field may not appear to be a large issue. However, mowing and tilling become hazardous when rock is struck by farm equipment. Rock through timber stands mar trees and potentially impact the market value.***[18] [emphasis added]

Accordingly, without acknowledging *flyrock*, the statement at p. 16 of the Blasting Impact Assessment report, that *"the proposed operation will not result in unacceptable impacts on surrounding receptors,"* is not credible. That "*receptors*" are not defined makes the Blast Impact Assessment report even less credible. At p. 3, Golder states that *"[t]his report…evaluates the long term impact of the blasting operations on surrounding structures," concluding that repeated blasting "would not [have] any noticeable cumulative effect,"*[19] despite complaints to the contrary based on the historical operation of the quarry. Equally disturbing is that the Joint Agency Review Team (JART) in its March 2013 report failed to raise concerns about *flyrock*, a health and safety issue ignored in the Blast Impact Assessment undertaken by Golder in connection with Dufferin Aggregates' March 2009 application to expand operations at the Acton Quarry. However, JART may not have possessed an awareness or understanding of "flyrock."

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[17] Mine Health and Safety Council, South Africa, https://mhsc.org.za/sites/default/files/public/research_documents/SIM140901%20Final%20Report.pdf.

[18] "Controlling the Adverse Effects of Blasting," OSMRE, https://www.osmre.gov/resources/blasting/docs/WYBlasterCertModules/8AdverseEffectsBlasting.pdf.

[19] In *Cage Brothers v. McCormack et al.*, 344 S.W.2d 203 (1961), the Texas appellate court held that repeated blasting at a limestone quarry had damaged four houses distant as far as 1,200 feet (366 metres) from the blasting area. One piece of "flyrock" weighing 85 pounds was launched 730 feet (223 metres). Dr. Tonn, the homeowners' expert testified that repeated blasting has a cumulative effect of causing cracks from initial blasts to widen or worsen, even if subsequent blasts are of a lesser intensity. https://scholar.google.ca/scholar_case?case=10141646206778100249&q=%E2%80%9Cblasting+damage%.

It is a little known fact that the impetus for environmental protection of the Niagara Escarpment, which is impacted by the Acton Quarry, came as a protest against the damage caused by *flyrock*, as explained by Murray Stephen of the Halton Region Conservation Authority in the January 1991 issue of *The Journal* (Milton Historical Society).[20]

> *The impetus for the conservation authority in this area came not from the need for flood control but as a protest against "flyrock" from industrial blasting at Mount Nemo [p. 4].*

All potential adverse effects, including *flyrock*, from a quarry blasting below the water table must be borne by the proponent/applicant, the private profit-seeking quarry operator.[21] It is repugnant for a quarry operator to attempt to impose adverse effects on innocent third-party homeowners living nearby and have their health, safety and welfare compromised, and their standard of living lowered without permission or compensation.[22]

In denying Troy Sand & Gravel's application to permit quarry blasting below the water table, the Town of Nassau concluded with the following reasons, highlighting, in particular, the egregious and presumed use of neighbouring properties as an off-site "dumping" ground for adverse effects (e.g., fugitive dust, air pollution, noise, vibration, flyrock) and sterilizing the properties from future development or redevelopment, without concern for the health and safety, quality of life, and financial well-being of the property owners.

> *Use of private lands surrounding the proposed quarry in order to buffer impacts is unacceptable. The Lead Agency's Findings Statement used the location of the homes located around the mine [quarry] property as receptors for judging impacts, such as fugitive dust and air pollution, noise, and vibration from blasting. In many cases, the Lead Agency relied upon the spaces and distances between the nearest houses and the property boundary of the mine [quarry] as a buffer area for off-site impacts of the mine [quarry]. For example, noise or vibration impacts migrating out from beyond the property line of the mine [quarry] were expected to dissipate on the properties of surrounding land owners, but prior to reaching the location of existing homes on the properties. The same conclusion was reached about dust and air pollution that would migrate beyond the mine [quarry] property boundary. In that event, according to the Lead Agency, dust and pollutants were expected to dissipate and settle upon the land of those property owners, but before those pollutants reached existing homes. Town Board members had a visceral reaction to the idea of the Applicant using neighboring private properties to buffer mine [quarry] impacts. This was essentially letting the Applicant using those properties to dispose of various forms of impacts or pollution without either their permission or compensating them. But the potential damage is still larger than that. The Town Board is aware that there are home-based businesses in the lands surrounding the mine [quarry] site that depend on the rural character and the existing peace and quiet as part of their businesses. Hence, the use of these properties as buffer areas for noise, dust and vibration, the impacts of the*

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[20] The Journal, Milton Historical Society, January 1, 1991, http://miltonhistoricalsociety.ca/documents/journal_archive/1991.pdf.

[21] In *Norma Moore et al. v. Smith Construction Company, a Division of the Miller Group Inc.*, OSCJ [Nov 2011], the Superior Court agreed with the defendants that a quarry owner "is a private, for-profit company and should be required to pay the full cost of its operations without forcing the plaintiffs [homeowners] to effectively subsidize its business through the free use of their properties [para. 70]."

[22] Resolution of the Town Board of the Town of Nassau Decision on the Troy Sand & Gravel Special Use Permit Application, Resolution 17, September 1, 2015, https://mhsc.org.za/sites/default/files/public/research_documents/SIM140901%20Final%20Report.pdf.

> *mine [quarry] will likely damage the local rural economy which is fragile as it is without additional stress factors. Still further, by relying on the location of existing homes only (receptors), the DEC's analysis on this point also rested on the unsupportable assumption that no new homes would be located closer to the mine in the next 100 years or so. This is improbable. The use of neighboring properties as buffer area for off-site impacts, and to deposit settling dust which migrates off-site, is unacceptable. The Applicant should have been required by the Lead Agency to mitigate these impacts before they reach the mine [quarry] property line.* [pp. 100-101]

As noted in the March 2013 JART report,[23] which reviewed the studies submitted by Dufferin Aggregates in support of its application to permit expansion of the Acton Quarry, there have been numerous complaints from nearby residents about well-water quantity and quality:

> *Private well-related concerns have been raised by some local residents since the mid-1990s and were again re-iterated at the September 26, 2012 public meeting at Halton Region and in correspondence with the Agencies regarding the proposed expansion. The comments ranged from general concern with the potential impacts of the proposed expansion on private water supplies to specific concerns that historical impacts on private wells are related to the existing quarry.*
>
> *Specific private well-related concerns have mainly been clustered around the homes to the east of the Dufferin-owned lands along Fourth Line. Between 17 Sideroad and the rail line to the north, private wells are typically bedrock wells drilled into the Cabot Head and Queenston Shale formations, with some using the Reynales or Whirlpool formations as a source of water. In general, well-related complaints have been attributed to the relatively poor capacity of the shale bedrock formations to provide sufficient capacity to be used as a reliable source of water, particularly under drought conditions. Water quality-related issues have generally been related to the operation of the private wells resulting in excessive drawdown during dry periods and resulting in degradation of the shale bedrock when exposed to air causing sediments in well water [p. 41].*

According to a January 26, 2010 article in the Independent Free Press,[24] the Lister family, who reside on a farm on Fourth Line 1,800 metres from the existing quarry and 1,850 metres from the extraction limit of the quarry extension (expansion),[25] complained that

> *their farm has been experiencing water shortage problems since 2005 when the quarry stopped pumping water into the southern pond. At that time she said their water supply changed. Over the past two years she said they have had to have water delivered every two days, which Dufferin [Aggregates] has paid for.* [underscoring added]

Other complaints relating to well issues and water quality and quantity by nearby residents are described as follows:

---

[23] JART REPORT, March 2013, http://webaps.halton.ca/Planning/Dufferin%20Aggregates%20Acton%20Quarry/Joint%20Agency%20Review%20Team%20(JART)/Final%20JART%20Report%20(March%202013).pdf.

[24] "Dufferin seeking to expand Acton quarry," https://www.theifp.ca/community-story/5358737-dufferin-seeking-to-expand-acton-quarry/.

[25] Dufferin Aggregates, OMB Case No. 15-137, August 26, 2016, para. 113.

> *Dufferin responded to one complaint received in regards to the Acton Quarry (ARA 5492) in 2012 relating to "cloudy water". Although their investigation did not determine the exact cause of "cloudy water", Dufferin installed a water storage tank and filtration system to prevent similar issues in the future [p. 5].*[26]
>
> *I've lived on the Fourth Line for approximately 13 years…Eight years ago [c.2004] we lost all our water, our well collapsed and its 200-foot well is full of 100 feet of sand*[27] *[Steve Hepman September 27, 2012]]*
>
> *This is a 1,500 gallon [plastic] water tank that the quarry has installed for us because several weeks ago on a Thursday we ran out of water. What came out of our taps was sand and sludge. We were told not to drink the water from the well because it could be contaminated. Now that has an impact on all of us. As you can see we have three children here. Three young people that need water.*[28] *[Pat Bonozew, Fourth Line Resident, December 3, 2012]* [underscoring added]

According to a representative of Dufferin Aggregates addressing residents at a December 10, 2012 public meeting,[29] Acton Quarry confines monitoring of ground water impacts caused by dewatering to a radius of 200 metres, which appears to be an inadequate cone of influence given that *water quantity and quality* complaints have been received from residents residing beyond the 200 metre radius chosen by Acton Quarry.

> *Dufferin Aggregates does not measure impact on the ground water outside 200 metres around the quarry boundary [p. 4].*

Maintaining the water allocation between the Credit River and Sixteen Mile Creek watersheds requires perpetual (i.e., forever) pumping (dewatering) at the Acton Quarry,[30] and, in the event of mechanical failure, the environmental consequences could be catastrophic.

> *The [JART] peer review team reiterates that perpetual pumping will be required to maintain the present allocation of flow between the Sixteen Mile Creek and Credit River watersheds. Without permanent active management, all surface and groundwater flows towards the existing quarry, and the proposed extension would be directed to the Credit River watershed.*
>
> *As part of the on-going agreement negotiations CVC and Conservation Halton have agreed that an allocation strategy for discharge between the Credit River and Sixteen Mile Creek will be required. This allocation is proposed to become a requirement of the long term agreements relating to the project [p. 39].*

---

[26] Report No. – LP(6-15- State of Aggregate Resources within Halton Region, September 2, 2015. http://sirepub.halton.ca/councildocs/pm/18/Sep%202%202015%20Planning%20and%20Public%20Works%20LPS9615%20%20State%20of%20Aggregate%20Resources%20within%20Hal%20%20LPS9615%20State%20of%20Aggregate%20Resources%20within%20Halton%20Regiondoc%20188685.pdf

[27] https://www.youtube.com/watch?v=oQOdpZuSrik.

[28] https://www.youtube.com/watch?v=1FsyvMFVokg.

[29] https://www.dufferinaggregates.com/wp-content/uploads/2020/06/Meeting-Minutes-20.pdf.

[30] JART Report March 2013.

According to the Town of Halton Hills, third-party haulers at the Acton Quarry repeatedly circumvent the designated haul route, and

> *In 2018, the records identified 50 violations of improper use of Maple Avenue….Dufferin Aggregates provided a one-time contribution of $15,000 to the Town to hire an additional two students to monitor the haul route [p. 2].*[31]
>
> *The Town's survey results identified an average of 11 violations of 37 trips travelled by haul trucks on Maple Avenue that accessed Acton Quarry between July 25, 2017 and July 30, 2019. The Maple Avenue violation rate of 30 percent (%) is due to the private haulers accessing Acton Quarry [p. 2].*

The one-time token payment of $15,000 by Acton Quarry to the Town to hire two students to monitor the haul route does nothing to stop truckers hauling aggregate from circumventing the designated haul route, thereby exposing residents to dust, noise, increased traffic and potential motor vehicle accidents, problems which will continue to adversely affect the health and safety of residents in the community unabated while the quarry remains operational.

After Acton Quarry bought out the homeowners of the 13 residential properties on Third Line, with the last two buyouts occurring in January 2010, two reported complaints related to noise and/or vibration from the blasting at the quarry were received even though the blasts were conducted within regulatory limits.

> *…[T]wo blast-related complaints (noise and/or/vibration) were received from local residents in 2014 [p. 6].*[32]

In a promotional Case Study of the Acton Quarry posted on the internet,[33] Orica Mining Services (Orica), the blasting contractor, cites testimonials received from Acton Quarry applauding the benefits of less downtime and more productivity (enhanced profitability) from larger blasts at the Acton Quarry, while externalizing costs on unwitting and innocent third-party homeowners, and ignoring to mention the adverse effects that blasting has had on the environment and neighbouring residents. **No neighbouring residents are cited as being thankful for the larger blasts at the Acton Quarry**. Of course, the Case Study fails to mention the consequences to the residents living nearby that the increase in blasting power causes problems such as higher ground vibration, airblast and flyrock.

> *The larger the blast, the less downtime and more productivity for the quarry. We went from single row blasts to 3 rows. The digging is good and we have less oversize. It's working out. And we're significantly below compliance even with the larger blasts.*

---

[31] Dufferin Truck Monitoring Station Update, August 13, 2019. https://pub-haltonhills.escribemeetings.com/filestream.ashx?DocumentId=6946.

[32] Report No. – LP(6-15- State of Aggregate Resources within Halton Region, September 2, 2015.

[33] Case Study – Reducing Community Impact while increasing Productivity with Larger Blast Sizes, Acton Quarry, Canada, http://www.oricaminingservices.com/uploads/Fragmentation/quarries/100034_Case%20Study_Reducing%20Community%20Impact%20while%20Increasing%20Productivity%20with%20Carer%20Blast%20Sizes_Acton%20Quarry_English.pdf.

> *We can shoot more pounds per delay, we can expand the pattern, so we save on drill costs, we save on not having to deck as much, and we get better fragmentation because of the accurate timing we can put in.* [Assistant Director of Operations Acton Quarry]
>
> *Before we were shooting every day and we had to shut down the operation for 45-60 min. in peak production time. Now if we can shoot once a week or every 5 days and it's a big plus for us.* [Quarry Manager Acton Quarry]
>
> *If we can put a week's worth of production on the ground with one blast, compared to blasting every day, there's 3 to 5 hours of down time saved every week.* [Quarry Manager Acton Quarry]

Orica is the same blasting contractor responsible for the May 4, 2007 blast at the Pattersonville quarry that launched flyrock debris 526 feet (160 metres) onto New York State Thruway I-90, striking two vehicles and a charter bus, and injuring two people, one of whom was a teenage passenger on the charter bus that was penetrated by a 100-pound boulder.[34]

> *On May 4, 2007, the shot was laid out by Orica and drilled by Archibald Drilling. Flyrock from the blast traveled approximately 526 feet onto the New York State Thruway, I-90, striking three separate vehicles. A charter bus traveling west was struck by a rock measuring approximately 16-inches by 12-inches and weighing approximately 100 pounds. The flyrock passed through the roof of the bus and struck a teenage passenger. A passenger car traveling east was struck in the driver's side windshield, striking the operator in the abdomen. A third vehicle received a broken windshield and dents to the hood.*

Buying out homeowners that are as far as approximately 1,509 metres from a quarry blasting below the water table speaks to the far-reaching significant and sometimes catastrophic adverse effects on the environment and neighbouring community, including the health, safety and welfare of its residents, pets and livestock, and their quality of life.

Demolition of the homes on Third Line, accompanied by the loss in market value of the remaining homes in the community surrounding the Acton Quarry, has eroded the municipality's tax base, a loss that will continue for as long as the blasting quarry remains operational.

In 2017, the Ontario Aggregate industry launched an industry-wide assessment appeal that resulted in the reclassification of aggregate pits from *industrial* to *Class 5 farm land*,[35] retroactive to 2009,[36] **shifting the realty tax burden without compensation to homeowners (for the life of the quarry operation)** and causing a substantial hardship on municipalities such as Halton Hills, with a number of Licensed Aggregate Sites and a small 2016 population base of approximately 61,200 residents.

---

[34] MSHA Contest Proceeding, May 26, 2010, https://fmshrc.gov/decisions/alj/Yk2007-74o.htm.

[35] Canada Land Inventory System Soil Classification defines *Class 5* as "Soils have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible."

[36] https://www.gottarent.com/news-story/7312110-settlement-to-cost-ontario-s-municipal-taxpayers-millions-as-gravel-pits-get-huge-tax-break/.

The Town of Caledon was the lead municipality in the scheduled assessment appeals before the Assessment Review Board. MPAC had applied an industrial land rate of $75,000 per acre to 846 acres of extraction lands in the Town of Caledon, while the appellants argued for agricultural land rates of $8,000 to $12,000 per acre. The details of the settlement reached in the Aggregate Property Assessment Appeals are contained in a November 17, 2020 memorandum addressed to Members of Caledon Council.[37]

> *For the 2009 – 2012 assessment cycle, aggregate/gravel pit property owners, supported by the Ontario Stone, Sand and Gravel Association (OSSGA) filed assessment appeals across the province. These appeals then carried forward to the 2013-2016 assessment cycle as they remained unresolved by the close of 2012. The property assessments of fourteen of the twenty-five gravel pits in the Town of Caledon were appealed, with two of these appeals going back to 2006. The initial valuation proposal put forth by the OSSGA was $8,000 to $12,000 per acre. Aggregate properties in Caledon were assessed at $75,000 to $101,000 an acre for 2009-2012 and $60,000 to $92,000 an acre for 2013-2016….*
>
> *For the current property assessment years between 2017-20, gravel pit assessments are now based on class 5 farm land rates and cap out at $15,000 per acre. That represents a significant hit to all affected municipalities and their taxpayers*. [underscoring added]

According to the Town of Caledon,[38] the Town's portion of the annual revenue tax loss stemming from the reclassification of gravel pits to farmland (class 5) is estimated at $270,000, which, over an assumed average quarry life of 40 years, results in a total revenue tax loss of $10,800,000 ($270,000 × 40 years), without taking into account inflation, the burden of which will fall on the shoulders of the residents of Caledon, in the form of higher property taxes.

> *According to Wendy O'Donnell, Manager Halton Hills, in addition to annual revenue losses – which have already been accounted for – town staff determined the settlement for Halton Hills pits alone would cost municipal taxpayers in Halton Region a total of $2,010,750.56 in back taxes to be refunded….*
>
> *The hit just for Halton Hills taxpayers based on seven listed pits in the report clocks in at $671,442.26 – all to be paid back to the pits in question for past taxes no longer applicable based on the settlement.*
>
> *The MPAC assessment settlement, which was explained to Halton Hills council in a presentation by MPAC reps at its May 9 meeting, drew understandable consternation from the mayor and all councilors present….*
>
> *"We have nine (gravel pits and quarries)…" said the mayor [Rick Bonnette], adding the tax revenue gained by allowing aggregate pits following this decision is becoming so small as to call into question the value of even allowing new ones*. [underscoring added]
>
> *A number of other councilors echoed those same concerns, pointing out the environmental impact of aggregate extraction and cost of road maintenance to accommodate the heavy trucks needed to transport the extracted materials*. [underscoring added]

---

[37] November 17, 2020 Memorandum, https://pub-caledon.escribemeetings.com/filestream.ashx?DocumentId=11838.

[38] May 13, 2013, Town of Caledon letter regarding Assessment Appeals of Gravel Pit Properties, https://www.peelregion.ca/council/agendas/pdf/rc-20130613/communication-ma-d1.pdf.

> *According to Somerville, the one-time hit of $670K and the loss of annual tax revenue is going to hit property taxes for local residences and business, who will be required to make up the shortfall.* [underscoring added]
>
> *"I don't think it's right, but I think we're stuck with it," added Councillor Jane Fogal.*

According to the 2020 Provincial Policy Statement, under **Part V**: **Policies (1.0 Building Strong Healthy Communities)**

> *Ontario is a vast province with urban, rural, and northern communities with diversity in population, economic activities, pace of growth, service levels and physical and natural conditions. Ontario's long-term prosperity, environmental health and social well-being depend on wisely managing change and promoting efficient land use and development patterns.* ***Efficient land use and development patterns support sustainability by promoting strong, liveable, healthy and resilient communities, protecting the environment and public health and safety****, and facilitating economic growth.* [emphasis added]

How a quarry blasting below the water table that causes numerous *adverse effects*, leading to the destabilization of a community, can possibly be consistent with the Province's policy objective of *building strong healthy communities* remains a mystery.

As implausible, ironic and arrogant as it seems, in 2014, Dufferin Aggregates "earned the prestigious Environmental Achievement and Community Relations Award," from the Ontario Stone, Sand & Gravel Association (SOSGA), a self-serving lobby group of the aggregate industry.

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Flyrock: The Ultimate Adverse Effect From Quarry Blasting Operations & The Need For Adequate Setbacks (30-Dec-20)

For previous research papers see:

https://intval.com/articles/Flyrock-and-Other-Impacts-from-Quarry-Blasting-Operations.pdf

https://intval.com/articles/Flyrock-and-Other-Impacts-Supplement-1.pdf

https://intval.com/blasting-quarries- -setbacks/

TABLE OF CONTENTS

SECTION I 3

Introduction 3
Why Is Flyrock So Dangerous? 4
Flyrock Is Inevitable Wherever Rock Is Blasted 6
Zero Tolerance of Flyrock – Blasting's Ultimate Adverse Effect 8
Flyrock Statistics Cited by Different Sources 10
Examples of Flyrock's Greatest Hits! 13
Examples of Known Repeat Flyrock Offenders 16
Quarry Operator Must Compensate All Residents Within 500 Metres to Relocate and Avoid Potential Dangers of Flyrock 17
Majority of Complaints Over Blasting Quarries Within 500 to 700 Metres 17
Study of Impacts of Opencast Blasting Operations 18
Effects of Blasting on Domestic Animals 19
Quarry Operator Denied Permit Due Mostly to Concerns Over Flyrock 19
Quarry Blast Mistaken for Earthquake Caused Significant Damage 21
Quarry Explosion Damaged Numerous Homes 22
Quarry Explosion Caused Massive Destruction of Houses 22
Quarry Blast Damaged Neighbouring Homes & Operator Agrees to Compensate Homeowners 23
Quarry Blast Damaged Dozens of Homes 24
Quarry Employees' Negligent Blasting Damaged Twenty Homes and No Insurance Coverage Available 26
Quarry Blast Killed At Least Eleven Employees, Destroyed Equipment and Damaged Houses Far Removed From The Quarry 27
Quarry Financially Responsible For Soil Erosion of Nearby Infrastructure, and Relocation of Two Residents 28
Quarry Explosion Damaged Nearby School and Caused Hospitalization of Thirteen Students, Three in Critical Condition 28
Quarrying Without an Adequate Setback from Road Caused $40 Million in Damages 29
Analysis of Flyrock Distances 30
Setbacks or Buffers the Only Effective Mitigation Measures Against Flyrock (The Ultimate Adverse Effect) 31
Municipality Cannot Ignore Competing Community Interests 37
Recommended Minimum Setback Requirements for Blasting Quarries 41

SECTION II 42
Flyrock 76 42
Flyrock 77 42
Flyrock 78 (27 & 49) 43
Flyrock 79 43
Flyrock 80 43
Flyrock 81 43
Flyrock 82 44
Flyrock 83 44
Flyrock 84 45
Flyrock 85 (& 52) 45
Flyrock 86 46
Flyrock 87 47
Flyrock 88 47
Flyrock 89 47
Flyrock 90 48
Flyrock 91 49
Flyrock 92 50
Flyrock 93 50
Flyrock 94 51
Flyrock 95 52
Flyrock 96 52
Flyrock 97 52
Flyrock 98 53
Flyrock 99 54
Flyrock 100 54
Flyrock 101 55
Flyrock 102 57
Flyrock 103 57
Flyrock 104 58
Flyrock 105 58
Flyrock 106 59
Flyrock 107 60

SECTION I

Introduction

Blasting is an ultrahazardous, abnormally dangerous activity. It has been identified as "intrinsically dangerous," because of the impossibility of *predicting with certainty the extent or severity of resulting consequences* rendering blasting ultrahazardous.[1] Ultrahazardous activities are also known as *abnormally dangerous* activities. No amount of reasonable care can "eliminate the risk of serious harm" accompanying an ultrahazardous activity such as blasting.[2]

Blasting quarry operations cause many adverse effects, one of which is *flyrock*. According to the research conducted, *flyrock* is considered the *ultimate hazardous effect* of blasting rock. Flyrock is any material propelled from a rock blasting operation. Most people have never heard of flyrock, and yet it is the most dangerous aspect of blasting rock.

> ***Flyrock is the dirty little secret of the aggregate industry and the explosives engineers acting on its behalf, and they have done a remarkable job of concealing it from the public!***

"Reports of flying rock incidents of stone quarries are a fairly common occurrence, according to Petrie" (District Manager of the Mining Safety and Health Administration in Warrendale, Pa) (Flyrock 62 – August 22, 2018)

According to *Blanchier*,[3] the risk and adverse effects of flyrock associated with quarry blasting is seldom or properly addressed as part of the investigations and studies undertaken in support of an application for a licence to permit quarry operations, even though flyrock is considered a greater hazard than vibrations or airblast:

> ***Accidental flyrock in blasting operations has a major impact on the external environment…due to the hazards involved and is more significant than vibrations or airblast….[E]ven if it is normal practice in these zones to take into account the impact of possible vibrations and even the effects of airblast when modeling the project, flyrock risks are not dealt with in initial studies, other than by way of integrating general safety distances. These risks are only sometimes taken into account much later in the operation and most often, following an accident or significant flyrock being recorded externally [off-site] [p. 549].*** [emphasis added]

An explosives engineer that is a member of the *Professional Engineers of Ontario* and that fails to address flyrock in a meaningful way (with an abundance of caution) in a **Blasting**

---

[1] *Guilford Realty & Insurance Co. v. Blythe Bros. Co.*, 131 S.E.2d 900 (1963) 260 N.C. 69. See also *Humphrey Land Investment Co. v. Resco Prods.*, 19-76 (N.C. Ct. App. 2019) for a discussion of "strict liability" applied to actionable harms proximately caused by blasting. https://scholar.google.com/scholar_case?case=15464038202938224374&q=flyrock&hl=en&scisbd=2&as_sdt=2006.

[2] See *Woodson v. Rowland*, 407 S.E.2d 222 (1991) 329 N.C. 330, at 350, 407 S.E.2d at 234.

[3] A. Blanchier, "Quantification of the levels of risk of flyrock," Rock Fragmentation by Blasting: The 10th International Symposium on Rock Fragmentation by Blasting, 2012 (Fragblast 10); Leiden: 549-553.

Impact/Assessment Report points to violations of the association's *Code of Ethics*, in particular,

2. *fidelity to public needs*
3. *devotion to high ideals of personal honour and professional integrity*
4. *knowledge of developments in the area of professional engineering relevant to any services that are undertaken*
5. *competence in the performance of any professional engineering services that are undertaken*

As to the omission of addressing **flyrock** in a **Blasting Impact/Assessment Report**, it also points to **negligence** and **professional misconduct** under the *Professional Engineers Act, R.S.O. 1990, c. P.28*:

> *"negligence" means an act or an omission in the carrying out of the work of a practitioner that constitutes a failure to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances. R.R.O. 1990, Reg. 941, s. 72 (1); O. Reg. 657/100, s. 1 (1).*
>
> *"professional misconduct" means,*
>
> *a) negligence,*
> *b) failure to make reasonable provision for the safeguarding of life, health or property of a person who may be affected by the work for which the practitioner is responsible.*

In a July 27, 2020 letter to the International Society of Explosives Engineers (ISEE),[4] the Pennsylvania Regulator (Chief, Explosives & Safety, Department of Environment Protection, Bureau of Mining Programs) points out that blasting is an "ultrahazardous activity" and that "flyrock is an inherent risk of blasting":

> *Blasting is an ultrahazardous activity and is regulated as such. Flyrock is prohibited. Flyrock is a serious violation and appropriate enforcement action will be taken in each case. All blasting in PA must be authorized by DEP permits. The activities conducted on those permits should not be a danger to the public or their property.*

Why Is Flyrock So Dangerous?

Wherever there is blasting of rock, flyrock can occur, and, no matter how well a blast is executed, the consequences of flyrock are unpredictable. Flyrock can launch in any direction at great speed, and flyrock debris can shower a large area. Flyrock comes in all shapes, sizes and weights. Flyrock has the potential to damage the environment and personal and real property, and injure and kill people, livestock and wildlife.

> ***Flyrock has killed and injured people.*** *Flying material, both within the blast area and outside it, is responsible for over half of all blasting –related injuries and fatalities. MSHA (Mine Safety and Health Administration) records from 1994-2001 show that in surface mining, 32 people were killed or badly hurt because the blast area was not cleared. Another 17 people were injured or killed by rocks that were thrown outside of the blast area. This total (49 people) is greater than the combined total of the other blast accident causes in mining (premature blast, transporting explosives, fumes, and misfires). Flyrock is a potential hazard anytime and anywhere there is blasting [p. 1].*
>
> *Flyrock can be as small as marbles or as large as a car. It is propelled with great force. Flyrock may come from high in the air, roll down a hillside, or come straight at you like a bullet. That is why the blaster places guards at entry roads around the area where rocks might fly—to keep people out and*

[4] https://www.easternpaisee.com/letter-from-the-chief-on-flyrock/.

protect workers from death and injury. Yet people have still been killed inside [and outside] the blast area…[p. 7]. [underscoring added]

What is the danger from flyrock? *Flyrock can come at you from any direction. Flyrock can be thrown high like a fly ball, fly straight like a fastball, roll along the ground, or ricochet from any direction. Flyrock can be gravel, rocks, tree trunks, construction materials, mud—even water [p. 3]….* [underscoring added]

What causes flyrock? *Sometimes problems occur during blasting. There may be a hidden crack below ground that the blaster fills with too much explosive. The blaster may think that he or she has to break a lot of tough granite, when really there is soft dirt from old diggings. The blast crew may have made a mistake and not loaded enough stemming. A mud seam below ground may not have been reported by the driller. These things seldom happen. But when they do, there is going to be flyrock—debris that travels beyond the guarded area…[p. 7].*

Flyrock is totally unexpected. *"I had shot a dozen of these. Each of them went 'poof.' The ground rose up and fell down. Just 'poof.' One of the regulars was standing by his door, just inside the blast area. I told him he had to go inside. He said, 'don't worry, nothing will happen.' I said, 'I know that, but you will have to go inside anyhow.' He fussed and we discussed, but in the end he went inside. We shot it, and it blew all over the place. There had been a water line there beside the hole, must have been decades ago. So the earth was not the hard rock that we expected. And it blew. Rocks landed right beside the door where the man had been standing. Had he stayed there, he would have been hurt.' –J.E., a Kentucky blaster [p. 3].*

Flyrock is fast. *On a Friday evening in 1994, two blast crew members were 236 feet [72 metres] away from the blast. The crew saw the flyrock coming toward them as soon as they set off the shot. They turned and ran to a pickup truck that was just 10 feet away. They did not make it. The survivor heard the flyrock hit the pickup truck and the ground. Then he saw his partner beside the pickup truck lying face down with blood coming out of his nose and ear. His hardhat was dented by the flyrock. He never regained consciousness [p. 3].*

Flyrock can travel beyond the blast area. *It can travel far and high. In July 2002 in West Virginia, rocks traveled one-half mile. One rock the size of a football smashed into the cab of a contractor's truck. It went through the front windshield, between a trucker and his supervisor and out the back. They were outside the blast area thought they were "safely" watching. They were lucky—they were not hurt [p. 5].*[5]

*[**Flyrock is Powerful.** The ISEE (International Society of Explosives Engineers) Blaster's Handbook states that each pound of explosives has the force of 76 million horse-power. An 8 ½-pound piece of fly-rock traveled 1,200 feet (366 metres) from the blast and with enough force to dent the roof of a truck. The dented roof killed the worker.]*[6]

[5] National Institute for Occupational Safety and Health (NIOSH), 2019, https://www.cfins.com/wp-content/uploads/2019/01/blasting-safety-worker-alert.pdf.

[6] "Tool Box Lesson A – What is Flyrock?" NIOSH, https://www.cfins.com/wp-content/uploads/2019/01/blasting-safety-toolbox-complete.pdf.

Flyrock Is Inevitable Wherever Rock Is Blasted

Many explosives experts and authors have commented on the inability to control the throw of flyrock, which is a natural phenomenon whenever explosives are used to blast rock.

- Flyrock can still be generated even in the best-designed blast (Slide 19, Power Point Presentation 2015).[7]
- Flyrock can never be completely eliminated (Surface mineral workings: control of blasting, 2000).[8]
- The detrimental effects of flyrock are unavoidable and cannot be completely eliminated… (Ghasemi et al, 2012)[9]
- Flyrock is a hazard that operators try to minimize but is always present (Ormerod, 2019).[10]
- Flyrock is an undesirable phenomenon in the blasting operation of open pit mines (Amini, et al, 2011).[11]
- Flyrock is a concern for both researchers and blasting engineers as it is a random phenomenon. However, it has received relatively little attention from researchers due to the complex nature of the interaction between blast design and rock parameters (Raina, et al., *2011)*[12]
- Danger and damage from flyrock in rock blasting has been a serious problem ever since blasting was introduced. Not only have men been killed and injured but also buildings, equipment and materials have been damaged (Lundborg et al. 1975).[13]
- The phenomena of flyrock are always uncontrolled and can never be brought down to zero (Singh, eta al, 2014).[14]
- Flyrock due to blasting in opencast mines is complex in nature as it is a random phenomenon.[15]
- "You can never say never." No matter how careful a blaster is there is no certainty a blast will not cause flyrock. (Tim Rath, Green Mountain Explosives, Testimony at Rivers Quarry Application Hearing)[16]

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[7] current developments in quarry blasting - e-library WCL.
[8] https://www.gov.scot/publications/blasting-surface-mineral/.
[9] http://tarjomefa.com/wp-content/uploads/2016/05/4695-English.pdf.
[10] https://envirosuite.com/news/kaboom-what-happens-around-a-blast-after-it-goes-off.
[11] file:///C:/Users/Windows%207%20PC/Downloads/Evaluationofflyrockphenomenonduetoblastingoperation%20(1).pdf.
[12] Raina, A.K., Chakraborty, A.K., Choudhury, P.B. *et al.* "Flyrock danger zone demarcation in opencast mines: a risk based approach," *Bull Eng Geol Environ* **70,** 163–172 (2011). https://doi.org/10.1007/s10064-010-0298-7.
[13] A. Aghajani-Bazzazi, M. Osanloo and Y. Azimi, "*Flyrock prediction by multiple regression analysis in Esfordi phosphate mine of Iran,"* © 2010 Taylor & Francis Group, London, file:///C:/Users/Windows%207%20PC/Downloads/074.pdf
[14] https://www.researchgate.net/profile/Avtar_Raina/publication/264560232_Prediction_of_blast-induced_flyrock_in_Indian_limestone_mines_using_neural_networks/links/5539cf9e0cf247b8588148a8/Prediction-of-blast-induced-flyrock-in-Indian-limestone-mines-using-neural-networks.pdf.
[15] R. Trevidi, T.N. Singh and A.K. Raina, *"Prediction of blast-induced flyrock in Indian limestone mines using neural networks,"* Journal of Rock Mechanics and Geotechnical Engineering 6 (2014) 447-454.
[16] http://www.killthealbionquarry.org/DEATH-FROM-THE-SKY-FLYROCK.html.

- Rivers' blasting expert cannot guarantee that flyrock will not leave the Rivers parcel, regardless of what precautions are taken to minimize the risk (Cross Exam of Rath 12/15/2008).[17]
- Every borehole is a separate detonation. This means that during every blast event (at the proposed Rivers' quarry) there would be 62 chances for flyrock from face burst, cratering, or stemming ejection. After every event, there will be an additional ten seconds or so when flyrock could rain down on neighboring homes, properties and Route 100B that could result in property damages, injury, or even death (Testimony of Art Hendrickson on 12/15/2008, para. 110).[18]
- Flyrock is a potential hazard anytime and anywhere there is blasting (MSHA, 2016).[19]
- Blasting is not an exact science (Scott Parker, expert blaster testifying on behalf of Director of Occupational Health and Safety, para. 23).[20] (Flyrock 20)
- "There is no technology to identify anomalies in rock such as mud seams or voids. 90% of all fly rock incidents are unexplainable." (Testimony of expert at hearing investigating flyrock incidents at Pakenham Quarry)[21] (Flyrock 18)
- Mining and quarrying are high-risk activities. Misfires and fly rock are common hazards associated with shot firing [blasting] activities, which are routinely undertaken in these industries. (WorkSafe Victoria safety alert published September 7, 2020)[22]
- Flyrock meets the Ontario EPA definition of contaminant, and the adverse effects of "flyrock" are not trivial.[23] (In *Castonguay Blasting Ltd. v. Ontario (Environment)*, [2013] 3 SCR 323, 2013 SCC 52 (CanLII), the Supreme Court held that "the flyrock could easily have seriously injured or killed someone.")
- According to Section 21.66 (1) of the Occupational Health and Safety Act (OSH), B.C., a blaster must take precautions against *flyrock*, which is referenced as "flying" material.[24]
- In April 2015, WorkSafeB.C. suspended the blaster's permit after a flyrock incident rained rocks on a Colwood Neighbourhood, including a 17-pound rock that smashed through a couple's bedroom ceiling and broke their bed frame.[25] (The company doing the blasting for Colwood's Allandale Pit received three penalties from WorkSafeB.C. within three years for violations related to flyrock.)

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[17] http://www.killthealbionquarry.org/flyrock_danger.pdf.
[18] "Blasting and Flyrock," http://www.killthealbionquarry.org/flyrock_danger.pdf.
[19] https://www.msha.gov/news-media/announcements/2016/03/24/flyrock-dangers-best-practices.
[20] *Director of Occupational Health and Safety v. Government of Yukon, William R. Cratty and P.S. Sidhu Trucking Ltd.*, 2012 YKSC 47 (CanLII), <http://canlii.ca/t/fs6vt>, retrieved on 2020-11-16. "The whole purpose of the *OHS Act* is to promote safe practices in the workplace at all time. This includes safety for members of the public that are in proximity to the workplace [para. 46]."
[21] Quoting from http://sg.crcrockwood.org/wp-content/uploads/2019/03/Flyrock-FAQ-True-and-False.pdf.
[22] https://www.aggregateresearch.com/news/state-investigates-quarry-blast/.
[23] The EPA "Land Use Compatibility Definitions" defines **"Trivial Impact"** as "present or predictable contaminant discharges which are or are likely so minor that there would not be an 'adverse effect." Wherever and whenever rock blasting occurs (i.e. proposed blasting quarry), "flyrock" is inevitable.
[24] https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-21-blasting-operations#SectionNumber:21.66.
[25] Kyle Esser, "Blaster has permit suspended after rain of rocks in Colwood," Times Colonist, April 16, 2015, https://www.timescolonist.com/news/local/blaster-has-permit-suspended-after-rain-of-rocks-in-colwood-1.1825157.

- Flyrock incidents occur wherever there is hard rock mining, and involves the uncontrolled propelling of rock fragment produced by blasting.[26]
- Flyrock occurrence and damage are unambiguous and cannot be disputed.[27]
- Despite the considerable progress made over the last three decades, significant challenges for wholly omitting of unwanted flyrock phenomenon, injuries, and fatalities still exist.[28]

Zero Tolerance of Flyrock – Blasting's Ultimate Adverse Effect

According to Lundborg (an engineer specializing in blasting), people should never be exposed to flyrock. Similarly, national laws in Chile relating to workplace safety require that workers never be exposed to flyrock. This requires that the probability of flyrock be zero for personnel (and non-personnel) located outside the Personnel Clearance Distance (blast area) for all blasts.[29] Likewise, Kentucky's Energy and Environment, Department for Natural Resources, has expressed a zero tolerance for flyrock incidents:[30]

> *The Department for Natural Resources believes that one flyrock event is too many, and to that end, has prepared this RAM [Reclamation Advisory Memorandum] to further define steps this Department will require of the coal industry in eliminating flyrock events.*
>
> *'Flyrock' is defined as 'blasted material cast into the air, or traveling along the ground, that is cast from the blasting site more than half the distance to the nearest dwelling, public building, school, church, commercial, community or institutional building; or any occupied structure; or that is cast beyond the permit boundary.'*
>
> ***Flyrock events historically have not been limited to blasting operations within the distances which require the submission and approval of an 'anticipated blast design'…prior to blasting. Rather, flyrock events occurred and impacted dwellings, vehicles, persons, animal life, and other physical structures thousands of feet from the blast site resulting in death and the destruction of property***. [emphasis added]

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[26] C. L. Eze and U. U. Usani, "Hard Rock Quarry Seismicity and Face Bursting Flyrock Range Prediction in the Granite and Migmatites Rocks of North Central Nigeria," *C. L. Eze Int. Journal of Engineering Research and Applications*, Vol. 4, Issue 12 (Part 2), December 2014, pp. 01-06, http://www.ijera.com/papers/Vol4_issue12/Part%20-%202/A412020106.pdf.

[27] T. N. Little & D. P. Blair, "Mechanistic Monte Carlo models for analysis of flyrock risk," *Rock Fragmentation by Blasting: 9th Int. Sym. On Rock…*

[28] Hasel Amini, Raoof Gholami, Masoud Monjezi, Seyed Rahman Torabi and Jamal Zadhesh, "Evaluation of flyrock phenomenon due to blasting operation by support vector machine," *Neural Computing & Applications*, May 2011, file:///C:/Users/Windows%207%20PC/Documents/Evaluation%20of%20flyrock%20phenomenon%20due%20to%20blasting%20operation%202011%20Amini%20et%20al.pdf.

[29] *"Flyrock – A Basis For Determining Personnel Clearance Distance And Quantifying Risk of Damage to Equipment,"* scribd.com.

[30] "Reclamation Advisory Memorandum," https://eec.ky.gov/Natural-Resources/Mining/Mine-Permits/RAMS/RAM140.pdf. "During calendar year 2007, the Commonwealth of Kentucky had a [known] total of thirteen (13) flyrock events on surface coal mining sites, include one (1) that resulted in a fatality. To date [July 18] there have been nine (9) [known] flyrock events, including one (1) that resulted in a minor injury that very easily could have resulted in a fatality."

In response to a spike in flyrock incidents, the Queensland (Australia) Government issued a safety bulletin in February 2009,[31] which, in part, states:

> ***In the past few months, there have been some very serious incidents reported from the coal mines of the Bowen Basin, North Queensland and from quarries around Brisbane. All of these could well have ended up with very serious or fatal results. Significant damage to property and structures has also been reported. The frequency of these [flyrock] incidents has reached a point where it is well beyond acceptable limits***. [emphasis added]
>
> *Flyrock is an integral part of blasting. However, uncontrolled or unexpected flyrock that is projected past a defined safety zone is not acceptable. It is well known that rock and/or debris can be thrown over a kilometre from the blast site, and in a recent case rocks travelled approx 1.3km [1,300 metres].*

According to Eloranta, past president and former vice-president for technical matters for the International Society of Explosives Engineers (ISEE), ***"[a]ny amount of flyrock is unacceptable.***"[32]

> *…**[A]nyone involved in blasting is obligated to place safety above all other considerations, according to Eloranta. Even if blasts that launch life-threatening rocks into populated areas are rare, even if no one is injured, accepting that as inevitable is unethical***. [emphasis added]

The Mine Health and Safety Council (MHSC) of South Africa considers "flyrock" the ultimate adverse effect of blasting and must be avoided at all costs.

> ***Human response to flyrock is generally extreme. Apart from any consideration of damage, it is the only blasting-related hazard that can cause serious injury and death. It is the ultimate adverse effect of blasting and must be avoided at all costs***.[33] [Milestone 5, p. 31] [emphasis added]

Judge Moran, in a civil penalty proceeding[34] that alleged "[t]he fly rock prevention plan (general safety precautions) is not being complied with," was critical of the MSHA Secretary's 55-word submission (with unexplained reasons) ratifying a settlement agreement with the respondent (Kentucky Fuel Corporation) involving a serious flyrock incident at the Beech Creek Surface Mine, characterizing the submission as "making a mockery of the settlement review process." The judge rejected the settlement agreement, commenting as follows on the seriousness of the potentially fatal consequences of flyrock:

> *…[A]lthough all mine safety standards are important, the subject of blasting, an inherently dangerous activity, and the hazards of flyrock are particularly noteworthy and have been the subject of several cases and safety studies. Several litigated cases underscore the gravity associated with that activity and the importance that proper procedures be employed [p. 5].*

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[31] "Flyrock Incidents," https://www.dnrme.qld.gov.au/business/mining/safety-and-health/alerts-and-bulletins/explosives/flyrock-incidents2.

[32] Mark Fischenich, "Flyrock from any blast 'unacceptable,'" The Free Press, Oct 21, 2017, https://www.mankatofreepress.com/news/local_news/expert-flyrock-from-any-blast-unacceptable/article_8ad31cf8-b5cf-11e7-bf58-c3cdd328cf7f.html.

[33] https://mhsc.org.za/sites/default/files/public/research_documents/SIM140901%20Final%20Report.pdf.

[34] Federal Mine Safety and Health Review Commission, August 3, 2015, https://www.fmshrc.gov/decisions/alj/ALJo_8032015-KENT%202012-979%20Kentucky%20Fuel%20Corporation.pdf.

> *For example, in Revelation Energy, 36 FMSHRC 1581, 1587, 1600 (June 2014) (Judge Andrews), a violation of § 77.1000 was found to be significant and substantial where flyrock fell in an inhabited area approximately 1000 feet [305 metres] from a blast site….Similarly, in Central Appalachia Mining, LLC, 29 FMSHRC 430, 430-31 (June 2007) (Judge Barbour), flyrock from a highwall blast flew into the pit where miners were working. Vehicles were hit, and a miner suffered a compound fracture when his leg was hit. Id. at 433….In Lakeview Rock Products, 34 FMSHRC 244, 246 (Jan. 2011) (Judge Moran), flyrock penetrated the roof of a home located above the highwall and 600-700 yards [640 metres] away from the detonation site [p. 5].*
>
> *Beyond case examples, MSHA has issued blasting alerts addressing these issues. See, e.g., Blasting Safety Alert: 6 Fatalities from blasting accidents 2010-2013, http://www.msha.gov/Alerts/SAbulletins/BlastingAlert12014.pdf. Studies also warn of these hazards [p. 5].*

Tragically, the risks of flyrock are too often taken into account long after a blasting operation has been established, and is most often the result of a catastrophic flyrock event resulting in personal property damage, real property damage, personal injury or death, or a combination thereof.[35] "***Flyrock is an accident that needs to be considered before it happens*** *[p. 13]*."[36] [emphasis added]

Flyrock Statistics Cited by Different Sources

As acknowledged by *Raina et al.* in their February 2015 article,[37] "flyrock is one of the most contentious issues in bench blasting [and] has the propensity to cause fatality and severe injuries." Flyrock, arising from open-pit blasting, continues to elude explosives engineers, despite a reasonable understanding of throw [p. 660]. According to the article, the amount of research conducted on flyrock is "abysmal,"[38] and the percentage of accidents occurring due to flyrock justifies its importance irrespective of the fact that the problem is seldom reported.[39] Over various timeframes, the percentage of injuries attributed to *reported* flyrock incidents by the following authors ranges from 19.05% (Verakis and Lobb)[40] to 68.20% (Little)[41]:

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[35] Blanchier, A., "Quantification of the Levels of Risk of Flyrock," *Proceedings of the Thirty-Ninth Conference on Explosives and Blasting Technique* (pp. 17-20), St. Louis, MO: ISEE.

[36] Jackson, Brett Christopher, "Total Cost Optimization For Contour Blasting In The Appalachia Region," (2015). *Theses and Dissertations-Mining Engineering.* 20. https://uknowledge.uky.edu/mng_etds/20.

[37] Raina, A. K., Murthy, V. M. S. R. and Soni, A. K., "*Flyrock in surface mine blasting: understanding the basics to develop predictive regime,"* Current Science, Vol. 108, No. 4, 25 February 2015, https://www.currentscience.ac.in/Volumes/108/04/0660.pdf.

[38] Raina, A. K., Soni, A. K. and Murthy, V. M. S. R., "*Spatial distribution of flyrock using EDA: An insight from concrete model tests. In Rock Fragmentation by Blasting* (eds Singh, P. K. and Sinha, A.)," Taylor and Francis, London, 2013, pp. 563–570.

[39] Davies, P. A., "*Risk based approach to setting of flyrock danger zones for blasting sites*," *Trans. Inst. Mines Met.*, May–August 1995, 96–100.

[40] Verakis, H. and Lobb, T., "*Flyrock revisited an ever present danger in mine blasting*," 2007; http://docs.isee.org/ISEE/Support/Proceed/ General/07GENV1/07v109g .pdf.

[41] Little, T. N., "*Flyrock risk*". In Proceedings of EXPLO Conference, Wollongong, NSW, 3–4 September 2007, pp. 35–43, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-2570%2120191217T043417.551%20GMT.

Table 2. Accident statistics of reported flyrock cited by different authors

Reference	Period	Blasting injuries	Percentage of flyrock injuries in blasting related accidents
Mishra and Mallick[11]	1996–2011	30	24.19
Verakis[10]	2010–2011	18	38.00
Bajpayee *et al.*[9]	1978–1998	281	40.57
Verakis and Lobb[19]	1994–2005	168	19.05
Little[20]	1978–1998	412	68.20
Kecojevic and Radomsky[21]	1978–2001	195	27.69
Adhikari[22]	–	–	20.00

- More than 50% of the 103 accidents from different mining sites in United Kingdom during 1980-85 are reported to be due to flyrock up to distances ranging from 350 to 900 metres (Bandari, 1997).[42]
- According to a 2003 paper prepared on behalf of the International Society of Explosives Engineers (ISEE),[43] flyrock accounted for 21.5% of all blasting injuries in surface mining in the United States from 1994 to 2001.
- In China, flyrock accounts for about 27% of surface mine disaster events, as reported in a January 2020 article appearing in Journal of Mining and Environment (JME).[44]
- According to Dyno Nobel Americas, which participated in a 2008 "Blast Service Management" presentation, in one year they fire "approximately 100 blasts per day", reporting "approximately 150 [customer] flyrock incidents annually," while conceding that "many [flyrock] incidents aren't reported." In 2007, Dyno Nobel Americas had 32 flyrock incidents for 30,021 quarry blasts or 1.07 flyrock incidents per 1,000 blasts.[45]
- Davis (1995) considers under-reporting is responsible for five to ten times the actual number of [flyrock] incidents.[46]
- A North American study of 412 lethal and non-lethal accidents in 2001 found that 27.7% of these accidents were caused by wild flyrock outside the clearance zone and 45.6% were due to localized flyrock within the clearance zone.[47]

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[42] G.R. Tripathy and I.D. Gupta, "Technical Note on The Prediction and Control of Flyrock During Rock Blasting," *Central Water and Power Research Station,* Khadakwasla, India, https://www.isrmtt.com/wp-content/pdf/vol-10-2004/jan-2004-vol-10-no-2/g-r-tripathy.pdf.

[43] H. Verakis and T. Lobb, "An Analysis of Blasting Accidents in Mining Operations," *International Society of Explosives Engineers*, 2003.

[44] Norouzi Masir et al., *Journal of Mining & Environment, Published online*, retrieved 2-May-20 http://jme.shahroodut.ac.ir/article_1666_85bf4cbae3cc897226cce579c31233b3.pdf.

[45] "Blast Service Management, https://www.911metallurgist.com/blog/wp-content/uploads/2016/01/Blast-Service-Management.pdf.

[46] T.N. Little, "*Flyrock Risk*," EXPLO Conference, Wollongong, NSW, 3-4 September 2007, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-2570%2120191217T043417.551%20GMT.

[47] "Flyrock prediction? From mystery to science," Quarry, F10, 2014. https://www.quarrymagazine.com/2014/10/02/flyrock-prediction-from-mystery-to-science/.

- During 2019, the Tennessee State Fire Marshal's Office received 302 blasting complaints, of which 14 were for *flyrock*, accounting for 5% of the blasting complaints.[48]
- According to an 18-page March 2009 report issued by the Charleston Field Office of the Office of Surface Mining Reclamation and Enforcement (OSM), the OEB investigated "only 4 of 36 flyrock events during the period examined, from January 2004 to December 2007."[49]
- A failure to report or under-report flyrock incidents is a major safety concern of the European Federation of Explosives Engineers (EFEE), as expressed in its December 2016 Newsletter. [50]

  > ***The work of the EFEE's Environment Committee has shown in the last few months that it is still very difficult to obtain feedback about [flyrock] incidents or accidents occurring during blasting operations***.[emphasis added]
  >
  > *Although everyone agrees that this feedback is fundamental for preventing probable future incidents and therefore for risk management, the incidents and their causes are still badly indexed. However, civil society, elected officials and especially residents, increasingly demand that these [flyrock] incidents be accounted for by public authorities, companies, and sometimes request information directly via the press or television.*

- Canada does not track the number of flyrock incidents that have led to death or injury caused by blasting at surface mining operations. However, according to the National Institute for Occupational Safety and Health (NIOSH), flyrock at surface mining operations in the United States has killed or injured 311 people from 1978 to 2004.[51] NIOSH defines flyrock as,

  > *"**any debris that lands outside the designated blasting area. It can vary in mass from marble-sized to car-sized and can be incredibly dangerous and potentially fatal**."* [emphasis added]

According to *Raina et al*,[52] one of the major reasons flyrock incidents go unreported is to avoid disclosure of legal responsibility:

> *…[Flyrock] is known to have resulted in accidents ranging from serious injuries, fatalities, and damage to property – belonging and not belonging to the owner of the mine (Jenkins and Floyd, 2000; Rehak, et al., 2001; Bajpayee et al. 2002; Fletcher and D'Andrea, 1987; Verkis, 2011).*

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[48] 2019 Annual Report on Blasting Fines in Tennessee, https://www.tn.gov/content/dam/tn/commerce/documents/fire_prevention/posts/2019-BLASTING-COMMISSIONERS-REPORT.pdf.

[49] Ken Ward Jr., "Have a blast: OSM finds WVDEP lax in policing flyrock," Coal Tattoo, August 17, 2009, http://blogs.wvgazettemail.com/coaltattoo/2009/08/17/have-a-blast-osm-finds-wvdep-lax-in-policing-flyrock/#comment-17503.

[50] EFEE Newsletter, December 2016, https://efee.eu/wp-content/uploads/2016/12/2016-12-EFEE-Newsletter-3.pdf.

[51] Josh Cabel, "*NIOSH Offers Tips for Flyrock Safety*," EHSToday, January 25, 2007, https://www.ehstoday.com/construction/article/21911356/niosh-offers-tips-for-flyrock-safety.

[52] Avtar Krishen Raina, V.M.S.R. Murthy and Abhay Kumar Soni, "Relevance of Shape of Fragments on Flyrock Travel Distance: An Insight from Concrete Model Experiments Using ANN," *EJGE*, Vol. 18 [2013], Bund. E, 899-907, http://www.ejge.com/2013/Ppr2013.079alr.pdf.

Flyrock incidents still continue to happen (McKenzie, 2009; Amini et al. 2011; Stojadinovic, et al., 2011; Rezaei, et al., 2011; Kricak, et al. 2012).

One of the major constraints in the prediction of flyrock is non-reporting of such incidents (Davies 1995) for obvious legal reasons [p. 900]..

Examples of Flyrock's Greatest Hits!

Some of the more disturbing and fatal flyrock incidents, compiled from a variety of sources, are listed as follows:

- A quarry blast launched flyrock debris that shattered a NAPA auto parts store window and showered the customer parking lot, damaging cars, and flyrock debris crashed through the roof and landed in the bedroom of a home a half-mile (805 metres) from the blast. One man was injured by the flyrock debris and stitched up at the hospital.[53] (Flyrock 9 – May 21, 2015)
- A quarry blast launched flyrock that struck a resident on the head who was mowing grass on his property 930 feet (283 metres) from the blast, and he subsequently died from his head injuries (Flyrock 36 – July 11, 1990).
- A quarry blast launched an 82-pound boulder 402 metres that penetrated the roof of the porch of David Ross's residence and tore off the home's siding (Flyrock 58 – August 23, 2010).
- A large amount of flyrock travelled approximately 300 feet (91 metres) from the blast and struck a car on Interstate 75, and 16-year old Brian Agujar, a passenger in the car driven by his parents, was killed as a result of the flyrock impact (Flyrock 34 – June 4, 1993).[54].
- Flyrock debris was launched for a distance up to 200 metres from the rock face, killing a factory worker and injuring two others, and damaging several vehicles (Flyrock 48 – July 15, 2015).
- Flyrock fragments travelled approximately 1,586 feet (483 metres) from the blast striking and killing 40-year old Bobby Messer, a mechanic, and rocks hit and damaged the mechanic's truck (Flyrock 74 – July 16, 2007).
- Two employees were injured and a third employee had her arm severed below the elbow after being struck by baseball-sized rocks propelled 400 metres to 500 metres from the quarry blast (Flyrock 13 – September 26, 2011).
- A quarry blast launched flyrock debris into a residential neighbourhood that struck and damaged five properties (Flyrock 55 – November 27, 2019).

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[53] "A person who answered the phone at Loudoun Quarries on Thursday [May 21, 2015] said he was not sure whether the rocks came from their quarry, the only one in the area," https://www.washingtonpost.com/local/person-injured-after-flying-rocks-from-nearby-quarry-fall-on-home-in-sterling/2015/05/22/6170a84e-007d-11e5-8b6c-0dcce21e223d_story.html.

[54] The United States District Court for the Eastern District of Tennessee sentenced the blaster to 10 months, five to be served in a penitentiary and five months to be served under home detention (with electronic monitoring) followed by a year of supervised probation." The day shift superintendent was given an eight-month sentence. The company went out of business within four months of the blasting incident.

- A quarry blast launched flyrock debris more than 300 metres and caused widespread damage to the quarry plant, private cars and buildings within the complex, and three people were injured (Flyrock 27, 49 & 78 – January 10, 2006).
- A quarry blast showered flyrock debris over an area of 650 metres that struck and damaged three residences, primary school, tavern, saw mill and fish pond (Flyrock 61 – May 5, 2007). **The forensic investigation of this catastrophic flyrock incident "led to the conclusion that it was necessary to set the safe distance for residents at [a] distance [greater] than 700 metres."** [emphasis added]
- A quarry blast launched boulder fragments that struck and killed 10-year old M. Nandhini, and that struck and injured her brother Soundarrajan (Flyrock 68 – May 27, 2020).
- A quarry blast hurled hundreds of rocks, some the size of car tires, which sprayed a shopping centre, office complex and service station, and injured three people, one of them critically (Flyrock 64 – February 4, 2009). Police closed off roads littered with large chunks of rocks, and paramedics and emergency workers raced to treat the injured.
- A quarry blast launched flyrock debris, some of which bore through the roof of a house and struck and killed 36-year old Shupikai Chitsana, and her aunt was also struck by flyrock, but she survived her injuries (Flyrock 41 – August 15, 2019). Shupikai leaves behind her five children and husband.
- A quarry blast showered flyrock debris as far as 1,000 metres that damaged 18 cars and 14 factories, and injured 10 workers and residents in a housing estate and killed one factory worker in a factory penetrated by numerous rocks at a distance of 500 metres (Flyrock 12 – July 19, 2013). A team of 37 fire and rescue personnel carried out a search and rescue operation with the assistance of 16 policemen and TNB employees before declaring the area safe for the public.[55] [56]
- A quarry blast showered flyrock debris that damaged 14 pieces of parked equipment and several vehicles, injuring one person, and a 309-pound boulder was launched 250 metres (Flyrock 46 – 2008).
- A quarry blast showered flyrock debris 3,000' (914 metres) on an industrial park doing damage to a building and 11 vehicles in the Technica USA parking lot, and flyrock debris was showered 4,000' (1,219 metres) in another direction landing on a runway of West Lebanon Airport (Flyrock 24 – June 11, 2007).

[55] Edy Tonnizam Mohamad, Danail Jabed and Hossein Motaghedi, "*The Effect of Geological Structure and Powder Factor in Flyrock Accident, Masai, Johor, Malaysia*," EJGE, Vol. 18 [2013], Bund. X: 5661-5672, http://www.ejge.com/2013/Ppr2013.485mar.pdf.

[56] Official Website Department of Occupational Safety and Health, Ministry of Human Resources, https://www.dosh.gov.my/index.php/archive-news/2013/894-nepalese-worker-killed-in-johor-baru-quarry-blast.

- A quarry blast launched 13 boulders across a four-lane highway into residents' yards of 5-acre estate lots, and a store. A car was damaged, and another 50-pound boulder was launched 1,760 feet (520 metres) (Flyrock 26 – April 25, 2006).[57]
- A quarry blast generated excessive airblast (145 decibels) and flyrock debris that damaged 23 homes. Three homes had structural damage from flyrock and two homes had glass broken from their windows (Flyrock 37 – November 3, 1989).
- A quarry blast launched flyrock that struck and killed a blaster's helper at a distance of 280 metres from the blast (Flyrock 38 – April 5, 2017).
- A quarry blast launched flyrock debris that struck a 32 years old quarry employee at 800 feet (244 metres), who subsequently died from his injuries, with flyrock debris having showered an area of 1,500 feet (457 metres) (Flyrock 40 – 1999).
- A quarry blast sent an 80-pound boulder crashing into a school bus on the New York Thruway carrying 52 students and striking and injuring three students. A man driving eastbound on the same Thruway was also struck and injured by flyrock. The flyrock incident was ***Termed by many as the Blasting Industry's worst Nightmare!*** (Flyrock 76)
- A quarry blast launched flyrock debris, including a 96-pound boulder that struck and killed Stephen Hetzler, an experienced blaster, standing 153' (47 metres) from the blast (Flyrock 86 – December 4, 2013).
- A quarry blast propelled flyrock debris that struck teenager Ismail Kayima, causing a badly broken leg that had to be amputated (Flyrock 88 – July 11, 2008).
- A blast from a quarry near Burlington International Airport sent flyrock debris in the wrong direction, hurling rocks, some the size of microwave ovens hundreds of yards away that damaged at least five planes, seven buildings and a dozen cars. Some stones left craters in the asphalt and ripped small branches from trees. (Flyrock 19 – September 24, 2008)[58]
- A quarry blast showered flyrock debris over an area of 800 metres, killing Ronald Sutherland (quarry owner and blaster), injuring 5 people, wrecking 10 vehicles, significantly damaging 14 houses and causing minor damage to 20 other houses. (Flyrock 94 – December 13, 2017)
- A blast at the Suzio York Hill Trap Rock Quarry launched one employee, Skip Sibley, over a quarry ledge, leaving him seriously injured, and another employee, Joel Kanute, had his body impaled by flyrock debris, killing him instantly. Both employees were experienced blasters (Flyrock 100 – July 16, 1997).

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[57] "Denny Perry, president of Stuart M. Perry Quarry, said his family's business contracts Winchester Building Supply to do all their blasting. 'We got out of it because we felt it was safer and more economic,' he said. 'We didn't want to store explosives.'" https://www.aggregateresearch.com/news/state-investigates-quarry-blast/.

[58] "Quarry blast goes horribly wrong," Sept. 25, 2008, https://www.aggregateresearch.com/news/quarry-blast-goes-horribly-wrong-in-vermont/.

- A baby on her mother's back was struck and killed by flyrock debris from a blast at a nearby quarry, and, reportedly, "the child was ripped in half by the force of the impact from the flying rock" (Flyrock 103 – 2015).
- A 12-year-old boy was standing in his courtyard about 300 metres away from the blast at a nearby quarry when he was struck and killed by flyrock debris (Flyrock 104 – April 12, 2007).

Examples of Known Repeat Flyrock Offenders

The following are examples of blasting operations where the incidence of flyrock has occurred on more than one occasion.

- Gateway Materials Quarry (2 known flyrock incidents – Flyrock 7 & 29)
- Alum Luck Mine (2 known flyrock incidents – Flyrock 17)
- Arnprior Quarry (2 known flyrock incidents – Flyrock 18)
- Hamilton Boulevard Extension (2 known flyrock incidents – Flyrock 20)[59]
- Percy Quarry (2 known flyrock incidents – Flyrock 21)[60]
- Miller Braeside Quarry (2 known flyrock incidents – Flyrock 22)
- Comsbec Red Hill Valley Parkway (2 known flyrock incidents – Flyrock 31)
- Surface Mine Campbell County (2 known flyrock incidents – Flyrock 34)[61]
- City Sand's Quarry (2 known flyrock incidents – Flyrock 42)
- Hobet Mine (2 known flyrock incidents – Flyrock 45)
- Netley Branch Mine (numerous flyrock incidents over 15 years – Flyrock 51)
- Imperial Quarry (2 known flyrock incidents – Flyrock 65)
- Morrisville Mine (2 known flyrock incidents – Flyrock 66)
- Manitou Sand and Gravel Pit (2 known flyrock incidents – Flyrock 75)
- Colwood's Allandale Pit (3 known flyrock incidents)[62]
- Trail Bay Estates (2 known flyrock incidents)[63]
- Compass Quarries, Paradise, Lancaster County (2 known flyrock incidents – Flyrock 83)
- New Greenpark, Rawang (more than 2 known flyrock incidents – Flyrock 84)
- Northampton County (more than 1 none flyrock incident – Flyrock 89)
- Tan An Quarry (numerous flyrock incidents – Flyrock 93)

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[59] November 1, 2007, a piece of flyrock flew 350 metres penetrating the roof of a residence and landing in the living room (para. 7) in the Lobird Trailer Court neighbourhood. On May 6, 2008 flyrock debris was launched onto the same neighbourhood penetrating the roof of one residence and landing in the living room, and showering flyrock debris struck roads, fences, sheds and residences (trailers) (para. 1). *Director of Occupational Health and Safety v. Government of Yukon, William R. Cratty and P.S. Sidhu Trucking Ltd.*, 2012 YKSC 47 (CanLII), <http://canlii.ca/t/fs6vt>, retrieved on 2020-11-16.

[60] One of the two flyrock incidents occurred on April 22, 2008. Flyrock consisting of rocks four to eleven inches struck neighbouring houses and the Morristown Highway Garage. "Smaller pieces of flyrock impacted the neighboring homes with so much force the flyrock was found embedded in a metal post and a lawn landscaping rock, as shown in the investigator's photographs…" http://www.killthealbionquarry.org/flyrock_danger.pdf.

[61] https://www.osmre.gov/resources/blasting/docs/Flyrock/1993SugarRidgeFatality.pdf.

[62] Shalu Mehta, "Three penalties in three years for blasting firm working Allandale lands in Colwood," Jan. 9, 2020, https://www.saanichnews.com/news/three-penalties-in-three-years-for-blasting-firm-working-allandale-lands-in-colwood/.

[63] Christine Wood, "Residents raise concerns with blasting," CoastReporter, April 6, 2007, https://www.coastreporter.net/news/local-news/residents-raise-concerns-with-blasting-1.1179765.

- Adams Claim Mine (3 known flyrock incidents – Flyrock 101)
- Regimanuel Quarry (numerous flyrock incidents – Flyrock 103)
- Pemberton Quarry (2 known flyrock incidents – Flyrock 105)

Quarry Operator Must Compensate All Residents Within 500 Metres to Relocate and Avoid Potential Dangers of Flyrock

The residents of Kyaggundal Village, who are affected by flyrock debris from a nearby 15-acre quarry, have rejected compensation from the quarry operator as being inadequate to relocate from their damaged houses.[64]

> *Residents of Kyaggunda Village in Bukulula Sub-county, Kalungu District, who are affected by flying stones from a nearby quarry, have rejected compensation for their damaged houses, saying the money is too little to facilitate their relocation.*
>
> ***A Chinese firm, Hunan Road and Bridge Construction Group Companies Ltd, which is managing the quarry, last week started compensating about 80 residents with plots of land and houses within 500 metres radius from the stone quarry to enable them to relocate to safer places and return after 24 months***…. [emphasis added]
>
> *The crushed stones are being used to tarmac the Nyendo-Bukakkata road….*
>
> *Some residents near the quarry, including Mr Herman Kafeero and Mr Andrew Kavuma, claimed they were not considered for compensation yet their farmland and houses are located within a radius of 500 metres of the quarry….*
>
> ***Mr David Dratre, the Hunan Road and Bridge Construction Company Ltd spokesperson, said the compensation was based on a report by the government chief valuer and advised those who are not satisfied with the amounts given to them to put their complaints in writing***….[emphasis added]

Majority of Complaints Over Blasting Quarries Within 500 to 700 Metres

As referenced in the July 2014 Department of State Development *Resource Area Management and Planning Final Report*,[65] the *Urban Growth Management for Metropolitan Adelaide* report discusses the findings of complaint data received by quarry operators, the EPA, PIRSA (Department of Primary Industries and Regions), and the City of Tea Tree Gully with regards to excavation activity within and adjacent metropolitan Adelaide, and indicates average distances of around 500 to 700 metres "capture" the majority of complaints for hard rock quarries.

> *The majority of complaints received were in relation to blasting activities, with the average distance for these complaints occurring at 489m from the mine/quarry.* [2.3.2, p. 20]
>
> *Dust was also a common complaint, the average complaint distance relating to dust from hard rock quarries occurred at a distance of 690m…indicating that blasting activity is likely to cause dust to travel further distances.* [p. 20]

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[64] "Residents reject cash to abandon stone quarry site," Daily Monitor, September 4, 2019, https://www.monitor.co.ug/uganda/news/national/residents-reject-cash-to-abandon-stone-quarry-site-1846128.

[65] Department of State Development *Resource Area Management and Planning Final Report*, July 2014, https://energymining.sa.gov.au/__data/assets/pdf_file/0020/240662/2014-07-22_DSD_Resource_Area_Management_and_Planning.pdf.

The average distance for noise complaints for hard rock quarrying was 675m…[p. 20]

The highest frequency of complaints for hard rock quarries occur between 500m and 550m…[p. 20]

The findings in this report show that while 60% of blasting complaints were received at a distance of 500m or less, the majority occurred at around the 500m. This would suggest that for blasting operations, a separation of at least 500m would be needed. [p. 20] [emphasis added]

Study of Impacts of Opencast Blasting Operations

In 2016, South African Mine Health and Safety Council (MHSC)[66] completed a study of the impacts of opencast blasting at four mines, "selected from previous scanning of news media," [Milestone 6: Project Final Report, Section 4 Executive Summary, p. 5] in response to numerous complaints from residents and landowners. [underscoring added] The challenges experienced by the residents of communities surrounding mines that conduct blasting operations take into account the following:

1. Damage to infrastructure [mostly houses]
2. Health and safety implications; and
3. Impact on animals and wildlife

All the identified mines are surrounded by communities or farmers who have expressed concern about the effects of blasting on their quality of life [Milestone 6, Section 4 Executive Summary, p. 5] [emphasis added]

In recent years, the effect of opencast blasting on people, domestic and wild animals, dwellings, buildings and other civil structures has become a serious concern as it has led to numerous complaints by residents and landowners, protests, lawsuits, and even the closure of mining operations. [Milestone 4, Section 9.1 Context, p. 26]

…[W]hen blasting takes place, most individuals experience anxiety or fear (81%) and health effects (19%), Figure 8 below. Examples of some of the responses of anxiety experienced by the interviewees are "scary, I think the walls might fall on me", "I run outside afraid the house might fall on me", and "even the baby wakes up". Examples of health effects experienced by the interviewees were, "coughing from the dust", "air pollution" and "some people become weak because the water is also affected (SIC)".[Milestone 2, Section 8.3, p. 27, Three villages within 1 km of the closest active pit of the Platinum mine in Limpogo.]

Those individuals who did report their perceived blast related incidents were mostly not satisfied with the responses they received from the mine (85%), with only 15% of the interviewees being satisfied. From the interviewees who were dissatisfied with the responses from the mine, 40% said that they resort to striking as a way of getting their complaints resolved. Some of the interviewees (30%) simply take their complaints back to their chief/headman, while others submit them back to the CED office. Only 10% of the interviewee took their dissatisfaction to lawyers (Figure 12). [Milestone 2, Section 8.3.4, p. 29, Platinum mine in Limpogo]

- The personal effects experienced during blasting in three communities surrounding the Limpogo Platinum mine include *smells* (33%), *difficult to breath* (25%), *other* (dust pollution, noise pollution; anxiety/fear; chest pains; and coughing) (22%), and *ears popping* (17%). Only 3% experienced no personal effects. (Milestone 2, p. 26)
- The personal effects experienced during blasting in three communities surrounding the Gauteng Gold Mine include *other* (dust pollution; sinuses; psychological effect;

[66] https://mhsc.org.za/sites/default/files/public/research_documents/SIM140901%20Final%20Report.pdf.

smells; coughing; and difficult to breath) (40%), *difficult to breath* (20%), and *smells* (15%). No effects were reported by 25%. (Milestone 2, p. 36) According to the operator of the Gauteng Gold mine the "tolerable" distances for blasting are 500 metres from buildings and other structures. (Milestone 2, p. 19)

- The personal effects experienced during blasting in one community adjacent to the Mpulmalanga Coal mine include *smells* (27%), *other* (dust pollution; noise pollution; anxiety/fear; intensity dependent; chest pains and coughing) (27%), *difficult to breath* (13%) and *ears popping* (6%). No effects were reported by 27%. (Milestone 2, p. 48) According to the operator of the Mpumalanga Coal Mine the "tolerable" distances for blasting are 500 metres from buildings and other structures. (Milestone 2, p. 19)
- At the Limpopo Coal mine blasters initiate a blast at a distance *more* than 500 metres from the blast blocks. (Milestone 2, p. 17)

Approximately 46 randomly selected buildings, mostly residential, in the communities surrounding the three opencast mining operations were inspected and showed varying degrees of damage caused by blasting. Most of the buildings are constructed of concrete blocks and timber and iron sheet roofs and were damaged (Milestone 2, p. 59). (Milestone 2, Tables 4, 5 and 6)

> *…[T]he causes of damage (cracks) were investigated. The cracks were categorized in terms of aesthetic, serviceability and structural stability. The majority of the buildings surveyed were damaged….The damage ranged from collapse to hairline cracks. These were attributed mainly to ground movements due to mining activities and poor detail design and workmanship*….[Milestone 2, p. 58]

Effects of Blasting on Domestic Animals

A 2016 questionnaire conducted by the South African Mine Health and Safety Council (MHSC)[67] of pet owners (67% of interviewees) residing in a community of modern residential buildings in proximity to Mpumalanga Coal mine documents the impact that blasting has had on their dogs and cats.

> *The interviewees that were pet owners stated that their animals get scared and confused when blasting takes place. For example some owners state that "the dogs run off, sometimes they disappear for 3 days." The time taken for the animals to settle down as reported by the interviewees is variable…[37% within one hour, 25% within two hours, and 38% greater than two hours].*[Milestone 2, Section 8.5.2, p. 50]

Quarry Operator Denied Permit Due Mostly to Concerns Over Flyrock

The US Town of Gurley (Town), with a population of 900 people, passed an ordinance zoning land acquired for a proposed blasting quarry to agricultural, a land use category which does not permit a blasting quarry. The zoning was appealed by the proponent (M & N Materials, Inc.), arguing that the Town's ordinance did not satisfy "rational basis scrutiny," while the Town sought Summary Judgment.

[67] https://mhsc.org.za/sites/default/files/public/research_documents/SIM140901%20Final%20Report.pdf.

The US District Court ruled in favour of the Town,[68] commenting that the Town only had to identify some legitimate purpose that it could have been pursuing, not its actual motivation, and to show that the zoning ordinance furthered that purpose.

As the Town's action of zoning the property for agricultural purposes was motivated by the desire to promote the *health, safety, morals*, and *general welfare* of its residents, the U.S. District Court ruled that the character of the Town's governmental action served the public interest.

Because a quarry uses blasting with explosives, the Town had serious concerns about air quality (dust), damage to homes and businesses, heavy traffic on the road to the quarry, damage to existing streets from heavy trucks, and damage to the Town's water-storage tank located on the road.

Ludwiczak's expert testimony showed that flying rock from the blasting operation could travel 2,000 feet (610 metres) to 3,000 feet (914 metres) from the blast site and could *hit*

- A public housing project
- Numerous private apartments and private residences (many of which are designated historic)
- The Town of Gurley's water tank
- Two propane distribution operations
- A restaurant
- A gas station
- An electrical substation
- Madison County Elementary School and its playground and activity field
- TVA high voltage power lines running directly through the middle of the subject property (When flyrock comes into contact with the lines, it can cause "arcing" and swaying of the lines, which will result in fires and explosions, and can even result in tower failures.)

The expert testified that "in his professional opinion, within a reasonable degree of blasting certainty, that flyrock is likely to occur and will be difficult to control."

> ***I have seen flyrock occur in hundreds of other cases where conditions were similar to those encountered on Gurley Mountain. Some of these flyrock occurrences had some of the best blast designs I have ever seen, but flyrock still occurred. In some of [those] cases, flyrock traveled as far as 3,000 feet [914 metres], and frequently traveled 2,000 feet [610 metres]****. Because there is a high risk of flyrock, it is necessary to evaluate the potential hazards. To begin, the topography of the area is very significant in that the face of the mountain proposed for quarrying directly faces the Town of Gurley and rises above the Town and associated structures. It also faces U.S. Highway 72, a major roadway with four lanes of traffic. The topography of the quarry zone therefore directs all adverse effects of blasting toward the Town of Gurley and its residents and motorists.* [emphasis added]

[68] *M & N Materials, Inc., v. Town of Gurley, et al.*, United States District Court Northern District of Alabama Northeastern Division, Civil Action No. 5:14-CV-00184-CLS, https://lanierford.com/images/NewsPDFs/federal-court-decision-gurley-alabama-quarry-case.pdf. See case summary "Gurley wins another round in the quarry case," prepared by Lanier Ford, Attorneys at Law, https://lanierford.com/news-frontpage/gurley-wins-another-round-in-the-quarry-case.

Another expert, Dennis Key, opined that property values near the area would likely have decreased by up to 12.2 percent, *if* the operation of a blasting quarry had been permitted under the zoning classification.

Quarry Blast Mistaken for Earthquake Caused Significant Damage

A blast on December 2, 2020 at the Thomas Contracting Quarry, Algonquin Highlands (Ontario), was initially believed to be an earthquake or home explosion.[69]

> *An incident…on Dec. 2 that some area residents believed could have been an earthquake or home explosion turned out to be a "blast gone wrong" at the Thomas Contracting Quarry, located on North Shore Road near Highway 35 in Algonquin Highlands. Shortly before 2 p.m. dozens of people, some as far away as Minden and Haliburton Village, reported experiencing a loud blast and subsequent rumbling. While there was much immediate speculation online about what could have caused the issue, Algonquin Highlands Mayor Moffatt moved quickly to allay the public's fears. As everything shimmied and shook on my desk at home, I blurted out things I won't put on this page. I wondered if it was an earthquake or rock blast; and after making a few quick calls I can confirm the blast occurred in the aggregate pit on North Shore Road," Moffatt posted on her political Facebook page….*
>
> *According to Gary Wheeler, a spokesperson for the Ministry of Environment, Conservation and Parks (MECP), blasting operations at the site have been contracted out Austin Powder Ltd. The incident was reported to both the MECP and the Ministry of Natural Resources and Forestry on Wednesday. "The ministry is working to determine the cause of the blasting noise limit exceedance, any potential violation and address public concerns. Currently, it is too early to determine the results of the ministry's review and assessment of the incident," Wheeler informed the Times.* ***Wheeler confirmed the MECP received numerous complaints from the public following the incident. A post on a local community page on Facebook discussing the blast has so far garnered 104 responses****. Many local residents are using it as a platform to share their experiences in the aftermath of the explosion. "It was pretty crazy how the house rumbled and the trees shook for a while afterwards," noted Joleen Thomas.* ***Andrea Coysh reported hearing the blast at her home just east of Minden, on County Road 21, approximately 20 kilometres away from the blast site****. Emmy Lester, who lives in nearby Ingoldsby, said she too heard the explosion. Susan Deborah works in Minden, and she said the blast "reverberated in the windows of our office building." "Knew it was a blast, but unbelievable it was that far away," Deborah noted. Living in the vicinity of the Thomas Contracting Quarry, Bert Kennedy is no stranger to the usual noises that emanate from the site. Last Wednesday's blast was anything but usual, Kennedy claimed. "We live quite close to the pit where the blast took place and our house vibrated and shook," Kennedy wrote. "I was in my wood shop and thought a big tree was coming through the roof.* ***Neighbours report things like structure damage, window and concrete cracks****."….Wheeler noted the organizations will be required to meet with individuals who claim the blast damaged their property. "We are requiring that the company conduct inspections of the reported damage to determine what steps are necessary to restore the property….*[emphasis added]
>
> *[Resident Cheryl Richman wrote on the mayor's Facebook page, "****I have someone coming to check on my home as I am concerned about structural damage due to the violent shaking caused the shockwaves from the blast. There should be limits on the strength of dynamite being used near residences****." Elaine Smith added, "we are directly across from North Shore Road, on Beech Lake. We thought the earth had moved."]*[70] [emphasis added]

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[69] Mike Baker, Local Journalism Initiative Reported, Haliburton County, "Ministry investigating North Shore Road blast," Yahoo!news, December 9, 2020. https://ca.news.yahoo.com/ministry-investigating-north-shore-road-195945694.html.

[70] Lisa Gervais, "Ministry investigates blast," The Highlander, December 4, 2020. https://thehighlander.ca/2020/12/04/ministry-investigates-blast/.

Quarry Explosion Damaged Numerous Homes

On June 3, 2013, an explosion at a Quebec quarry damaged 20 homes in the nearby community of Saint-Joseph-de-Coleraine.[71]

> *Routine dynamite use went wrong. Quebec provincial police and the province's workplace health and safety board are investigating after an explosion damaged several homes in a small community near Thetford Mines, Que.*
>
> *The explosion occurred in a granite quarry in the community of Saint-Joseph-de-Coleraine on Monday afternoon.*
>
> *No one was hurt, but the blast broke windows and cracked some of the bricks of nearby homes….*
>
> *He says workers at the quarry often use dynamite during excavation.*
>
> *Gagné says investigators are on the scene today trying to find out what went wrong in the routine explosion.*

Quarry Explosion Caused Massive Destruction of Houses

On January 12, 2019, an explosion at a quarry destroyed several houses in nearby Kagoto village (Kenya).[72]

> *Leaders and residents of Kagoto village in Bahati have demanded closure of a quarry after a dynamite blast destroyed several houses on Saturday.*
>
> *Police had a difficult time calming the angry residents who protested for several hours against the explosion and quarry operations on Saturday.*
>
> *"There has been massive destruction of houses, it is unfortunate. We will hold a meeting of all stakeholders on Monday (yesterday) to seek a lasting solution," Bahati MP Kimani Ngunjiri said.*
>
> *He assured residents the county had talked to the management of Karsan Ramji and Sons Civil Engineering and Construction Company to compensate residents for the damages.*
>
> ***The MP agreed** that the quarry poses a danger to the residents and said the solution can only be "that the nearby residents be fully compensated and relocated or the quarry be **closed**." He called on leaders not to politicise the matter.* [emphasis added]
>
> *The company's manager Maryline Mbaya apologised to the residents and assured them of compensation.*
>
> *Bahati OCPD Edward Wafula said there were no injuries but several houses were destroyed.*
>
> *"We are yet to have the exact figure of the houses damaged. We ask the residents to be calm as a lasting solution is sought," the police boss said….*
>
> *TRAGEDY WAITING TO HAPPEN?*
> ***Four years ago a student from Kagoto primary school was killed after a stone from a nearby quarry hit him on the head**.* [emphasis added]
>
> *A month after the Solai Dam tragedy, veteran politician posted on Facebook, "Another tragedy is waiting to happen at Kagoto and Heshima in Nakuru where people have built houses on the side of*

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[71] CBC News, "20 homes damaged after Quebec Quarry explosion," June 4, 2013. https://www.cbc.ca/news/canada/montreal/20-homes-damaged-after-quebec-quarry-explosion-1.1349324.

[72] Rita Dimary, "Close killer quarry, pay us damages, say residents," STAR, January 15, 2019. https://www.the-star.co.ke/counties/rift-valley/2019-01-15-close-killer-quarry-pay-us-for-damages-say-residents/.

Menengai Hill while two companies are blasting huge rocks from the mountain to make gravel for sale without caring that each blast is causing tremors that shake houses and induce landslides... "

Resident Mary Muthoni said, "It [dynamite explosions] is often much more powerful, scary, unsettling and completely disrupts your concentration. It spooks our kids and visitors. I usually curse, then try to compose myself and get back to work."

Quarry Blast Damaged Neighbouring Homes & Operator Agrees to Compensate Homeowners

On September 23, 2016, a blast at a quarry in Batu Kawan (Penang, Malaysia) caused damage to homes in a nearby neighbourhood.[73]

The quarry operator in Batu Musang, here, has come to an amicable agreement with nearby residents following allegations that the blasting from the quarry had damaged their homes. [emphasis added]

The owner of the company who declined to be named, not only apologised personally to the residents for causing them discomfort, but also offered to look into the damage to their houses.[74]

He said the company and Batu Kawan member of Parliament, Kasthuri Patoo had a meeting with residents to discuss the matter yesterday.

"This is the first time that such an incident has happened and I'm really sorry to have caused damage to the houses and unease to all living nearby," he said when contacted, today.

He also offered assistance to those whose houses have been affected.

"Appointees from Bandar Cassia Barat, Bandar Cassia Tengah and Jalan Pengkalan will help to collect details on the affected houses to be submitted by the end of this week to the quarry operator's consultant.

"Then a contractor will ascertain the scale of damage and our company will offer reasonable compensation or help to repair the houses," he added.

On top of that, he assured the residents that there would be no more blasting activity there until investigations by the Seberang Prai Municipal Council (MPSP) and Mineral and Geoscience Department (JMG) have been completed….

On Sunday, residents of several neighbourhoods in Batu Kawan protested and claimed that strong blasting from the quarry earlier on Friday shook their houses, causing cracks and damage to the walls….[emphasis added]

[73] "Quarry operator in Batu Kawan apologises, will look into damage to houses," The Sun Daily, September 27, 2016. https://www.thesundaily.my/archive/1984271-ISARCH397411.

[74] The Penang Development Corporation (PDC) terminated the tenancy of Zambina Wawasan Sdn Bhd, the quarry operator, effective September 26, 2016, and the notice of termination was also forwarded to the Seberang Prai Municipal Council (MPSP) and other relevant authorities for their action. The PDC also lodged a police report about the mater. *The Star*, "Blasting halted in Batu Musang, September 28, 2016." https://www.thestar.com.my/news/nation/2016/09/28/blasting-halted-in-batu-musang-pdc-issues-notice-to-firm-to-terminate-quarry-operations.

Quarry Blast Damaged Dozens of Homes

On December 5, 2019, a quarry blast caused damage to 30 homes in a nearby residential subdivision in Virginia (USA).[75]

> *A Beckley attorney and former state legislator is asking a Virginia-based company to repair damages that a Thursday blast reportedly caused to dozens of homes in Raleigh County.*
>
> *A large blast occurred shortly after 4 p.m. Residents of Maxwell Hill in Beckley and one caller from Mercer County reported to The Register-Herald that they had been startled by the violent, sudden noise. Maxwell Hill residents said that their homes were damaged.*
>
> *Raleigh County Emergency Operations Center dispatchers reported that the blast was the result of Appalachian Aggregates crews blasting a hillside at a rock quarry on Sand Branch Road.*
>
> *According to Randolph McGraw, a Beckley attorney, dozens of residents have reported damage to their homes.*
>
> *"I've had over 30 people call my office today," McGraw said on Friday. "They've got broken windows and cracked Sheetrock and ceilings, and most people I've spoken to live rather closely in proximity.*
>
> *"They were closely located to that rock quarry," he reported. "But I just hung up with a guy that lived out at Grandview.*
>
> *"He said it shook his house. It's amazing, how far-reaching this thing is."*
>
> *Mary Peters of Maxwell Hill reported three blasts Thursday.*
>
> *She said residents in her neighborhood have lived with the blasting since at least 2003.*
>
> *Peters' husband, now 79, had a stroke in 2003, and Peters, now 71, stopped work to look after him.*
>
> *"I used to work all the time, and I didn't get home, sometimes, 'til 6 or 7 in the evening," explained Peters, who has lived in her house for 44 years. "Now, every time there was a shot put off, I would hear it.*
>
> *"I've never heard three in a row in the 16 years I've been sitting in this house."*
>
> *Peters said, over the years, she had questioned neighbors about the blasts. Nobody knew what they were.*
>
> *One neighbor said it was a mine. Another told her a gas company was depressurizing a line.*
>
> *"We weren't ignoring it," she said. "We just didn't know what to do about it or how to find out the true matter of what was going on.*
>
> *"We just lived with it. But as time wore on, it started to tear up our property."*
>
> *She said a blast last winter had caused damage to an outbuilding and to the brick at the back of her house. She repaired both of those this past summer.*
>
> *On Thursday, she said she heard a blast shortly after 4 p.m. Five minutes later, she said, there was another.*
>
> *Shortly after the second blast, a "shot" rocked her home. She said she looked at her clock and saw 4:28 p.m.*
>
> *"I mean, it just struck you plumb out of your chair," Peters explained. "The house was vibrating.*

[75] Brad Davis, "Attorney seeks answers for blasts," The Register-Herald, Dec 7, 2019. https://www.register-herald.com/news/attorney-seeks-answers-for-blasts/article_7dcdcc67-c752-5c23-b160-8d75ba056b2a.html.

"The sound came right in through my house like a gun had gone off. It scared us."

Peters went out to check her property.

"I went out and was looking, and I seen all these cracks on the outside (of the house)," she said.

The blast knocked a rafter out of her two-car garage, which sits beneath an upstairs apartment, Peters said.

"My wall is leaning right now," she reported.

Peters said she learned from her neighbor, Jim O'Dell, that Appalachian Aggregate was making the blasts. O'Dell told The Register-Herald that his ceiling was damaged by the Thursday blast.

Another of Peters' neighbors, Linda Martin, told The Register-Herald that the blast had cracked two of her windows.

Peters said she spoke with McGraw on Friday and learned that other property owners had sustained damage. She said she wants the company that is blasting to be a good citizen and help repair damage.

"I just want to have my garage, to keep my vehicles in," she said. "I'm not a person that wants a whole lot for nothing, for no reason.

"I've worked hard my whole life. I don't believe in ripping nobody off. I'd just like to have my property the way it was before this happened."

McGraw, who travels frequently, lives on Dry Hill Road and said he knew about the blast before he had gotten a single call from a property owner.

He had heard it.

"I happened to be sitting here at my house with a gentleman from my office who is a Vietnam War veteran," McGraw said. "It rattled the walls, and my dog was sleeping, and he just jumped up and was scared.

"My friend said, 'I haven't felt anything like that since I was in Vietnam and they were bombing.'

"I can't tell you exactly what's going on," McGraw said, "but whatever it is, it just needs to be looked into, and that's what we're going to do."….

McGraw, a former state legislator, said he was in office around the turn of the century, when state lawmakers relaxed laws about blasting. He said the state dropped a law requiring companies to notify neighbors within a three-mile radius of the blast and also allowed companies to use more power in the blast.

"I felt like that was the wrong thing to do at the time, and I'm fearful now we're seeing those fears realized," he said Friday. "It can't be right when you start damaging your neighbors' property.

"You've got to be responsible for that," he said. "You've got to rethink what you're doing, and my guess is, at this point, they're getting a little overzealous, and they're setting off too big of charges to kind of speed up the process.

"I'm just guessing, at this point, but that certainly looks like what's going on," McGraw said. "It's particularly more burdensome to people who are on fixed incomes."

McGraw said he is representing neighbors who want more information about the blasting that damaged there homes….

Quarry Employees' Negligent Blasting Damaged Twenty Homes and No Insurance Coverage Available

On August 12, 2003, two employees intentionally blasted 400 pounds of diesel-soaked ammonia nitrate at the Marion County Road Department Rock Quarry in Tennessee (USA), which damaged 20 nearby homes or businesses.[76]

> *The two Marion County Road Department Rock Quarry employees who intentionally detonated 400 pounds of diesel-soaked ammonia nitrate that damaged at least 20 homes or businesses Aug. 12 at the county-owned quarry on Highway 62 west of Yellville have been fired, according to Marion County Judge Charles Trammell.*
>
> *Rock quarry employees Bill Elam Jr. and Thomas Michael Byers were terminated Aug. 26 and the quarry has been shut down until further notice. "The Marion County Rock Quarry is now temporarily shut down for obvious reasons and also for mechanical problems," Trammell said….*
>
> *Mine Safety & Health Administration inspector Wyatt Andrews, who investigated the quarry a few days after the blast, said he was going to recommend the county pay a $10,000 fine for two serious federal violations. "The first violation is for not properly notifying nearby residents as required by federal law and the second one is for not properly establishing a safe blasting area," Andrews said.*
>
> *When the Times telephoned Andrews' Little Rock office Sept. 2 to inquire if federal authorities had decided if or how much a fine there will be, he said the investigation is still ongoing.*
>
> *Andrews also cited the quarry for the following offenses:*
>
> * *Failure to provide a record of training for personnel files.*
> * *Broken cover plate on a 110-volt wall switch.*
> * *No barrier or mid-axle height at south end of stockpile.*
> * *Explosives improperly stored.*
> * *Employees could be injured if a stray bullet or rock passed through structure walls.*
>
> *Andrews said county employees should not have exploded the eight 50-pound bags of ammonium nitrate Aug. 12 using a blasting cap resulting in a limestone crater eight feet deep and 30 feet wide. "I understand they were trying to get rid of the material because it had expired and that's fine. However, all they had to do was burn it by pouring a little diesel on the bags," said Andrews. "And burning it doesn't cause it to explode."*
>
> *Andrews said his investigation determined that quarry employees did not notify any residents nearby that they were about to blast. "And the workers did not sound the siren to warn residents they were about to blast. It's a miracle no one was killed or injured."*
>
> *Andrews said he was told that at least one of the county employees who detonated the ammonia nitrate suffered minor injuries. "The explosion was the same type used by Timothy McVeigh in the (April 19, 1995) bombing in Oklahoma City."…*
>
> *The federal inspector said his team would assess the incident and determine the proper fine and steps to take to keep the quarry open. "If these same violations occurred in any other quarry or mine, typically there would be at least a $10,000 fine."*
>
> *He added that he would not recommend closing the quarry but certain requirements would have to fulfilled to keep it open. "Supervisors of the quarry will have to make certain they either retrain the employees responsible or find new ones to train and certify to perform legal and safe blasting procedures."*

[76] Kevin Mathis, "2 employees dismissed – No insurance to repair homes damaged by blast," Bolivar Herald-Free Press, September 5, 2003, https://bolivarmonews.com/home/2-quarry-employees-dismissed---no-insurance-to-repair-homes-damaged-by-blast/article_e4905a61-7874-5b9b-8100-bcec8b1fb5ff.html.

Andrews, a federal inspector who works for the U. S. Department of Labor, interviewed several people who own part of the 20 homes or businesses that reported damage from the blast.

At least two of the nearest homes to the 2:30 p.m. Aug. 12 blast received extensive damage and may even end up being declared unsafe or uninhabitable, residents said. [emphasis added]

The family of John and Joanne Surber, who live nearest to the quarry, found two windows blown out of their home, a window air conditioner blasted onto the floor inside a bedroom, and two box window fans were knocked out. Joanne Surber said she inquired if she would be paid for damages caused to their home by the blast.

An Aug. 26 press release from the professional association of Duncan & Rainwater trial lawyers in Little Rock, legal representatives for the Association of Arkansas Counties' Risk Management Fund, said, "No," because the county employees violated one or more of the following procedures:

** Negligence of any degree.*
** Conduct outside the course and scope of an official's or employee's official county duties.*
** Conduct that is contrary to the official policy of the county.*
** Intentional misconduct.*

"There is, therefore, no AACRMF protection available to the county to pay for damages caused by an unnotified blast at Marion County Rock Quarry," the press release said.

"I feel bad for the people whose homes were damaged because apparently none of the ones who lived near the blast site has any insurance," Trammell said. "But I have to go by what the law says and I've been told that the city and county have tort immunity and can not typically be sued. Perhaps there's something the county can do for them later on."…

Andrews, who said his office typically inspects each quarry or mine at least twice per year, said the Marion County Road Department's Rock Quarry has received numerous other federal violations.

According to the Mine Safety & Health Administration's website…the Marion County Rock Quarry has had at least 50 federal violations costing the county a total of $36,174 in fines since it opened Nov. 1, 1993…. [emphasis added]

Quarry Blast Killed At Least Eleven Employees, Destroyed Equipment and Damaged Houses Far Removed From The Quarry

On August 3, 2018, a blast at a quarry in Hathibelagal village (India) killed at least 11 employees and damaged houses far removed from the quarry.[77]

At least 10 labourers died and many more were injured in a powerful detonators blast in a stone quarry in Kurnool district of Andhra Pradesh late Friday night. Three tractors, a truck and a shed were also reduced to ashes. There were 30 labourers at the site when the blast took place. District administration rushed fire tenders to the spot to control the fire.

According to information reaching here, the accident took place in a quarry in Hathibelagal village under Aluru block between 8:30 pm and 9 pm. The impact of the blast was such that houses far away from the quarry developed cracks and residents ran out in fear for life. Several huts laid by the labourers in the area were razed to the ground.

…Several bodies were burnt beyond recognition. Officials said some were trapped under the huge boulders that flew in the air and fell down under the impact of the blast. Those present in the shed were burnt alive. [emphasis added]

[77] P. Pavan, "Andhra Pradesh: 11 labourers dead in blast in stone quarry," Mumbai Mirror, August 3, 2018, stone quarry blast: Andhra Pradesh: 11 labourers dead in blast in stone quarry (indiatimes.com).

According to locals, the labourers initially tried to conduct the blasts in the afternoon, due to drizzle, they postponed it. In the night after dinner, they attempted again, though it was continuing to rain. The detonators burst making a huge sound, possibly due to a short circuit.

Pawan Kalyan criticized the government for turning a blind eye to the gross violation of safety norms in quarries. He demanded the government award exemplary punishment to the quarry management.

Quarry Financially Responsible For Soil Erosion of Nearby Infrastructure, and Relocation of Two Residents

The shifting soil undermining infrastructure, starting in late 2005, and the forced relocation of two residents was caused by a nearby blasting quarry in Georgia (USA).[78]

Lafarge Aggregates and multiple insurance companies are slated to pay Forsyth County $3.7 million, a number that covers all "out-of-pocket expenses defending the claim," said County Attorney Ken Jarrard.

The situation dates to December 2005, when Lafarge workers discovered a crevice had formed in the rock quarry along Ronald Reagan Boulevard.

Shifting ground beneath the northwest section of the property forced the relocation of two nearby residents and closed a mile-long stretch of Ronald Reagan, between North Old Atlanta and Pendley roads (click for map), for several months.

County officials also drained a nearby water tower as a precautionary measure when the cracks began to grow along the north-south route.

Land disturbance activity resulted in damages to county infrastructure, according to Jarrard, including roads and water tanks….

The $3.7 million settlement would be effective for those claims approved through Feb. 20, 2009, Jarrard said, but the county "is not giving up our right to make claims if there is any further seismic activity disturbances in that area."

The total area of impact was about 11 acres. The ground was reported to be moving as fast as 4 inches in 24 hours on certain parts of the property, where it began to shift into the quarry*….*[emphasis added]

Quarry Explosion Damaged Nearby School and Caused Hospitalization of Thirteen Students, Three in Critical Condition

On December 11, 2020, an explosion at a quarry damaged a nearby Ugandan school, and caused the hospitalization of 13 students.[79]

At least 13 female students were admitted to different health facilities following an explosion at a stone quarry near their school.

The 13 students are all candidates in senior four and six at Lumuza High School, located at Katende, in Mpigi district.

[78] Frank Reddy, "Deal struck in lawsuit over land disturbance," Forsyth County News, March 25, 2009, https://www.forsythnews.com/local/local-government/deal-struck-in-lawsuit-over-land-disturbance-near-quarry/.

[79] Simon Ssekidde, "Quarry blast leaves 13 students in shock, hospitalized," December 12, 2020, Quarry Blast Leaves 13 Students In Shock, Hospitalised (newvision.co.ug).

> ***The incident took place at around 2:30 pm on Friday, after the village leaders had announced on the local radio station warning the residents near the quarry to move away at least four km.*** [emphasis added]
>
> *The stone quarry being operated by Kaki developers limited is located a few meters away from the school.*
>
> ***According to the school director of studies, Muzafaru Wamala, they received a warning from the local village leaders that there was going to be a blast in the quarry and they relocated the students a few kilometers away from the place but they were surprised to see that after the first blast, the students got a shock***. [emphasis added]
>
> ***13 of them became unconscious, their conditions worsened after the second blast from the quarry and they had to rush them to Lubaga hospital. Others were taken to St Monica health center and Mpigi health center IV in critical condition***. [emphasis added]
>
> ***"Immediately the blast went off, some female students lost their conscious and started falling down one by one, we had to rush them to nearby health centers first but three students were referred to Lubaga hospital in critical condition," Wamala said***. [emphasis added]
>
> *He added that school structures including the classroom blocks and school dormitories developed cracks….*
>
> *"If the situation doesn't change and it keeps like this, our students are likely to be affected greatly, the school as well is likely to suffer losses," Wamala said.*
>
> *Some of the affected students were identified as Priscilla Namutebi, S4, Edith Nambi, S6, Hasifah Nangoobi, S6, Joan Nansamba, S4, and Swabrah Nabulya, S4, among others.*
>
> *Edith Nambi, a senior four student who was receiving treatment at St Monica health center, said she does not recall anything as she woke up only to find herself in the hospital.*
>
> *Peter Musoke, the village chairperson said they had warned residents neighbouring the quarry to relocate for a few hours to enable the mining of the hardcore stones. He advised the responsible persons to compensate the school for the damaged property.*
>
> *[Kaki Developers, a mining company with a quarry in Mabuye, Mpigi district, has agreed to compensate victims that were affected by stone blasting last Friday….*
>
> *John Kayanja, a resident of Mabuye village, said his house has developed cracks and his only cow also died following the stone blasting.*
>
> *Lawrence Sseruwagi, the Luvumbula village chairperson, said he had received many reports of residents whose houses either developed cracks or got damaged as a result of stone blasting….]*[80]

Quarrying Without an Adequate Setback from Road Caused $40 Million in Damages

Vulcan Materials agreed to pay $40 million to the Illinois Department of Transportation for damage to a road from quarrying without an appropriate setback.[81]

> *Vulcan Materials Co. has agreed to pay $40 million to the Illinois Department of Transportation, ending a 12-year legal dispute over a faulty stretch of Joliet Road that divided the company's limestone quarry in west suburban McCook, the agency said Tuesday.*

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[80] Simon Ssekidde, "Students affected by stone blasting to be compensated," Newvision, December 20, 2020, Students Affected By Stone Blasting To Be Compensated (newvision.co.ug).

[81] Gerry Smith, "Quarry firm to pay state $40 million in Joliet Road case," Chicago Tribune, May 18, 2010, https://www.chicagotribune.com/news/ct-xpm-2010-05-18-ct-met-vulcan-idot-settlement-20100518-story.html.

The Transportation Department closed a 1-mile stretch of Joliet Road between 55th Street and East Avenue in May 1998 when pavement suddenly shifted.

The closed roadway sits atop a narrow, pillar-like ridge that divides a deep, century-old limestone quarry operated by Vulcan. IDOT contended Vulcan caused the damage by mining too close to the ridge, undermining the road's rock foundation. Vulcan contended the cracks that caused Joliet Road to dip and buckle extend much deeper than the company mined.

Since the closure, thousands of vehicles have been rerouted to other roads, and Vulcan has ceased mining activities at the site. ***The state filed a lawsuit in 2001 after Vulcan did not agree to state-requested mining setbacks and land contributions. The settlement ended three weeks of negotiations in Cook County Circuit Court. Vulcan agreed to the settlement with no admission of liability, IDOT said Tuesday****.* [emphasis added]

U.S. Rep. Dan Lipinski, D-Ill., said IDOT engineers must first determine whether Joliet Road can be reopened, a scenario the congressman said was unlikely. Lipinski said IDOT will hold community meetings in coming months to get input from residents on how to improve traffic congestion caused by the road closure.

Analysis of Flyrock Distances

A number of sources (media announcements, governmental incident reports, studies, articles, journals, presentations) all identified by way of internet searches, resulted in a comprehensive data set on the distances that flyrock debris has been hurled as a consequence of blasting operations.

Distance From Blast (m)	Number of Incidents	Percentage of Total	Cumulative Percent
0-99	2	2%	2%
100-199	9	10%	12%
200-299	16	17%	29%
300-399	20	22%	51%
400-499	9	10%	61%
500-599	7	8%	68%
600-699	7	8%	76%
700-799	0	0%	76%
800-899	6	7%	83%
900-999	3	3%	86%
1000-1099	5	5%	91%
1100-1199	0	0%	91%
1200-1299	5	5%	97%
1300-+	3	3%	100%

An analysis of 92 flyrock incidents, where the distance from the blast is known, indicate that 91% (84) of the flyrock incidents occurred within 1,099 metres, and 97% occurred within 1,299 metres.

- 20 (22%) of the flyrock incidents occurred between 300 and 399 metres (330 metres avg)
- 9 (10%) of the flyrock incidents occurred between 400 and 499 metres.(446 metres avg)
- 7 (8%) of the flyrock incidents occurred between 500 and 599 metres (515 metres avg)
- 7 (8%) of the flyrock incidents occurred between 600 and 699 metres (622 metres avg)
- 6 (7%) of the flyrock incidents occurred between 800 and 899 metres (802 metres avg)
- 5 (5%) of the flyrock incidents occurred between 1,200 and 1,299 metres (1,225 metres avg)
- 3 (3%) of the flyrock incidents occurred over 1,300 metres (2,307 metres average)

Further, at 80%, which accounts for the first 74 flyrock incidents in ascending order, flyrock reached a distance of 800 metres, and, at 90%, which accounts for the first 83 flyrock incidents in ascending order, flyrock reached a distance of 1,020 metres.

Setbacks or Buffers the Only Effective Mitigation Measures Against Flyrock (The Ultimate Adverse Effect)

The only effective way to prevent flyrock from being launched outside the boundaries of a blasting quarry operation, and avoid injury or death of innocent people is to impose mandatory minimum setback requirements. Preserving the *health, safety and welfare* of the community is the overriding priority of government, and applications for new or expanded blasting quarry operations must only be permitted in locations where the owner of the proposed quarry lands can provide its own setbacks or buffers, and avoid land use conflicts with established settlement areas or areas designated for population growth. Setbacks or buffer zones for blasting quarries vary from 500 metres to 800 metres in the following jurisdictions:

		Setback/Buffer Zone
- Nova Scotia, Canada	:	800 metres[82]
- New Brunswick	:	600 metres[83]
- Quebec, Canada	:	600 metres[84]
- India	:	500 metres[85]
- Malaysia	:	500 metres[86]
- Victoria, Australia	:	500 metres[87]

[82] "The NSE *Pit and QuarryGuidelines* (1999) stipulated setbacks to prevent structural and environmental damage as well as the requirements for pre-blast surveys, blast monitoring, and blast designs. The setback between blasting for a quarry and structures is 800 m. "http://www.scotianmaterials.info/quarry.html#:~:text=The%20setback%20between%20blasting%20for,800%20m%20of%20the%20Project..

[83] "k) 600 metres from any drinking water supply well, unless the written permission of the owner(s) within the 600 metres is obtained and submitted to the Department for acceptance….", Department of Environment and Local Government, Rock Quarry Siting Standards, https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/RockQuarrySitingStandards.pdf.

[84] "11. The operating site of a new quarry must be located at a minimum distance of 600 m from any dwelling, unless the dwelling is owned or rented to the owner or operator of the quarry." 10. It is prohibited to establish a new…quarry, the operating site of which is located in a territory zoned by the municipal authorities for residential, commercial or mixed purposes (commercial residential0. It is also prohibited to establish a new quarry less than 600 m from such territory…", http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/q-2,%20r.%207.

[85] "As per Directorate General of Mines Safety circular n. – DGMS (SOMA)/(Tech) Cir. No. 2 of 2003 Dt. 31/01/2003 (Annexure ll), on subject of **Dangers due to blasting projectiles**, all places within the radius of **500 m** from the place of firing to be treated as danger zone and accordingly, all person in danger zone to take protection in substantially built shelter at the time of blasting." "The regulations for danger zone (500 m) prescribed by Directorate of Mines…have to be complied with compulsorily and necessary measures should be taken to minimize the impact on environment." https://mpcb.gov.in/sites/default/files/whats_new/2020-08/CircularSitingcriteriaforstonequarriesinthestateofMaharashtra03082020.pdf.

[86] Environmental Requirements: A guide to Investors 2010, Appendix G.

[87] Gill Higgins, "Fair Go: Dust particles from quarry causing adverse health effects for residents nearby," !news, June 22, 2020, https://www.tvnz.co.nz/one-news/new-zealand/fair-go-dust-particles-quarry-causing-adverse-health-effects-residents-nearby.

- According to the Mine Safety and Health Administration (MSHA), where flyrock incidents have been known to occur at operating surface mines, the "blast area should as a minimum be one-and-a-half times the furthest distance that any previous flyrock has traveled."[88] For example, a known flyrock incident occurring 400 metres from the blast area imposes an expanded minimum setback or buffer of 600 metres (400 m × 1.5).
- On two occasions in July 2009, blasting at the Pakenham quarry near Arnprior launched flyrock beyond the 200-metre control area. In the first incident, a small rock struck a worker at a neighbouring business on the arm. In the second incident, rocks were observed flying well beyond the control area. A scale house located 230 metres from the blast was struck by a number of rocks. Two vehicles held at a controlled stop along nearby Young Road on the edge of the quarry property located about 300 metres from the blast were also struck by rock resulting in extensive damage. An investigation of the two off-site flyrock incidents determined that the control zone (setback) should have been 500 metres.[89] (Flyrock 18)
- On two occasions blasting at the Miller Braeside quarry in the Township of McNab/Braeside propelled flyrock debris outside of the limits of the quarry, once in September 2005 and again in August 2007 (Flyrock 22). The 300-metre setback from the quarry boundary proved inadequate, putting neighbouring residents and property at considerable risk. Blasting at the quarry in September 2005 propelled flyrock debris into a nearby residential neighbourhood causing damage to residences, driveways and wells. "One neighbor, Mr. Battison, described flyrock that landed on his roof over 400 metres from the site."[90] Reportedly, some neighbours received compensation but only if they signed a confidentiality agreement, and to never come after Miller again for any damages. The August 2007 quarry blast hurled flyrock debris that damaged a home and structurally damaged the foundation of another home in another direction, with one of the property owners (James), claiming $250,000 in damages.
- City Sand quarry (St. John's, Newfoundland) carried out a legitimate but inherently dangerous operation, and it had no right to eject flyrock outside the quarry site, which constituted a danger to persons and property. The quarry site was subject to a 300-metre setback. On two separate occasions blasting by City Sand propelled flyrock beyond its property limits, and in one instance the flyrock damaged two houses in a residential subdivision. City Sand's quarry leases did not confer upon City Sand rights over property outside the quarry site (para. 38).[91] In 1996, in

[88] David Sparkman, "It's Been a Busy 2018 for MSHA," ESHToday, Mar 26, 2018, https://www.ehstoday.com/safety/article/21919560/its-been-a-busy-2018-for-msha.
[89] Court Bulletin (Austin Powder Ltd. OCJ 2014), https://news.ontario.ca/en/court/29428/burlington-firm-fined-130000-for-arnprior-blasting-offences.
[90] *Miller Paving Ltd.*, PL130785, OMB, October 27, 2015 [para. 55].
[91] *City Sand and Gravel Limited v. Newfoundland (Municipal and Provincial Affairs)*, 2007 NLCA 51 (CanLII), <http://canlii.ca/t/1sfnv>, retrieved on 2020-11-10. Leave to Appeal to the Supreme Court of Canada denied. *City Sand and Gravel Limited and O.D. Holdings Limited v. Her Majesty the Queen in Right of Newfoundland, as represented by The Honourable Minister of Municipal and Provincial Affairs*, 2008 CanLII 1399 (SCC), <http://canlii.ca/t/1vgkt>, retrieved on 2020-11-10.

response to a growing awareness of the dangers of flyrock as a public health and safety issue, the Department of Municipal and Provincial Affairs in its conditions for approval of a blasting quarry required a 1,000-metre buffer zone be maintained from a *cottage* or *residence* (Flyrock 42).

- The State of Vermont Environmental Court upheld Moretown Village's decision not to issue a permit for the proposed Rivers Quarry, based in part on the "unduly harmful" impacts that quarry blasting and potential flyrock hazards would have on the quality of life of residents residing within 1,500 feet (457 metres) of the quarry:[92]

> ***Rivers is recommending that neighbors within 1,500 feet [457 metres] of the quarry suspend their use and enjoyment of their outdoor property whenever a blast is to occur. A dozen times per year, for the next thirty-three years. All of Rivers' neighbors presently enjoy the scenic natural beauty of their property without interruption; some have done so for decades prior to the Rivers quarry being proposed for their neighborhood. The Rivers quarry will bring undue harmful impacts to its neighbors; it fails to conform to criterion 9(E)(i) [impact upon the environment or surrounding land uses]****.[p. 63]* [emphasis added]

Setbacks and buffers work in tandem when analyzing the potential adverse effects of a proposed blasting quarry or expansion of an existing blasting quarry.

In *Capital Paving Inc. v. Wellington (County)*, [2010] O.M.B.D. No. 9, the OMB addressed the application of what became para. 1.2 of the 2014 Provincial Policy Statement (PPS) on the buffering of resource extraction activities and sensitive land uses from each other and coordination of uses to prevent adverse effects. The OMB stated that:

> ***While residential sensitive uses would be restricted in locating near to existing or expanding aggregate operations and in the area of known deposits, the PPS also provides protection in buffering or separation when the residential use is in place first … It is fair to say that the PPS speaks to the incompatibility of sensitive residential use with earlier aggregate operations and the reverse is also true that a proposed pit may be incompatible with the prior residential use [para. 16].*** [emphasis added]

Setbacks and buffers are to be applied in a consistent and reciprocal manner to avoid adversely effecting or sterilizing (fully or partially) pre-existing sensitive uses (e.g., residential) on land not under the same control or ownership of the proponent of a proposed offending land use. Land zoned or designated for sensitive uses (e.g. residential) must also be protected by restricting offending (obnoxious) land uses to be established beyond a safe distance of the lot or zoning limits so as not to have the effect of precluding legally permissible uses.

Janet Bradley, legal counsel for the Township of McNab-Braeside, argued before the Ontario Municipal Board (OMB) that buffers (setbacks) are often the only effective means of eliminating adverse effects between incompatible land uses. Bradley prevailed in advancing the Township's position that the buffers be provided within the boundary limits

[92] *Rivers Dev. Conditional Use Appeal*, https://cases.justia.com/vermont/environmental-court/2010-03-25-Rivers%20Development%20LLC-1.pdf?ts=1396150941.

of the ownership or control of the landowner needing the buffers (i.e., *Miller Paving*, the quarry operator).

> *Often distance is the only effective way to mitigate the [adverse] effects of industry on its neighbours….Bradley contended buffers should be on the properties of the parties needing it for their operations (not extending into people's back yards)*…[p. 4].[93]

A private for-profit company such as a quarry operator does not possess a legal right to externalize buffer (setback) requirements that diminish the utility and value of neighbouring properties, the owners of which do not participate in the anticipated profits from the quarry operation or receive any financial compensation. (In the *Miller Paving* case, the Planner representing *Miller Paving* eventually conceded to adhering to the existing 300-metre setback imposed by the Township of McNab-Braeside.)

In *Carlyle Development Corp. v. Baldwin (Township)*,[94] the OMB found that the subject matter of s.2.2.6 and 2.2.7 of the Provincial Standards (Aggregate Resources Act) is distinct from the land-use planning issues addressed in policy E.10.2 of the Official Plan. Section 2.2.6 and 2.2.7 of the Provincial Standards addresses issues for the Minister to consider on an application for an aggregates licence, while para. E.10.2 of the Official Plan addresses incompatible uses in the context of land use planning:

> *The Township argued that s. 66(1) of the ARA allows for the coexistence of the ARA, its regulations and the provisions of licences and site plans with municipal by-laws or official plans, unless they deal with the same subject matter. In this regard, it noted that policies 2.2.6 and 2.2.7 of the Aggregate Resources of Ontario, Provincial Standards Version 1.0 (the "Provincial Standards") require that technical reports on noise and blast design be submitted with applications for aggregates licences under the ARA where proposed extraction activities will be within 500 m of a receptor.* ***The Township argued that the 500 m buffer areas in the Provincial Standards address a separate issue from that addressed by the 1,000 m area of influence in the Official Plan. The Township submitted that the subject matter of these Provincial Standards provisions is noise assessment and blast design for the purposes of aggregates licences, while the subject matter of para. E.10.2 of the Official Plan concerns incompatible land uses in areas surrounding industrial-extractive designations for the purposes of land-use planning and does not address aggregates licensing issues****.* [emphasis added]

In *Uxbridge Township v. Timber Brothers*,[95] the court ruled that the *Ontario Planning Act* explicitly provided for the power for municipalities to make by-laws prohibiting pits and quarries in certain areas. Uxbridge Township had imposed a by-law providing land uses and residential setbacks for pits and quarries. A further by-law regulated the operation of pits and rehabilitation and safety requirements.[96]

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[93] "Quarry expansion, but no asphalt plant in Braeside: Opponent," Arnprior Chronicle, March 25, 2015, https://issuu.com/arnpriorchronicleguide/docs/arnprior032615.

[94] *Carlyle Development Corp. v Baldwin (Township)*, 2017 CanLII 31075 (ON LPAT), <http://canlii.ca/t/h3x73>, retrieved on 2020-03-29.

[95] [1975] O.R. (2d) 484 (Ont. C.A.) Leave to appeal to Supreme Court of Canada Dismissed. 1975 CanLII 507 (ON CA), <http://canlii.ca/t/g1cpz>, retrieved on 2020-11-05.

[96] Laura Bowman, Staff Counsel, Environmental Law Centre, "Gravel can be the pits!" Webinar – September 22, 2010, https://elc.ab.ca/media/7529/GravelPitsHandout.pdf.

The court interpreted this to allow only the prohibition of new pits, not the regulation of existing ones. The court considered that the Municipal Act in Ontario provided the power to regulate the "operation" of pits and quarries. The operator challenged an Uxbridge Township bylaw on (among other grounds) the basis that the province already regulated quarry rehabilitation and setbacks. The court found that the Municipality could provide additional setbacks:

> The provincial legislation does no more than set the minimum set-back requirements or standards and in no way attempts to restrict the right of a municipality to enhance these standards. This the municipality may do provided it acts within its delegated legislative powers and does not enact provisions in by-laws which are inconsistent with statutory provisions.
>
> The court held that municipal setbacks that were less than those provided for in provincial legislation were invalid.

The court allowed an injunction against the pit based on the other portions of the gravel regulation bylaw.

This case was referenced by the Supreme Court of Canada in Spraytech[97] *specifically for the proposition that municipalities may regulate the environment more than the province does.*

The SCC went on to hold that general welfare provisions in municipal statutes, including in Alberta, authorize environmental regulation within a municipality relating to pesticides, notwithstanding the existence of provincial laws relating to the same subject.

In *Matter of Troy Sand & Gravel Co., Inc.* (TS&G) *v. Fleming*,[98] the Appellate Division of the Supreme Court of New York upheld the decision of the Planning Board of the Town of Nassau to deny the proponent a special use permit for a proposed blasting quarry over concerns that the proposed quarry would discourage *appropriate* future development of adjoining land in a *rural residential district* and have a detrimental financial impact on the value of neighbouring homeowners' properties:

> ***The second special use standard requires that "the nature and intensity of intended operations shall not discourage the appropriate development and use of adjacent land and buildings nor impair the value thereof"*** *(Local Law No. 2 [1986] of Town of Nassau art VI [A]* ***[2]). In finding that this standard was not satisfied, the Town Board relied on, among other things, a property value impact analysis, prepared by an expert whose qualifications have not been challenged. The analysis concluded that the proposed quarry would, unequivocally, have a deleterious financial effect on existing homeowners in the surrounding area and could result in a significant decrease in neighboring property values****.*** [emphasis added]

The adverse effects on the future development prospects of the community anticipated from TS&G's proposed mining activity (excavation and blasting), which was to be set back from the property line (lot limit) 200 feet (61 metres), with the mining activity being no less than 1,210 feet (369 metres) from the nearest *existing* residence, were found to be unacceptable.

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[97] *114957 Canada Ltée (Spraytech, Société d'arrosage) v. Hudson (Town)*, 2001 SCC 40 (CanLII), [2001] 2 SCR 241, <http://canlii.ca/t/51zx>, retrieved on 2020-11-05

[98] *Troy Sand & Gravel Co., Inc. v. Fleming*, 156 AD 3d 1295 (2017) 68 N.Y.S.3d 540, 2017 NY Slip Op 09222, https://scholar.google.ca/scholar_case?case=6635546804191739814&q=property+values+near+quarries&hl=en&scisbd=2&as_sdt=2006.

In *Saint-Romuald v. Olivier*[99] the Supreme Court of Canada, in discussing the role of zoning in avoiding conflicting land uses, makes reference to private law remedies designed, in a general sense, to protect neighbourhood amenities from damaging externalities occasioned by intruding non-compatible and undesirable land use activities:

> *The doctrine of Rylands v. Fletcher (1868), L.R. 3 H.L. 330, imposes virtually absolute liability on owners who bring on their land "anything likely to do mischief if it escapes" and causes damage to a neighbour, unless the escape was due to the neighbour's default (pp. 339-40) [para. 9].*

As noted by the OMB in *Caldwell Construction Ltd. v. Kirkland Lake (Town)*,[100] the objective of land use planning is to avoid adverse effects by separating incompatible land uses or incompatible activities:

> *Land use planning differentiates and separates incompatible uses to prevent or minimize adverse effects on the persons occupying those land uses. The individual characteristics of the current occupants of a land use do not set the standard for establishing an adverse effect. The standard is more general and relates to an assessment of compatibility between two land uses such that persons generally may occupy those uses without adverse effects [para. 70].*

As decided by the Nova Scotia Court of Appeal in *City Sand & Gravel Ltd. v. Newfoundland (Municipal and Provincial Affairs)*, the quarry operator could not compel the municipality to restrict development of adjacent land so that a public danger would not be created, and that the quarry operator had to alter its blasting practice within the boundaries of its own land as it had no right to eject flyrock outside the quarry site.

> ***City Sand understood from discussions with the Department of Mines and Energy, which issued the quarry leases, that there was a [300-metre] buffer zone around the quarry site. However, the quarry leases did not confer upon City Sand rights over property outside the quarry site [p.38].*** [emphasis added]
>
> ***A municipal authority reviewing a proposed residential development may owe a duty of care to future residents in respect of known hazards. Though City Sand emphasized that point, it did not acknowledge directly that its blasting, which entailed the inherent risk of fly-rock, exposed it also to liability in tort to those same residents. As City Sand had no right to eject fly-rock outside the quarry site, the respondent argued that Metro Board owed no duty of care to City Sand.*** *The trial judge agreed – Trial Decision para. 56. I see no fundamental flaw in that position.* ***City Sand carried on a legitimate but inherently dangerous operation. It constituted a danger to persons and property outside the quarry site.*** *Prior to the development of Jane Heights, neither the owner of the land comprising that development, nor Metro Board, found it necessary to take legal action in respect of fly-rock landing outside the quarry site.* ***City Sand could not however compel Metro Board to restrict development of adjacent land so that a public danger would not be created [para. 54].***[101] [emphasis added]

Courts have ruled it unlawful for a municipality to enact a zoning by-law for the exclusive benefit of a proposed quarry operation by imposing setback (buffer) requirements on neighbouring lands which restrict their use or preclude their development (i.e., de facto

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[99] *Saint-Romuald (City) v. Olivier*, 2001 SCC 57 (CanLII), [2001] 2 SCR 898, <http://canlii.ca/t/51z2>, retrieved on 2020-01-09.

[100] *Caldwell Construction Ltd. v Kirkland Lake (Town)*, 2018 CanLII 58222 (ON LPAT), <http://canlii.ca/t/hsqcr>, retrieved on 2020-01-11.

[101] *City Sand and Gravel Limited v. Newfoundland (Municipal and Provincial Affairs)*, 2007 NLCA 51 (CanLII), <http://canlii.ca/t/1sfnv>, retrieved on 2020-07-11.

taking of land without compensation) and which impose (externalize) unwanted adverse effects.[102] [103] Any burdens imposed on a proposed quarry operation, including setback requirements, to avoid adverse effects must be borne entirely by the proponent and confined within the boundaries of the proposed offending quarry. Neighbouring property owners are not legally bound to subsidize a for-profit quarry operation, nor are they expected to endure the adverse effects of a quarry operation (e.g., blasting - a hazardous activity, flyrock, concussion, vibration, noise, odour, pollution, loss of access to groundwater - a property right, truck traffic, injury or death, respiratory illnesses, property damage, reduced property value, etc.).

A proposed blasting quarry operation that cannot overcome the problem of incompatibility with abutting land uses through the use of its own setbacks that take into account all of the potential adverse effects on adjoining properties, the proponent of the proposed quarry can either acquire land elsewhere or buyout owners of adjoining properties at market value to provide the necessary setbacks, provided that in doing so the surrounding area (or community) is not destabilized or the environment is not adversely impacted.

Municipality Cannot Ignore Competing Community Interests

In the following case, the Planning Authority failed to consider competing interests of the Community under Ontario's Provincial Policy Statement (PPS). As mandated by the OMB, a planning authority cannot disregard the competing interests of the community at the behest of the aggregate industry while addressing and weighing land use policies and options:[104]

> *The PPS mandates that that all relevant policies must be considered by the planning authority.*[105] *The Ontario Municipal Board found in Ontario (Ministry of Natural Resources)…that Part lll of the PPS makes it "abundantly clear" that a planning authority must consider all relevant interests, and that all policies must be considered and weighed when land use decisions are to be made [para. 30].*[106]
>
> *The phrase "as is realistically possible" in section 2.5.2.1 of the PPS means that a proposal for aggregate must address competing interests:*
>
> > The "as is realistically possible" approach means addressing competing interests of many stakeholders, one of which is the aggregate industry. With respect, it would be an oversimplification of the policy and an error of interpretation in my estimation to suggest that "as is realistically possible" only includes the physical existence of the aggregate resource.[107] [para. 36]

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[102] *City Sand and Gravel Limited v. Newfoundland (Municipal and Provincial Affairs)*, 2007 NLCA 51 (CanLII), <http://canlii.ca/t/1sfnv>, retrieved on 2020-11-10. Leave to Appeal to the Supreme Court of Canada denied. *City Sand and Gravel Limited and O.D. Holdings Limited v. Her Majesty the Queen in Right of Newfoundland, as represented by The Honourable Minister of Municipal and Provincial Affairs*, 2008 CanLII 1399 (SCC), <http://canlii.ca/t/1vgkt>, retrieved on 2020-11-10.

[103] *Miller Paving Ltd.,* PL130785, OMB, October 27, 2015 http://www.omb.gov.on.ca/e-decisions/pl130785-Oct-27-2015.pdf.

[104] *Kevin Matthews et al v. Lempiala Sand & Gravel Limited*, File no. PL180754, https://www.cela.ca/sites/cela.ca/files/TLCA%20Case%20Synopsis.pdf.

[105] *PPS*, Part lll, policy 4.4.

[106] *Ontario (Ministry of natural Resources), Re,* 2012 CarswellOnt 10693, at para 25 [*Ontario (MNR)*], in TLCA Book of Authorities, Tab 2, applying Part lll of *PPS,* 2005.

[107] *2220243 ONT Inc., Re*, [2015] OMBD No 418, at para 41, in TLCA Book of Authorities, Tab 4.

> *Ontario's Planning Act, and the PPS and the Official Plan applicable in the unorganized township of Gorham, stress balance and compatibility between land uses.* ***Contrary to that mandatory direction, the LRPB [Lempiala Sand & Gravel Limited] focused solely on the provisions of the planning documents which support aggregate extraction [section 2.5] and did not consider the provisions which support recreational and residential land use, and environmental protection*** *[para. 3].* [emphasis added]

Section 1.2.6 of the 2020 Provincial Policy Statement (*PPS*)[108] sets out the provincial expectation when planning for major facilities such as a quarry in proximity to sensitive or incompatible land uses:

> *Major facilities and sensitive land uses should be planned and developed to avoid, or if avoidance is not possible, minimize and mitigate any potential adverse effects from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term operational and economic viability of major facilities in accordance with provincial guidelines, standards and procedures.*

The *PPS* (Section 6.0) takes its definition for "adverse effects" from the Ontario *Environmental Protection Act* (EPA),[109] and includes one or more of the following factors:

a) impairment of the quality of the natural environment for any use that can be made of it;
b) injury or damage to property or to plant or animal life;
c) harm or material discomfort to any person;
d) an adverse effect on the health of any person;
e) impairment of the safety of any person;
f) rendering any property or plant or animal life unfit for human use;
g) loss of enjoyment of normal use of property; and
h) interference with [the] normal conduct of business.

The *PPS* policies (Part V) flow from the provincial interests articulated in s. 1.1.1 of the *Act*, including,

c) avoiding development and land use patterns which may cause environmental or public health and safety concerns
d) avoiding development and land use patterns that would prevent the efficient expansion of *settlement areas* in those areas which are adjacent or close to *settlement areas.*

1.1.3.1 *Settlement areas* shall be the focus of growth and development.

c) minimize negative impacts to air quality and climate change, and promote energy efficiency
d) prepare for the *impacts of a changing climate*

The *PPS* must also be read in conjunction with s.14(1) of the *EPA*:

> *…a person shall not discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment.*

[108] https://files.ontario.ca/mmah-provincial-policy-statement-2020-accessible-final-en-2020-02-14.pdf.
[109] https://www.ontario.ca/laws/statute/90e19#BK16. (August 1, 2020 – e-Laws currency date)

The *EPA* is to be given a broad and liberal meaning.[110] The *EPA's* definition of *contaminant* means "any ***solid***, ***liquid, gas, odour, heat, sound, vibration, radiation*** or combination of any of them resulting directly or indirectly from human activities that cause or may cause an *adverse effect*." ***Flyrock*** is a "solid" and one of a number of potential contaminants associated with quarry blasting.[111]

Flyrock is the "**ultimate hazardous effect**," and, according to Section 3.4, (***Irreconcilable Incompatibilities***),

> ***When impacts from discharges and other compatibility problems cannot be reasonably mitigated or prevented to the level of a trivial impact (defined in Procedure D-1-3, "Land use Compatibility: Definitions") new development, whether it be a facility or a sensitive land use, shall not be permitted.***[112] [emphasis added]

Any development must also adhere to the **D-1 Land Use and Compatibility** *guideline* of the Ontario Ministry of the Environment, Conservation and Parks (MOECC).[113] *Section 14(1) of the Environmental Protection Act* is the primary legislative basis for this *guideline*.

> ***The guideline is intended to apply only when a change in land use is proposed, however, compatibility concerns should be recognized and addressed at the earliest possible stage of the land use planning process for which each particular agency has jurisdiction. The intent is to achieve protection from off-site adverse effects, supplementing legislated controls.*** [emphasis added]
>
> *The guideline encourages informed decision-making for Ministry staff, land use planning and approval authorities, and consultants.* ***All land use planning and resource management agencies within the Province shall have regard for the implications of their actions respecting the creation of new, or the aggravation of existing, land use compatibility problems. The Ministry shall not be held liable for municipal planning decisions that disregard Ministry policies and guidelines. When there is a contravention of Ministry legislation, Ministry staff shall enforce compliance***. [emphasis added]

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[110] "The *EPA* is Ontario's principal environmental protection statute. Its status as remedial legislation entitles it to a generous interpretation (*Legislation Act, 2006*, S.O. 2006, c. 21, Sch. F, s. 64; *Ontario v. Canadian Pacific Ltd.*, 1995 CanLII 112 (SCC), [1995] 2 S.C.R. 1031, at para. 84). Moreover, as this Court recognized in *Canadian Pacific*, environmental protection is a complex subject matter — the environment itself and the wide range of activities which might harm it are not easily conducive to precise codification (para. 43). As a result, environmental legislation embraces an expansive approach to ensure that it can adequately respond 'to a wide variety of environmentally harmful scenarios, including ones which might not have been foreseen by the drafters of the legislation' (para. 43). Because the legislature is pursuing the objective of environmental protection, its intended reach is wide and deep (para. 84)," *Castonguay Blasting Ltd. v. Ontario (Environment)*, [2013] 3 SCR 323, 2013 SCC 52 (CanLII), <http://canlii.ca/t/g1038>, retrieved on 2019-09-29.

[111] In *R. v. Glen Leven Properties Ltd.*, (1977), 15 O.R. (2d) 501, O.J. No. 286, the Divisional Court found that sand which naturally blows in the wind is not a contaminant, but when sand that would normally remain stationary is moved by human activity, such as a blasting operation, it becomes a contaminant. http://www.beament.com/wp-content/uploads/2016/03/2.-Ontario-Court-of-Appeal-to-Hear-Case-Involving-Flyrock.pdf.

[112] "'More details for specific facilities may be identified in other Ministry guidelines listed in Procedure D-1-2, "Land Use Compatibility: Specific Applications."' https://www.ontario.ca/page/d-1-land-use-and-compatibility.

[113] https://www.ontario.ca/page/d-1-3-land-use-compatibility-definitions#:~:text=period(s).-,Trivial%20Impact,normal%20use%20period(s).

> ***Nothing in this guideline is intended to alter or modify the definition of 'adverse effect' in the Environmental Protection Act.*** [emphasis added]

EPA Guideline 3.0 addresses the importance of **Separation Distance** between incompatible land uses, excerpts of which are reproduced as follows:

> *Incompatible land uses are to be protected from each other, in land use plans, proposals, policies and programs to achieve the Ministry's environmental objectives….Distance is often the only effective buffer, however, and therefore adequate separation distance, based on a facilities influence area, is the preferred method of mitigating 'adverse effects.'*
>
> *The linear measurement between a 'facility' property/properties and a 'sensitive' land use/uses." The distance should be adequate to minimize or prevent the 'adverse effects' of one land use upon the other, so that there would only be a 'trivial impact."*
>
> *The separation distance should be sufficient to permit the functioning of the two incompatible land uses without an 'adverse effect' occurring. Separation of incompatible land uses should not result in freezing or denying usage of the intervening land. When development is proposed beyond a facility's potential influence area or actual influence area, the Ministry shall not normally object to development on the basis of land use compatibility. Exceptional situations may be identified in documents for specific facilities which are listed in Procedure D-1-2, "Land Use Compatibility: Specific Applications."*
>
> *Within the separation distance, municipal controls to increase zoning by-law setbacks for facilities or restrictions on location and use of outdoor storage could assist in achieving distance separation.*

In determining an "adverse effect," as a **Significant Impact**,

> *…[T]he timing and magnitude of contaminant discharges should be related to the 'sensitive land uses' normal use period(s).*

The *EPA* defines **Sensitive Land Use** as follows:[114]

> A building, 'amenity area' or outdoor space where routine or normal activities occurring at reasonably expected times would experience 1 [one] or more 'adverse effect(s)' from contaminant discharges generated by a nearby 'facility'. The 'sensitive land use' may be a part of the natural or built environment. Depending upon the particular 'facility' involved, a sensitive land use and associated activities may include one or a combination of:
>
> i. residences or facilities where people sleep (e.g. single and multi-unit dwellings, nursing homes, hospitals, trailer parks, camping grounds, etc.). These uses are considered to be sensitive 24 hours/day.
> ii. a permanent structure for non-facility related use, particularly of an institutional nature (e.g. schools, churches, community centres, day care centres).
> iii. certain outdoor recreational uses deemed by a municipality or other level of government to be sensitive (e.g. trailer park, picnic area, etc.).
> iv. certain agricultural operations (e.g. cattle raising, mink farming, cash crops and orchards).
> v. bird/wildlife habitats or sanctuaries.

[114] https://www.ontario.ca/page/d-1-3-land-use-compatibility-definitions.

Recommended Minimum Setback Requirements for Blasting Quarries

The research conducted in the preparation of this research paper and previous research papers prepared by the author in connection with *Blasting Quarry Operations* has identified numerous adverse effects on the environment; the health, safety and welfare of the public; and the quality of life of residents in nearby communities and the diminution in the value of their homes.

A mandatory minimum setback requirement of 800 metres imposed by municipalities on applications for new blasting quarries or for expansion of existing blasting quarries would

- eliminate most land use conflicts;
- substantially reduce the dangers of injury and death by flyrock (an unavoidable consequence of rock blasting, which is an ultrahazardous activity);
- substantially reduce property damage by blasting and flyrock;
- substantially reduce property damages (loss of market value, loss of homeowner equity, lack of marketability and lack of mortgageability);
- substantially reduce or eliminate environmental impacts from dust, odour, fumes, airblast and ground vibration; and
- substantially reduce complaints from residents in surrounding communities.

SECTION II

The following list of numbered "Flyrock" incidents is an on-going exercise documenting incidents of flyrock that have come to the attention of the public by way of media releases, incident reports, articles, power point presentations, case law, etc., generated by research using Google, Bing and Ecosia search engines. Prior incidents of flyrock, numbered consecutively, can be found in Sevelka's previous papers addressing issues related to blasting quarry operations at www.intval.com.

Flyrock 76

In an online Power Point presentation "Blasting Safety" by Mirabelli of Quarry Academy,[115] there is reference to a quarry blast that sent an 80-pound boulder crashing into a school bus on the New York Thruway carrying 52 students and striking and injuring three students. A man driving eastbound on the same Thruway was also struck and injured by flyrock. The flyrock incident was ***Termed by many as the Blasting Industry's worst Nightmare!***

> *A quarry blast sent an 80-bound rock crashing into a chartered bus carrying 52 band and choral students from a Connecticut high school. Three (3) people were injured in the accident, which occurred on the New York Thruway, about 25 miles west of Albany. Two (2) girls on the bus, which was headed westbound to a Toronto music contest, were injured….A Utica man driving on the eastbound side of the Thruway also sustained minor injuries from flying rock.* [Slide 7]

Flyrock 77

A January 11, 2001 incident report of the Queensland Government[116] documents an explosion at a blasting quarry that caused flyrock, which struck an employee at a distance of 75 metres, resulting in the employee losing his right eye, and having his cheek bone shattered and jaw broken. Other pieces of flyrock were scattered up to 150 metres from the area of the blast.

> *A shotfirer [blaster] was struck on the right side of his face by flyrock after a toe was blasted at a quarry. He was videoing the shot 75m from the blast area whilst sheltering behind a steel hopper with another person. The flyrock travelled towards these persons. The shot was fired by another person from a different location.*
>
> *The shotfirer lost his right eye, his cheek bone was shattered, which required reconstructive surgery and his jaw was broken.*
>
> *The flyrock involved and its trajectory were not identified however the video record shows flyrock ricocheting upwards and to the side of the camera. Other pieces of flyrock were found scattered up to 150m from the blast area.*

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[115] Lawrence J. Mirabelli, Senior Technical Consultant, Quarry Academy (DYNO and SANDVIK), https://www.911metallurgist.com/blog/wp-content/uploads/2016/01/Blasting-Safety.pdf.

[116] Queensland Government, Department of Natural Resources, Mines and Energy, Serious injury flyrock accident, Significant incident report n. 27, 11 January 2001, Version 1," https://www.dnrme.qld.gov.au/business/mining/safety-and-health/alerts-and-bulletins/mines-safety/serious-injury-flyrock-accident?SQ_DESIGN_NAME=print_preview.

Flyrock 78 (27 & 49)

On January 10, 2006, a blast at a Tipperary quarry launched flyrock over 300 metres causing widespread damage to quarry plant, private cars and buildings, and injuring three people.

> *On the 6 November 2009 at Clonmel Circuit Court, Tipperary, Dennis Tarrant & Sons Limited [William Tarrant, Irish Industrial Explosives Limited and Mr. Manus Carroll [each] pleaded guilty to one charge [and paid nominal fines.]. This case arose as a result of a flyrock incident on the 10 January 2006 at the quarry of Denis Tarrant & Sons Limited, Kilfeacle, Co. Tipperary. The rock travelled over 300m and caused widespread damage to quarry plant, private cars and buildings within the quarry complex. Three people were also injured.*[117]

Flyrock 79

In May 2017, the Planning & Environment Resources Regulator, NSW Government[118] reported a blast at a surface mine that propelled flyrock a distance of 245 metres striking a ute (utility vehicle), with six people standing alongside the ute within the 500 metre exclusion zone.

> *Flyrock hit and damaged a ute when the rock was ejected during blasting operations at a mine. There were six people standing alongside the ute at the time…. The operator reported that the people and ute were positioned inside the blast exclusion zone, 245m from the blast.* ***The blast exclusion zone required a distance of 500m.*** [emphasis added]

Flyrock 80

In 1991, a blast at a Killanully quarry launched an 8-pound rock 802 feet (244 metres), within 20 paces of a house in Ballygarvan Village.[119]

Flyrock 81

In 2011, a blast at an Opencast Coal Quarry in West Glamorgan launched flyrock beyond the site's 150-metre danger zone.[120]

> *A blast took place at an Opencast Coal Quarry in West Glamorgan, South Wales, causing flyrock to project outside the site's 150 metre danger zone. The weather conditions were dry, sunny and freezing and that day was regarded as the coldest day during two weeks of freezing conditions.*
>
> ***The incident was reported to the Health and Safety Executive although it was not reportable under RIDDOR, as the flyrock did not project beyond the site boundary****.* [emphasis added]

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[117] Health and Safety Authority, Prosecutions 209, https://www.hsa.ie/eng/Topics/Inspections/Prosecutions/Prosecutions_2009/.

[118] Weekly incident summary, May 24, 2017, https://www.resourcesandgeoscience.nsw.gov.au/__data/assets/pdf_file/0008/717434/weekly-incident-summary-week-ending-24-may-2017.pdf.

[119] "Residents oppose quarry expansion," The Irish Times, July 12, 2004, https://www.irishtimes.com/news/residents-oppose-quarry-extension-1.1148702.

[120] The Global Mineral Products Health & Safety Hub, Incident alert, 01/03/2011, https://www.safequarry.com/IncidentReports/IncidentView.aspx?kincident=283.

Flyrock 82

In 2011, a blast at a quarry projected flyrock debris up to 450 metres from the blast area that damaged a building.[121]

> *Employees and infrastructure were put at risk when a face-burst projected flyrock material up to 450m from the blast area. .Flyrock in storage shed (approx. 250m) This incident became even more serious when it was discovered that not all personnel had been removed from the exclusion zone.*

Flyrock 83

On December 21, 1999, blasting at a quarry in Paradise, Lancaster County, launched flyrock debris that struck and killed Lee Messner, a loader operator, while sitting in his truck approximately 800 feet (244 metres) from the blast. Other flyrock debris damaged a building approximately 1,500 feet (457 metres) from the blast.[122]

> *On December 21, 1999, Lee E. Messner, loader operator, age 32, was fatally injured when he was struck by flyrock while sitting in a pickup truck. Messner and Arthur Miller, production foreman, were in the truck guarding the access roadway leading to the quarry and primary plant during blasting operations.*
>
> *The accident occurred because the company and the contractor failed to ensure that persons had cleared the blast area or were in a blasting shelter or protected location. The contract blaster had not verified their location prior to initiating the shot, had not informed them of any potential for flyrock, and had only instructed them to clear the primary crusher area….*
>
> *The accident occurred on a roadway adjacent to the surge pile located in the primary plant area. The roadway was approximately 40-50 feet wide, and intersected the haul road from the pit to the primary crusher dump. The accident site was approximately 180 feet away from the west quarry wall, and approximately 800 feet from the blast holes located on the third production bench, one level above the quarry floor….*
>
> *At least one of the blastholes 'blew-out' causing a massive amount of flyrock. Flyrock peppered the west highwall. Flyrock damaged a building approximately 1,500 feet [457 metres] west of this blast.*
>
> ***Flyrock had struck buildings at the secondary crushing plant approximately 3 years ago [1996] from a prior shot in another area of the quarry**. A seismograph was in place approximately 950 feet from the blast at Hess Mills, Vintage Road….*[emphasis added]
>
> ***The blaster was aware that there were blast holes which could create flyrock. Failure to clear the blast area or ensure that all personnel were in a blasting shelter or other protected location prior to initiating the blast showed a serious lack of reasonable care which constitutes more than ordinary negligence and is an unwarrantable failure to comply with a mandatory standard.*** [emphasis added]

[121] NSW Government, Industry & Investment, Safety Alert, "People put at risk inside blast exclusion zone," June 2011, https://resourcesandgeoscience.nsw.gov.au/__data/assets/pdf_file/0007/397294/SA11-06-People-put-at-risk-inside-blast-exclusion-zone.pdf.

[122] United States Department of Labor and Mine Safety and Health Administration, Report of Investigation, April 17, 2000, https://arlweb.msha.gov/FATALS/1999/FTL99M53.HTM.

Flyrock 84

On July 26, 2007, a blast at a quarry in New Greenpark, Rawang launched flyrock debris into a nearby residential subdivision that penetrated the roof of the home of Harkit Kaur and landed in her living room, and that struck one other house.[123]

> *Housewife Harjit Kaur had the shock of her life when a rock, the size of a football, landed in her living room recently.*
>
> *That was not all. The granite rock punched a hole through the roof, carpet and floor tiles of her house on Jalan NGP 2/5 in New Greenpark, Rawang in the 3.20pm incident on July 26, [2007].*
>
> *If it had happened a week earlier, it could have killed her maid and her 80-year-old mother Gurdev Kaur, said a shaken Harjit.*
>
> *"My mother would usually lie down on the couch here while the maid would sit on the floor in the hall to watch television. It so happened that my mother went to hospital that day and the maid was outside the house.*
>
> *"If the maid had been sitting in her usual spot, she would definitely have been hit by the rock. We hope such incidents will stop because flying rocks raining down on houses and people could cause fatal injuries," she said….*
>
> *According [to] Rawang B New Greenpark RT chairman Zahir Abdullah, residents in the area had to cope with vibration and a few had their roofs damaged.*
>
> ***"It has been going on for years. Some houses have been hit by flying rocks from the quarry while others have cracks on their walls."***
>
> ***"There should not be a quarry so close to a residential area at all. Why is this blasting still going on? There are many places out of town where quarrying could take place," he said***. [emphasis added]
>
> *Selayang Municipal Council (MPS) deputy president Jamri Basni and MPS councillor M.B Raja, who were visiting the area, saw a rock hitting another house located about 30m from Harjit's place.*
>
> *Raja noted that the grill at the back door of the house had been hit by the rock debris.*
>
> *"The rock debris caused the side of the grill to break."…*

Flyrock 85 (& 52)

On April 14, 2011, a residential subdivision in the village of Kilsyth was showered with flyrock debris from a blast at a nearby quarry, and five homes on Ladeside Drive were damaged, some of them severely.[124]

> *The [flyrock] incident involved a controlled blast at a site operated by Dawn Homes, off Kilsyth's Stirling Road [which exceeded the perimeter of the safety exclusion zone set by specialist blasting contractors on site].*
>
> ***A number of homes have been damaged - some of them severely - after an explosion at a nearby building site in Kilsyth, North Lanarkshire.*** [emphasis added]

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[123] "Flying rocks from quarry blasting," The Star, 10 August 2007, https://www.thestar.com.my/news/community/2007/08/10/flying-rocks-from-quarry-blasting.

[124] "Kilsyth explosion in building site badly damages homes," BBC, April 14, 2011, https://www.bbc.com/news/uk-scotland-glasgow-west-13082821.

Jean Fleming, who lives on Stirling Road, said rocks were blasted out of the quarry and flung over the rooftops. She said: "There was the most massive explosion. The noise was horrific. Absolutely deafening.

"The rocks went right over the house - you could see them being blasted across the roof.

"Everyone is shocked and very traumatised."

Mrs Fleming said her house had a smashed window, broken roof tiles and a broken circuit board.

Her neighbour, Betty Wilson, saw her roof broken and a rock fall into her shower. Mrs Wilson added: "If I had been in the shower I would be dead. A brick came through the roof."…

Yvonne Ross, who lives in nearby Ladeside Drive, saw the damage to houses on her estate after she arrived home with her children

She told BBC Scotland: "The police and fire brigade were here when I got back. The street was cordoned off and they were checking everyone's house.

"Rocks from the explosion went through the roofs of houses. In one case a boulder went right through into the lounge.

"One of bricks has broken our front step but the damage is quite minor. It must have travelled quite a distance to reach my door."

Mrs Ross said debris from the explosion went right through a brick wall in one garden and "right through a conservatory and bathroom wall" in another home.

She added: "No-one has been injured which is quite surprising really. It's a total miracle."

Strathclyde Police said it was believed a total of five homes in Ladeside Drive, opposite the quarry, had been damaged by debris…."

A spokesman for Strathclyde Fire and Rescue said: "Fire crews were immediately tasked with searching the dwellings for any casualties, evacuating the immediate area of non-emergency services personnel and instigating a 300m [984ft] hazard zone in liaison with the police.

"It was subsequently confirmed that, thankfully, no members of the public had suffered any injuries….

Flyrock 86

On December 4, 2013, a blast at Kansas Falls Quarry launched flyrock debris that struck and killed Stephen W. Hetzler, the blaster, who was standing 153 feet (47 metres) from the lead holes of the blast. The largest rock that struck Hetzler weighed approximately 96 pounds.[125]

Stephen W. Hetzler, Lead Man, age 63, was killed on December 4, 2013. He initiated a blast and was struck by flyrock. Hetzler was standing 153 feet away from the lead holes of the blast. The largest rock that struck Hetzler weighed approximately 96 pounds.

Several pieces of flyrock traveled toward Hetzler's location. A rock 19 inches long by 14½ inches wide by 7½ inches thick struck Hetzler in the upper torso knocking him to the ground.

The blast consisted of 66 holes, 3½-inches in diameter to a full depth of 8 feet, laid out in 6 rows on a 9-foot by 9-foot burden and spacing. The bench height was 8 feet with no drill log. One lead-in line was observed during the investigation. The amount of explosive product, ANFO, loaded in the 66 holes was 716 pounds. The holes were stemmed with 5 feet of drill cutting

[125] United States Department of Labor, Mine Safety and Health Administration, Metal and Nonmetal Mine Safety and Health, Fatal Explosives and Breaking Agents Accident December 4, 2013, MAI-2013-19, https://www.msha.gov/sites/default/files/Data_Reports/Fatals/Metal/2013/ftl13m19.pdf.

> ***The investigators reviewed the basic blast design and determined the flyrock that resulted in this accident was a blow-out type of flyrock due to the straight path that directly impacted the victim. Investigators determined the flyrock was travelling approximately 400 miles per hour***. [emphasis added]
>
> ***Steve Hetzler (victim) had approximately 16 years of mining experience and worked at this mine for 11 years, 48 weeks, and 4 days. A representative of MSHA's Educational Field Services staff conducted an in-depth review of the mine operator's training records. The training records for Hetzler were reviewed. All of his required MSHA Part 46 training, including annual refresher training and task training, was found to be up-to-date and in compliance with MSHA requirements***. [emphasis added]
>
> ***The accident occurred because management failed to establish safe work procedures for persons to follow during blasting activities at the mine. The victim was using his work cellular phone to video record the blast. Hetzler was positioned too close to the blast and was not provided a blasting shelter to protect him from flyrock***. [emphasis added]
>
> ***Corrective Action: Management developed and implemented a Blasting SOP [Blasting Standard Operating Procedures], addressing the positioning of miners during blasting procedures. Miners will be located at least 1,000 feet [305 metres] from the blast area. The blaster will always be located inside a blasting shelter.*** *The SOP also addresses communications of the blaster with the other miners to clear the blast area before the blast is initiated. All persons involved in blasting were trained regarding the SOP.* [emphasis added]

Flyrock 87

On April 25, 2005, a blast conducted by Maine Drilling and Blasting at a quarry in Raymond, HN, launched flyrock debris that resulted in damage to buildings and vehicles over 1,000 feet (305 metres) away.[126]

Flyrock 88

On July 11, 2008, flying debris from a blast at a Uganda quarry struck teenager Ismail Kayima while riding in a lorry (truck) and had to have a badly broken leg amputated.

> *A teenager has had to have a badly broken leg amputated after being struck by a flying rock while riding in a lorry, while residential areas have been affected by flying explosion debris. A school roof and a health centre were damaged adjacent to the Cementers quarry.*

Flyrock 89

On July 13, 2016, a blast at a quarry in Northampton County launched flyrock debris that damaged houses in the nearby Hillside Farms neighbourhood.[127]

> *An explosion July 13, 2016 sent chunks of limestone flying in the air and landing in the nearby Hillside Farms development.*
>
> *Residents called police to report damages to house siding, mailboxes and roofs from the dropping debris. Some fragments were found near a playground on Longview Drive.*
>
> *Township resident Joanne Messenlehner said similar incidents have occurred before and she wants township leaders to do something before someone gets hurt.*

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[126] Arthur Hendrickson, "Danger from Flyrock," The Valley Reporter, October 16, 2008, https://www.valleyreporter.com/index.php/news/my-view/4368. -

[127] "Quarry explosion damages homes in Upper Nazareth," Lehigh Valley Regional News," Jul 15, 2016. https://www.wfmz.com/news/area/lehighvalley/quarry-explosion-damages-homes-in-upper-nazareth/article_4358852c-f241-524b-b96a-0e3d67c0a5af.html.

"What steps are you taking to prevent this in the future?" Messenlehner asked as Wednesday's township supervisors' meeting.

Township Manager E.J. Mentry said the township does not have any authority regarding activity at the quarry.

"When an incident like this happens, the state steps in," Mentry said….

Flyrock 90

On March 26, 1998, a blast at Essroc Cement Corp. quarry in Upper Nazareth Township sent flyrock debris that penetrated the roofs of two nearby houses, a gazebo and two cars.[128]

Mud and rocks as big as 1-1/2 feet wide spewed from an Essroc Cement Corp. quarry in Upper Nazareth Township after a blast around noon Wednesday, poking holes in the roofs of two nearby houses and a gazebo and hitting two cars….

State Department of Environmental Protection spokesman Mark Carmon said the incident was a violation of state regulations and would be investigated by the state Bureau of Mining and Reclamation.

"They're not supposed to have any kind of projectiles," Carmon said of blasting operations. "It has to be a controlled blast."

The blast affected homes along the Bath Pike (Route 248) near Christian Springs Road, about a half-mile from the Nazareth border.

Flying debris shattered a window in the home of Sadie Hixon, who lives at 2819 Bath Pike.

"I could hear the glass breaking," she said. "I just stood there screaming, 'Oh, my God! Oh, my God!'"…

The blast occurred in Quarry 2, a 106-acre site on the north side of Route 248. According to a company fact sheet, the quarry is next to Plant 2, a bulk cement distribution facility, and provides stone for Plant 1 in Nazareth. Quarry 2 is one of three Essroc quarries in the Nazareth area and is near the Imperial Quarry, a 100-acre site acquired from Lone Star Cement. Quarry 1, in Nazareth and Lower Nazareth Township, is 122 acres….

Residents were upset about the unscheduled, man-made meteor shower.

"We've been complaining to them for quite a while," said Minnie Keglovitz, who lives at 2811 Bath Pike. "I've lived here since 1962 and I've never had this before," she said, adding a rock about 1-1/2 feet wide landed in her driveway. "It was a good thing I was in my house. I wouldn't be around here anymore."

Richard Huth of 2829 Bath Pike said he had just started a nap when the blast occurred. "The whole house (shook)," he said. "I thought it was going to fall in."

Lorna Dreisbach, 57, of Bushkill Township was driving on Bath Pike when the unexpected debris shower rained down. "I was just driving along and all of a sudden I heard this boom and everything came flying over the bank up there," she said. "So much mud was flying, I couldn't see very good." The car of Margaret Schuyler of Oak Lane, Northampton, was also hit….

Hixon, whose 6-year-old roof also was damaged, said the quarry blasting has become more annoying.

"For a couple years now, it's been getting worse. This is the worst it's been," she said.

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[128] Joe Nixon, "U. Nazareth Quarry Blast Damages Roofs, Autos* Accident At Essroc Cement Corp. Operation Sends Mud, Rocks Flyring," The Morning Call, March 26, 1988. https://www.mcall.com/news/mc-xpm-1998-03-26-3180302-story.html.

Denise Brooks was called home from work to check out the damage to her home, at 2824 Christian Springs Road. A rock had gone through her roof and lodged above her bathroom ceiling, said township Police Chief Alan Siegfried. Some spouting was also damaged.

Brooks just moved into the home in October. She said she has to give her dog a tranquilizer when blasting occurs. The dog was in the home Wednesday, but was not injured. "I knew the quarries were there, but I didn't expect it to be as bad as it's been a couple times," she said….

Flyrock 91

On August 21, 2014, a blast at the Superior Ready Mix quarry in Mission Gorge hurled flyrock debris into a nearby residential neighbourhood and damaged four homes.[129]

Imagine living next to a quarry with blasting, dust and noise invading your neighborhood.

People in Mission Gorge and Tierrasanta don't have to imagine.

At the Superior Ready Mix quarry on Mission Gorge Rd. there is dust, noise from rock crushers and about once a week, blasting.

A quarry subcontractor standing on a ridge in Tierrasanta videotaped one such blast in August 2014. The video shows the explosion and then the contractor running away as rocks fly overhead. [emphasis added]

Four homes were damaged when rocks flew through stucco walls, shattered windows and damaged an iron fence. [emphasis added]

Nobody was injured but families were inside the homes at the time of the blast, according to a Mine Safety and Health Administration investigation.

"That hole that was left inside the house, a child could crawl through that hole," said Josh Lahaye, a Tierrasanta neighbor.

In August, Lahaye invited CBS News 8 cameras into his house so we could see and hear for ourselves what it was like during a blast.

"Every time that happens it scares the hell out of me," said Lahaye, referring to the rumbling noise.

"It catches you completely off guard. Right away, you think earthquake; like I'm going to slide off the hillside," he said….

"They start at 7am. They make noise all day, all afternoon," said neighbor Steve Hermans, who lives next to the quarry with his family.

"I wipe my hand on the counter top, it comes away with the green dust; same with the bedrooms," said Hermans.

About a year ago, Hermans started videotaping the weekly blasts over his backyard fence.

"They detonate it and you can watch the whole thing blow up," he said….

Records show the San Diego County Air Pollution Control District has received about 20 complaints about the quarry's operations over the past two years, most concerning dust and odor issues….[emphasis added]

[129] "Mission Gorge quarry has neighbors living in the blast zone," CBS 8, November 202, 2015. https://www.cbs8.com/article/news/local/mission-gorge-quarry-has-neighbors-living-in-the-blast-zone/509-4118f042-af4b-4520-813b-2777703732fd.

Flyrock 92

On June 22, 2005, a blast at the Loughnane Concrete (Birr) Ltd Quarry hurled flyrock outside the quarry boundary, which resulted in a nominal fine of €500.

> *Mr Thomas Byrne, an independent shotfirer, was requested by Eddie Hogan (Drilling) Ltd to load and fire the blast. Mr Byrne took the blast and flyrock resulted. The flyrock extended outside the quarry boundary.*

Flyrock 93

In July 2015, a blast at Tan An Quarry launched flyrock that penetrated the roof of a nearby house and damaged some furniture.[130]

> *A man repairs a roof after a rock fell on his house a month ago, smashing the roof and damaging some furniture. Expansion of the Tan An Quarry across tens of hectares had affected the lives of residents and posed safety risks.*
>
> *Tens of houses in the Central Highland province of Dak Nong have been damaged due to blasting at local quarries.*
>
> *They claimed that Tran Phuc Private Enterprise had expanded its mine beyond the safety zone, putting local residents at risk.*
>
> *Le Thi Lan, a resident in Dak R'Moan Commune's Tan Phuong Village, said that her family had been living in the village for 21 years, and mining activities had never been a problem in the past.*
>
> *However over the past few years, the enterprise has expanded the mine to just 130 metres away from her house.*
>
> ***"The noise from the blasting is deafening and dust and rocks fly all over the place. It's really dangerous," she said**.* [emphasis added]
>
> *A month ago, a rock fell on her house, smashing the roof and damaging some furniture.*
>
> *Residents said that on average, blasting took place twice a day, but the enterprise had not offered any form of compensation.*
>
> *In the document that the enterprise supplied to Vietnam News Agency, its licence had just been extended last August, and permitted blasting across a 7.5 hectare zone.*
>
> *Le Dinh Thang, chairman of Dak R'Moan Commune's People's Committee, said that Tran Phuc Private Enterprise has been licensed to mine at Tan An Quarry for nearly ten years.*
>
> *The mine's expansion across tens of hectares had affected the lives of residents and posed safety risks.*
>
> *Thang said the committee had received a petition from residents. As regulated, the safe distance between a quarry and a residential area must be 200 metres or more.*
>
> ***The committee is working with authorised agencies to examine the impacts of mining on local households and plans to claim compensation from the enterprise**.* [emphasis added]
>
> ***It will also ask the provincial Department of Natural Resources and Environment and the Department of Industry and Trade to revise the firm's licence extension, and withdraw it completely if a threat was posed to people's lives**.* [emphasis added]

[130] "Quarry explosions damage houses, threaten residents," Viet Nam News, August 4, 2015. https://vietnamnews.vn/society/273961/quarry-explosions-damage-houses-threaten-residents.html.

Flyrock 94

On December 12, 2017, a massive blast at a quarry showered flyrock debris over an area of approximately 800 metres, that killed Ronald Sutherland, injured five people, wrecked vehicles and left many houses badly damaged. Ironically, the victim that was killed was the owner and blaster of the quarry rather than innocent third-parties residing and passing through the surrounding neighbourhood.[131]

> ***…The first error was the overpowdered charge and of course Sutherland's decision to stay in the danger zone. As it relates to the residents, police say the residents were taken 800 meters away from the blast – that is what prevented more fatalities****. And in terms of compensation for the residents the attorney for BRC [Belize Road Construction] told us this evening that they are going house to house, getting repair estimates. [emphasis added]*
>
> *"It was like 10 vehicles damage and approximately 14 houses with significant damages and 20 other houses just with minor damages with roofing and those roofs will be for the most part replaced but the company will not go out and physically put it on. What they can do is to receive the costing as long as it is reasonable to pay it out to the person that receive the damage then they hire their construction person to go and get it done as soon as possible. The company is aware that the weather is changing so at this very time they are in their offices trying to do some purchase orders so that the first thing tomorrow these roofs will have some time of coverage, interim coverage; just for them to not have water damage inside and cause any further discomfort to the persons living in the home.* ***The client wishes to mitigate any further loses by residence [sic] who were in the immediate vicinity and my client has informed me that they are not accepting liability however they will be paying for the lost or damage to these homes****. By no means is my client trying to leave anyone out in the cold without a proper roof or without proper windows or whatever the case may be."* [Rachel Montejo – Attorney, Belize Roadway Construction]
>
> *A team has been on the ground assessing the damage in the Santa Cruz area of Santa Elena – this is after Tuesday's massive quarry blast. The explosion killed Tiger Aggregates Ltd owner Ronal Sutherland, injured 5 persons and wrecked homes and vehicles. At this point, Belize Road Construction Ltd – who contracted Tiger Aggregates to do the blast, is focused on getting the residents back in the comfort of their homes before Christmas. But there are still many questions as to who granted the company permission to blast in this residential area. Well, very important to note, Inspector of Mines from the Mining Unit, Michelle Alvarez says the unit did not grant any license to blast in this area. In fact, they had no idea this was happening until after the deadly explosion. She says the unit normally advises against blasting especially in residential areas. Alvarez says that she and her team are still conducting their own investigation.*
>
> *So while the investigation and damage assessments continue, it is also important to look closer at what caused the explosion. As you heard in our story last night, it was caused by some human error.*
>
> *"…Sutherland has 30 years plus experience in doing blasting." "So he is certified and qualified experience[d] blaster, along with him there were two certified blasters, Mr. Timoteo Chiac and Mr. Carlitos Alford who were also blasters…licensed and certified to conduct [blasting] so the incident as seen was a planned and coordinated incident. What transpired is an unfortunate incident. In explosive terms an incident is something that occurred as a consequence of something going wrong. There was an initial partial blast which was rectified by Mr. Sutherland and his team and subsequent[ly] the secondary blast was…much larger which projected or flung the stone particles at a further distance than estimated. This may occur for 2 reasons, human error or as a consequence of the type of explosives or the quantity used."* [T. Col. James Requena, Retired BDF]

[131] AmbergrisCaye.com Forum, "Explosion At Quarry In Cayo Leaves One Dead," https://ambergriscaye.com/forum/ubbthreads.php/topics/527679/re-explosion-at-quarry-in-cayo-leaves-one-dead.html.

Flyrock 95

On June18, 2020, flyrock debris from a quarry blast penetrated the roof of a nearby school.[132]

> *Heavy blast in a quarry (open-pit mine of stones) at Silghagori hill of Bongaigaon district caused damage to a nearby school building on Thursday.*
>
> *Local people said that the blast in the quarry was done by a contractor. "Due to the blast, several pieces of scattered stones fell on the 33 No Salbari LP School. As a result, the roof of the school was damaged. This building has been converted into quarantine centre but thankfully no people have been brought in as yet and so there were no casualties. Local people have since long been demanding that blasts in the hill should be stopped but the administration and forest department have ignored their pleas," a villager said.*

Flyrock 96

In November 2017, a blast at a quarry in Gakunyu village caused an earth quake and propelled a large stone, which struck and instantly killed a resident, while harvesting in a garden. [133]

Flyrock 97

On June 29, 1999, a blast at the Imperial Quarry launched a half dozen boulders and several small chunks of limestone about 1,100 feet (335 metres) and caused property damage.[134]

> *One of several boulders hurled during blasting at ESSROC Cement Corp.'s Imperial Quarry Tuesday morning landed where Minnie Keglovitz had been pulling weeds 20 minutes earlier.*
>
> *"It was a really frightening experience again -- because this happened once before already," said Keglovitz, who was inside her Upper Nazareth Township home during the 10:45 a.m. explosion.*
>
> *No one was injured Tuesday, and property damage was minimal from the bowling-ball and fist-size chunks of limestone that catapulted from ESSROC's Imperial Quarry onto Route 248 and several lawns.*
>
> *However, Keglovitz and other residents of Route 248 (Bath Pike) worried about their safety in the aftermath of the second blast to send chunks of limestone from an ESSROC quarry toward their homes.*
>
> *In March 1998, mud and rocks up to 1-1/2 feet wide spewed from ESSROC's Quarry 2, causing $20,000 damage to three lawns, two homes and two cars.*
>
> *The state Department of Environmental Protection fined the company $10,000 after a monthlong investigation. In addition to allowing rock to leave the quarry, DEP cited ESSROC for failing to stop traffic on Route 248 during the blast and improperly locating a seismograph.*
>
> *DEP mining inspectors were on the scene Tuesday, but DEP spokesman Mark Carmon said they had not reported on their preliminary findings….*

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[132] "Blast in quarry damages school building at Silghagori hill," The Sentinel, June 19, 2020. https://www.sentinelassam.com/north-east-india-news/assam-news/blast-in-quarry-damages-school-building-at-silghagori-hill-of-bongaigaon-483684?infinitescroll=1.

[133] "Dilemma As Kiziguro Quarry Residents Remain Uncompensated," January 8, 2018, Dilemma As Kiziguro Quarry Residents Remain Uncompensated – KT PRESS

[134] Tracy Jordan, "Blast Hurls Debris Onto Lawns, R.248*Essroc, DEP Officials Don't Know Cause of Upper Nazareth Incident," The Morning Call, June 30, 1999. BLAST HURLS DEBRIS ONTO LAWNS, R.248 * ESSROC, DEP OFFICIALS DON'T KNOW CAUSE OF 2ND UPPER NAZARETH INCIDENT. - The Morning Call (mcall.com).

ESSROC spokeswoman Judith A. Kroeger said the company and its blasting subcontractor, Mauer & Scott of Northampton, will conduct independent investigations.

"I have no explanation for how it happened at this point," Kroeger said. "Until everyone can put their heads together, it would be pure speculation about what happened."…

The properties struck with debris during both explosions lie between ESSROC's Quarry 2, north of Route 248, and its Imperial Quarry, south of Route 248.

"The first time they said it was a freak accident, but now it doesn't seem like a freak accident," said Frances Vogel of 2833 Bath Pike.

Upper Nazareth Township Police Chief Alan Siefried said he received a report about rocks creating a road hazard on Route 248 a few minutes after the blast.

According to Siefried, a half dozen boulders and several small chunks of limestone shot about 1,100 feet [335 metres] out of the 170-foot-deep Imperial Quarry.

"Some of them were 10 to 12 inches long by 6 to 8 inches wide," Siefried said. "It's hard to say how many went flying. At least three or four large rocks and a bunch of smaller rocks."

During the blasts, the company must stop traffic if dynamite is set off within 850 of Route 248.

According to Siefried, Tuesday's blast was done about 1,100 feet from the road. Kroeger said she believes it was performed about 200 feet below ground level.

Siefried said he received property damage reports from Keglovitz, of 2811 Bath Pike, who had a tree damaged, and Clement Gilio, of 2823 Bath Pike, whose brick house was scratched by a boulder.

During Tuesday's explosion, Gilio was cleaning the garage. His 8-year-old granddaughter, Melissa Degenhart, had been helping him just a few minutes before the explosion.

"If someone would have been out in the yard, they (ESSROC) could have killed them," Gilio said. "Something has to be done. One time is excusable, but not the second time."

Flyrock 98

A blast at quarry in Ghana resulted in flyrock damaging the roofs of homes in a nearby residential community, and 300 residents have sued two quarry companies for causing damage to their homes and properties.[135]

Over 300 residents of Asuboi in the Ayensuano District of the Eastern region have sued two quarry companies for causing damage to their homes and properties.

The companies who have been sued are the China International Water & Electric Corporation – a Chinese construction and engineering company which has finished operating at the quarry site and handed over to a new one known as Anigord Famille Quarry Company.

The affected residents have filed a suit at the Koforidua High Court praying the court to compel the companies to pay compensation for damages and also ensure that due diligence is done during the blasting process.

The houses of the locals have developed deep cracks with roof damages from flying stones as a result of the blast. [emphasis added]

According to the residents, the activities of the quarry companies apart from the health implications have also affected their properties and created a lot of inconveniences for them. [emphasis added]

[135] "Over 300 residents sue over quarry blast," Today Online, December 30, 2015, E/R: Over 300 residents sue over quarry blast – Today Newspaper (todaygh.com)

The Administrative Manager of Anigord Famille Quarry Company, Alfred Turkson, told Starr News, the company has started evaluating the damage and has reduced the magnitude of blast over the suit.

"As you can see, a week to every blasting, there is information center in town, to announce to the community that on Thursday and Saturdays normally we do blasting, the only complaint we had was excessive blasting which we have taken care of," Turkson said.

"During the last blasting we brought the Minerals Commission who brought their machines to test the impact. We have heard of so many complaints that anytime there is blasting most houses crack, old ladies get frightened so we have reduced the blasting, there is a matter in court and we are ready to pay compensation if the court determines that our company caused it because most of the damages were caused before we took over from CWE."

The Ayensuano Coordinator of the National Disaster Management Organization S.D Kodua after visiting the site asked the company to adhere to work safety precautions as well as obey the Environmental Protection Agency's laid down rules in their operations.

Flyrock 99

On June 9, 2013, a blast at a quarry launched flyrock debris 500 metres, showered a Malaysian primary school, and injured students and damaged school property. A nearby house and two vehicles were also damaged by flyrock debris.[136]

The students were among 125 people in a Malaysian primary school hall for a colouring contest marking the anniversary of national independence in Kangar, Malaysia. Injured pupils and teacher Norhayati Mat were sent to nearby Tuanku Fauziah Hospital for treatment.

A teacher, who declined to be named, said he believed that the rock came from a cement quarry that carried out rock blasting activities 500 metres from the school. Several other rocks damaged the roof of the canteen, dormitory and science laboratory.

"I sustained injuries to my head and shoulder after a projector fell on me," said Norayati Mat. "The rock crashed through the roof, bringing down the ceiling, and it landed on the stage. We were all shocked. This is the first time that such an incident has happened."

It is understood that rock blasting activities are carried out at noon and 5pm daily. A teacher said residents were used to tremors from the rock blasting activities. However, this was the first time that rocks from the quarry have damaged the school's facilities.

The awning of a nearby house and the house owner's two cars were also damaged in the incident….

Sources: FMT News, The New Straits Times

Flyrock 100

On July 16, 1997, a blast at the Suzio York Hill Trap Rock Quarry launched one employee, Skip Sibley, over a quarry ledge, leaving him seriously injured, and another employee, Joel Kanute, had his body impaled by flyrock debris, killing him instantly. Both employees were experienced blasters.[137]

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[136] "Quarry blast injures school students," Quarry, June 9, 2013, Quarry blast injures school students – Quarry (quarrymagazine.com).

[137] Gary Libow and Marisa Osoria Colon, "Quarry Blast Kills 1 Worker, Injures Another In Meriden," The Hartford Courant, July 17, 1997, QUARRY BLAST KILLS 1 WORKER, INJURES ANOTHER IN MERIDEN - Hartford Courant.

A blasting expert was killed and another was critically injured early Wednesday when an explosive detonated prematurely in a local quarry, police said.

Joel Kanute, 43, of Wolcott, was thrown over a cliff by the blast and fell 50 feet to a lower ledge of the Suzio York Hill Trap Rock Quarry, police said. He was pronounced dead at Hartford Hospital. [emphasis added]

David Arrigoni, a payload operator for Suzio, was moving material when the explosion occurred, about 7:30 a.m. "When I came back to pick up another load, Joel was laying there in the rock," he said. "He was just barely breathing. I was calling his name but I wasn't getting any response from him. He didn't look good. He was banged up pretty bad."

City police Officer Glenn Milslagle also found Skip Sibley, 38, of Old Lyme, near the blast site. "He had a rock embedded in his chest and small rocks embedded in his body," Milslagle said. Sibley's face and chest had also been severely burned, the worker said. Sibley was listed in critical condition Wednesday night at Hartford Hospital. [emphasis added]

[The quarry where the accident occurred consisted of seven benches with an inclined haul road at the north-northeast end. The explosion occurred on the sixth bench and Kanute fell over the 46-foot highwall to the fifth bench.

The blast pattern consisted of 21 holes laid out in a triangular shaped blast pattern. Most of the holes were drilled on an 11-foot by 11-foot spacing and burden, however, the spacing between several of the holes near the highwall edge was less than 11 feet due to irregularities in the highwall face. These front holes were angled between 4 and 5 degrees to achieve an 11-foot burden at the bottom of the hole. Each blast hole was 4 inches in diameter and 51 feet deep. The holes were laid out and drilled by the drilling contractor, Dearco Drilling, Inc. The ground where the blast pattern was laid out was basically level with visible cracks near the edge of the highwall. The blast hole which prematurely detonated was located near the southeast corner of the blast pattern and was approximately 7 feet from the edge of the highwall. It was drilled straight and was not one of the angled holes.

The loading and initiation of the 21 holes was planned for the morning of July 16, 1997, by Dyno New England's blast crew. Each member of the crew had handled explosives in this quarry on several previous occasions….][138]

Flyrock 101

On October 16, 2015, a blast at Adams Claim Mine, Nevada caused flyrock debris to land on a neighbouring residential property up to 500 yards (457 metres) from the blast.[139] The following extracts are from the civil penalty proceeding conducted by the Federal Mine Safety and Health Review Commission.

On October 16, 2015, WESCO personnel conducted a blast at the mine…Bryan Lloyd was the WESCO employee in charge of the blast…Travess Lane and Cody Jensen, both employees of WESCO, were also present…Lane, a bench hand responsible for priming holes, loading and running equipment, testified that he noticed nothing abnormal about the loading and stemming for the blast…

On October 19, 2015, a private citizen filed a hazard complaint with MSHA alleging that flyrock from blasting operations at the Adams Claim Mine had fallen on her residential property…The complaint alleged that she was outside at the time and could hear flyrock landing around her…In addition, the

[138] Dept. of Labor MSHA Fatal Accident Report, July 16, 1997, MSHA - Metal and Nonmetal Mine Safety and Health Fatal Accident Report, Explosives, July 16, 1997.

[139] Dept. of Labor MSHA Civil Penalty Proceeding, December 20, 2016, https://www.fmshrc.gov/decisions/alj/ALJd_12202016-WEST%202016-209.htm.

complaint alleged that this had happened two other times, once in September 2015 and once in August 2011….

Jensen initially testified that their location was such that they were positioned between the shot location and the residences and any flyrock that went onto the residential property would have had to pass over top of them, but later indicated that they were not between the shot location and the residences…Lloyd estimated that the residential property line was 770 feet from the location of the shot…

Lloyd, Lane, and Jensen testified that they did not see any flyrock or hear any unusual sounds during the blast…However, at hearing, each acknowledged that it was possible they could have missed seeing flyrock…Lloyd stated that there was nothing out of the ordinary about the shot, but agreed that the blast did not go the way he wanted it to because the rocks were too big following the blast…As a result, WESCO, along with Art Wilson Company, changed the blast pattern after that blast…

At hearing, Lloyd opined that, depending on the velocity of the rocks, there would be an indentation where they hit the ground…According to Wilmoth, the gypsum seen in the pictures was the same material mined at the neighboring Adams Claim Mine…The photographs, which included a MSHA investigation folder in the frame for scale, show that the pieces of gypsum ranged in size from slightly smaller than a baseball to slightly larger than a softball….Based on the bright white color of the material and the lack of weathering, Wilmoth determined that the material was "fresh" and "didn't appear to have been there for a [long] period of time[.]"…Other material from the mine site was also observed on the residential property at the time, but it was easily distinguishable due to discoloration and browning from dirt buildup…Wilmoth estimated that the rocks traveled between 200 and 500 yards from the location of the blast to where the rocks were found…

Lloyd testified that he was not notified of the alleged flyrock incident until Friday, October 23, at which point he, Lane, and Jensen documented the event on company incident forms….At hearing, Lloyd agreed that the some of the rocks found by the inspector were fairly small and it was possible they did not see them during the blast….

I find that the Secretary established a violation of the cited standard. The cited standard requires that, before blasting, all persons be removed from the blast area, but provides an exception to that requirement when persons are in a blasting shelter or other location that protects them from the harmful effects of the blast. In order for an operator to comply with the standard they must not only ensure that everyone is outside of the blast area, they must also control the blast so that the concussion, flying material and gasses do not extend outside of the planned blast area. Accordingly, a violation will exist when persons are in the blast area during a blast and not in one of the excepted areas. Here, there is no dispute that the exception does not apply. As a result, the only question is whether persons were in the blast area when the blast occurred. For reasons set forth below, I find that persons were in the blast area.

The Secretary's regulations define the term "blast area" as "the area in which concussion (shock wave), flying material, or gases from an explosion may cause injury to persons."…The regulation states that "[i]n determining the blast area the following factors shall be considered: (1) Geology or material to be blasted. (2) Blast pattern. (3) Burden, depth, diameter, and angle of the holes. (4) Blasting experience of the mine. (5) Delay system, powder factor, and pounds per delay. (6) Type and amount of explosive material. (7) Type and amount of stemming." Id. In a case involving a different subsection of the cited standard, Commission Judge Moran explained that this list of factors, "while helpful, does not represent an exclusive list of the factors that are to be considered when conducting the ultra-hazardous activity of blasting." Lakeview Rock Products, 34 FMSHRC 244, 246 (Jan. 2012) (ALJ); see also Austin Powder Co., 35 FMSHRC 3656, 3672 (Dec. 2013) (ALJ). In Lakeview, Judge Moran found that, because flyrock landed on and penetrated the roof of a residence, the residence was "within the blast area." 34 FMSHRC at 249-250….

I already determined that the Secretary established a violation of the cited standard. Here, the hazard that the standard is designed to protect against is a person being injured by the "concussion (shock wave), flying material, and gases" from a blast. The specific hazard in this instance was the

private individual being struck by flyrock from the blast that traveled onto her property. Here, WESCO's failure to control the blast resulted in flyrock leaving the property and falling around the private individual while she was outside on her property. WESCO's failure to control the blast to prevent the rocks from going outside the planned blast area was reasonably likely to result in someone being struck by flyrock. ***Both WESCO and the private individual were lucky that the material fell around the individual and did not strike her. I credit the inspector's testimony that, assuming a person was struck by flyrock of the size found on the property, an injury was likely to occur and that injury was reasonably likely to be fatal or at least very serious****.* [emphasis added].

Flyrock 102

In December 2004, a blasting accident at Elk Mills Quarry, Cecil County, Maryland, sent flyrock debris up to a half-mile (805 metres) away, damaging several cars and the roof of one business.[140]

Flyrock 103

In 2015, a baby on a mother's back was struck and killed by a projectile from a quarry's rock blast. Subsequently, flyrock debris from another quarry blast penetrated the roof of one house and damaged other properties.[141] During each scheduled quarry blast local residents are expected to run as far away as possible to avoid the consequences of the rock blasting.

Parts of the small community of Joma, near Ablekuma in the Greater Accra Region, present a portrait of a society on the fringes. The economic inequality would surprise little and inhabitants there are managing like millions of other Ghanaians.

But this community has its peculiar fears. A number of them live within the buffer zone of a quarry run by Regimanuel Concrete Products (RCP).

This means they are at the mercy of flying rocks when the quarry carries out its usual rock blasts.

Some of the residents who spoke to Citi News team I was part of lamented their tense living conditions, like inhabitants of a village neglected during a civil war. Aspects of their situation are eerily similar life in areas worldwide that have to contend with regular bombings.

Sirens have been known to warn of oncoming bombings during wartime, presently and in times past. The sound of a siren ushers in a mad rush to safety from artillery shelling or bombs from the sky.

The people of Joma are also warned of blasts from the quarry sites by a siren which is supposed to sound three times within a 30-minute window. During this time, residents within the blast radius are expected to find safety….

The buffer zone, required by law to be between a radius of 300 and 500 metres, is supposed to be free of any residences, for the protection of human life. [emphasis added]

Some the most vulnerable of these encroaching residents' live mere meters away from the sources of rock blasts. [emphasis added]

Unsurprisingly, there have been some human casualties, in addition to the destruction of property. A baby on his mother's back was struck and killed by a projectile from the quarry's rock blasts in 2015. [emphasis added]

---

[140] Deanna Tortorello, "Investigators search for cause of quarry blast accident," cecildaily.com, December 16, 2004.

[141] Delali Adogla Bessa, In fear of sirens and rock blasts; life by a quarry at Joma," CNR, June 22, 2018. https://citinewsroom.com/2018/06/feature-in-fear-of-sirens-and-rock-blasts-life-by-a-quarry-at-joma/.

> ***The community is still haunted by the child's death. Some swear the child was ripped in half by the force of the impact from the flying rock.*** [emphasis added]
>
> *"The blasting of rocks ended up killing a child around here. At the time we protested, and police even had to come in. Despite our complaints, we haven't heard anything since," one resident said.*
>
> *Since that death, there have been close calls for other infants in this area, as a couple of mothers narrated.*
>
> ***"Exactly a week after I delivered my baby, I was forced to flee my home because of the blast. Rocks from the blast damaged my roof and other properties. They did not tell us about the pending blast," a first-time mother clutching her baby recalled.*** [emphasis added]
>
> *Another new mother had a similar story.*
>
> ***"Three days after I delivered my baby via caesarian section, I had to run out of my room with my baby for our lives because they were going to blast stones. People now live here so they should stop this. We have nowhere else to go," she said.*** [emphasis added]
>
> *Despite the close shaves, more developments are springing up in the area, within the buffer zone.*
>
> *These future homeowners ostensibly have the support of the Landlord Owners Association in the area. The association's president, Christian Hodor, recalled fondly the foreign company that operated the quarry before RCP.*
>
> *The quarry was first acquired by Construction Pioneers (CP) in 1986 for the construction of government projects. RCP took over in 2011.*
>
> *"Their [RCP's] blasting is disturbing us a lot. If I can remember, when CP was here, they were working with us. They always reshaped our roads and other things."*
>
> *"But when they [RCP] came in, they don't know how to blast. They blast anyhow. If they blast, stones can fly so many miles and destroy people. Even some of our houses are cracked. Some of our roofs are damaged," Christian Hodor complained….*

Flyrock 104

On April 12, 2007, "a 12-year-old boy who was reportedly standing in his courtyard about 300 metres away from the blasting site was fatally hit by a granite piece."[142]

Flyrock 105

On April 26, 2004, a blast at the Pemberton Quarry launched flyrock debris high above Mount Currie that landed near the band office and nearby homes. There was also a previous flyrock incident.[143]

> ***A rock blast gone awry sent rocks the size of softballs high above Mount Currie, only to come thudding to the ground near the band office and local homes on Monday***. [emphasis added]
>
> *It was the last straw for Mount Currie Chief Leonard Andrew, who only the week before had written a letter to the Squamish-Lillooet Regional District complaining about the noise and the smells from a neighbouring rock quarry.*

---

[142] Pathanamthitta, "Landslide causes heavy damage," The Hindu, October 4, 2010. https://www.thehindu.com/news/national/kerala/Landslide-causes-heavy-damage/article15768715.ece.

[143] Alison Taylor, "Pemberton quarry blast rocks Mount Currie band office," Pique Newsmagazine, April 30, 2004, https://www.piquenewsmagazine.com/whistler-news/pemberton-quarry-blast-rocks-mount-currie-band-office-2466718.

"I'm not going to wait until somebody gets hurt and then do something about it," he said on Wednesday.

"If one of these hits one of my band members or anybody within the area it's going to kill them, never mind just hurting them."

The blast came from a nearby piece of land just north of the Pemberton Industrial Park, where the Hazelwood Quarry operates. This land also borders a residential neighbourhood in Mount Currie.

"(The blast) did not go completely as planned and there was softball-sized rocks that landed down near the band office," said Keith Evans, operations manager of Terrane Development, the company that owns the land and operates the Hazelwood Quarry.

"(The) Ministry of Mines is investigating (and) we have an independent consultant that we've brought in to investigate."

The blast happened on Monday, April 26, on the same day the SLRD board members were discussing Chief Andrew's letter at their monthly meeting.

In that letter he wrote:

"We feel as if our community is being air bombed. Why are we under siege from an obviously inappropriate industrial development next to our community?"

The quarry has been in operation since last May or June, when the blasted rock was used to build up the front lots in the Pemberton Industrial Park.

Now the rock blasting and drilling is primarily focused on the construction of a road through the property, said Evans.

He said the company operates within a mining permit, only blasting within the permitted times on weekdays between 7 a.m. and 7 p.m.

But the blasting, flying rocks and noise aren't the only problem for nearby Mount Currie residents….

As far as the blasting he said the company has addressed noise concerns by staying within the allowable blasting time period.

The flying rocks however are another story.

***"(Last July) one little rock about the size of a marble landed down off our property, which is unacceptable as well, and there was an incident report over that," said Evans**.* [emphasis added]

"There wasn't quite the investigation that's going to be done over (Monday's blast). This is very serious."

Flyrock 106

On June 28, 2012, flyrock debris from a blast at an undisclosed quarry damaged several buildings (mill roof, emergency vehicle shed. crusher tower and dome tent) and a vehicle, and cut power to the pit.[144]

[144] Imerys Talc Power Point presentation, file:///C:/Users/Windows%207%20PC/Downloads/SI-Flyrock.pdf.

Flyrock 107

On May 23, 2019, flyrock debris from a controlled blast at a worksite landed outside of the designated blast zone and damaged cars and storefronts.[145] "One woman was taken to hospital for shock."[146]

> *It was supposed to be a controlled blast, but debris from a worksite northeast of Sherbrooke Thursday [May 23, 2019] proved it was anything but.*
>
> *Huge pieces of rock damaged cars and storefronts and landed in the roadway in Ascot Corner, some landing more than 50 metres outside of the designated blast zone.*
>
> *No one was injured – but it was clear the debris could have caused serious harm. The roof and rear window of a nearby Toyota Corolla was destroyed.*
>
> *The SQ and workers' health and safety board CNESST both opened investigations into the incident.*

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[145] "Debris causes major damage to cars, stores and in Eastern Townships," CTV Montreal, May 24, 2019. https://montreal.ctvnews.ca/debris-from-blast-zone-causes-major-damage-to-cars-stores-in-eastern-townships-1.4436420.

[146] Matthew Mccully, "Dynamite debris damage," The Record, May 23, 2019, https://www.sherbrookerecord.com/dynamite-debris-damage/.

Blasting Quarry Operations: Damage from Airblast (Noise & Concussion) and Vibrations, and Complaints and Lawsuits (7-Sep-21)

> ***Rock quarrying and stone crushing is now a global phenomenon and has been the cause of concern everywhere in the world, including the advanced countries (Lameed and Ayodele, 2010). Quarrying negatively affects the environment in a variety of ways from exploration and blasting, transport and disposal of waste rocks. The major environmental effects are destruction of vegetation, disruption of animal habitats, diversion and blockage of natural drainage systems, soil erosion and river siltation, noise,…vibration [and flyrock debris] and dust pollution (Maponga and Munyanduri, 2001) [p. 316].***[1] [emphasis added]

Table of Contents

Introduction 3

Vibration and Airblast (Noise) Are Contaminants Under the Environmental Protection Act of Ontario 5

Majority of Complaints Over Blasting Quarries Within 500 to 700 Metres 8

No Safe Level of Vibration For Threshold Damage to Nearby Structures or Dwellings Caused by Blasting 8

Vibrations Ruled a Public Nuisance 9

Strict Liability Extends to Ground Vibrations and Concussions (Airblast) From Blasting 9

Quarry Blasting Operations Ruled a Public Nuisance 12

Quarry Owner's Experts Testify That Every Property Owner Near a Quarry Is Uniquely Impacted By Blasting 13

Noise From Quarry Operations Causes Negligent Infliction of Emotional Distress 15

Probability of Damage From Blasting Operations 16

Repeated Blasting Damages Property From Vibrations Especially At Low Frequencies 19

Insurance Company Denies Homeowner Claim for Property Damage Caused by Vibrations from Off-site Quarry Blasting 22

Homeowners' Awards For Vibration Damage Caused By Blasting Restricted To Five-Year Limitation Period 22

Lafarge Fined For Mining (Blasting) and Removing Aggregate From Unlicensed Area 23

Coloured Aggregates Fined For Illegally Moving Blasted Rock and For Upgrading A Road Outside Its Permitted Area 24

Property Damage Complaints Persist Over Quarry Blasting Operations 24

On-going Complaints Over Vulcan's Blasting Quarry Operations in Lorton, Virginia 25

On-going Complaints Over Vulcan's Blasting Quarry Operations Near Hendersonville 26

[1] Marzouk, S.H. and Mohamed, Abuo El-Ela A., "Influences of limestone stone quarries on groundwater quality," *Int. J. Hum. Capital Urban Manage.*, 3(4): 315-324, Autumn 2018, http://www.ijhcum.net/article_34117_cb311e43b286d3457041ebfec70faa52.pdf.

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On-going Litany of Complaints Over Quarry Blasting From Residents As Far Away As Two Miles From the Quarry 27

Complaints of Property Damage From Quarry Blasting Vibrations Ignored by Council and Considered a "Civil Matter" 28

Developer Refuses to Exercise Option to Purchase Land Next to Blasting Quarry Due to Dangers of Flyrock and Vibration Damage to Foundations of Homes Expressed by the Quarry Owners 29

Quarry Application Denied Over Anticipated Vibration and Property Value Impacts 29

Diminution in Property Value and Loss of Property Use Occasioned by Blasting 30

Denial of Quarry Permit Supported By Material, Competent and Substantial Evidence as to Land Use Incompatibility 32

On-going Complaints and Environmental Concerns Over Votorantim Cimentos St. Marys Bowmanville Blasting Quarry Operations 33

Conclusions 34

Blast Vibration Damage Cases 35

Blast Vibration Damage 1 35
Blast Vibration Damage 2 36
Blast Vibration Damage 3 37
Blast Vibration Damage 4 37
Blast Vibration Damage 5 38
Blast Vibration Damage 6 38
Blast Vibration Damage 7 40
Blast Vibration Damage 8 40
Blast Vibration Damage 9 41
Blast Vibration Damage 10 43
Blast Vibration Damage 11 44
Blast Vibration Damage 12 45
Blast Vibration Damage 13 46
Blast Vibration Damage14 47
Blast Vibration Damage 15 48
Blast Vibration Damage 16 48
Blast Vibration Damage 17 49
Blast Vibration Damage 18 50
Blast Vibration Damage 19 52
Blast Vibration Damage 20 52

Introduction

According to a 2012 Power Point presentation prepared by Morin of Explotech,[2]

- *The derivatives of blasting which cause the greatest amount of concern to property owners adjacent to blast sites are flyrock, ground vibrations and overpressure (air blast). [Slide 90]. [underscoring added]*

Airblast and Ground Vibrations are defined as follows:

> ***Airblast*** *– Air over Pressure (air blast) is often used to describe the air waves, which are generated by blasting activities. Air waves are compressed waves that travel through the air. Under certain weather conditions and poor blast design, air blast can travel considerable distances. Audible air blast is called noise, while air blasts at frequencies below 20 Hz and inaudible to the human ear are called concussions. Over pressure is usually expressed in pounds per square inch (PSI) or in decibels. (dB) (Bollinger, 1971, Siskind et al., 1980, Konya and Walter, 1985, ABC, 1987) [p. 103].*[3]
>
> ***Ground Vibrations*** *– Is a technical term that is used to describe mostly man-made vibrations of the ground, in contrast to natural vibrations of the Earth studied by seismology. For example, vibrations caused by explosions, construction works, railway and road transport, etc. – all belong to ground vibrations. [Wikipedia, https://en.wikipedia.org/wiki/Ground_vibrations]*

This research paper deals primarily with ground vibrations and airblast from blasting quarry operations, briefly touching on flyrock, and the complaints and lawsuits brought against companies engaged in rock blasting. Noise and vibration, along with flyrock, are *contaminants* under the *Ontario* Environmental Protection Act (EPA), and have the potential to

- adversely or permanently impact the environment
- compromise the health or safety of human and non-human life
- negatively impact the quality of human and non-human life
- damage personal and real property
- damage or preclude crop production (e.g., organic, specialty farming, etc.)
- disrupt business operations and recreational activities
- cause nuisance or trespass

According to A. G. Taylor of the Ministry of the Environment, the acoustic wave (concussion) generated by quarry blasting can be of greater significance than ground

---

[2] https://www.slideserve.com/ami/city-of-ottawa-explosives-information-session-2012-explotech-engineering,

[3] Mohamed, Adel M. E.," Quarry blasts assessment and their environmental impacts on the nearby oil pipelines, southeast of Helwan City, Egypt," *NRIAG Journal of Astronomy and Geophysics*, Volume, Issue 1, June 2013: 102-115, https://reader.elsevier.com/reader/sd/pii/S2090997713000308?token=F95F3CA4B70080D9A6CCA1A5C6E7355F0501C222785348C0711CD4F4EC3F93ACB38A575A96DA1F9D6924309479117970&originRegion=us-east-1&originCreation=20210728140702.

vibration induced by the same blast, and that sonic boom research can be applied to quarry blasts:[4]

> *Quarry blasts were monitored during 1973--1974 at several locations in Southern Ontario to determine if the acoustic wave (concussion) was likely to be of significance from the points of view of structural damage and human annoyance. The monitoring instrumentation used included sonic boom microphone-- carrier system and FM tape recorder.* ***The characteristics of the blast wave, overpressure, spectrum, and duration were analyzed using a storage oscilloscope and real-time analyzer and were compared with the characteristics of sonic booms. The two phenomena were shown to be similar in spectral content to most energy in the infrasonic region; the overpressure at several thousand feet from a blast can be similar to that of a sonic boom, whereas the duration of the pressure perturbation is several times longer for a blast than for a sonic boom. It is concluded that damage and annoyance criteria developed from sonic boom research may reasonably be applied to quarry blasts. It was also found that in many instances the acoustic wave can be of greater significance than ground vibration induced by the same blast****.* [emphasis added]

Rock extraction typically involves the use of explosives, and requires preparation of a proponent-driven Blast Design Report (Blast Impact Assessment), which theoretically only measures overpressure sound (airblast) and ground vibrations, both of which are contaminants. The theoretical predictions of ground vibration and airblast must be measured along the perimeter of the proponent's site to ensure that the contaminants do not escape and cause, or are likely to cause, external *adverse effects*. Subsurface conditions of the lands where blasting is to occur are unknowable, as are the subsoil conditions of neighbouring private third-party properties over which the quarry proponent has no legal right of trespass.

> ***Blasts are made with the same mixture of ammonium nitrate and fertilizer and fuel oil used in the bomb that killed 168 people [including 19 children, and more than 500 people were injured] in Oklahoma City [in 1995]…., but the mining explosions are 10 to 100 times stronger," Loeb wrote in August 1997. (U.S. News and World Report)***
>
> ***Blast detonations associated with the larger mines have increased from approximately 100,000 pounds [45,359 kilograms] to over 1 million pounds [453,592 kilograms] of explosives. (Ken Ward Jr., August 3, 2003)***

According to the judge's ruling in *Macdonald v. Construction LTEE et al.*,[5]

> *…**[T[he use of explosives, on the balance of probabilities, does involve danger to another's property. I cannot see how anyone can possibly describe such an operation as not being, in the language of the cases on the subject, "extra hazardous" or "inherently dangerous."*** [emphasis added] (Citing J. P. Porter Co. Ltd. v. Bell, [1955] 1 D.L.R. 62, 35 M.P.R. 13, and Rylands v. Fletcher)

[4] Taylor, A.G., "Quarry blast acoustic wave (concussion) – response of structures and human annoyance," *Ontario Ministry of the Environment*, Toronto, *JASA*, https://asa.scitation.org/doi/pdf/10.1121/1.1995087.
[5] *Macdonald v. Desourdy Construction LTEE et al.*, 1972 CanLII 1150 (NS SC), <https://canlii.ca/t/gwg69>, retrieved on 2021-08-17.

Vibration and Airblast (Noise) Are Contaminants Under the Environmental Protection Act of Ontario

In *R. v. Chenard*,[6] the accused was charged with discharging a contaminant, namely *vibration*, from blasting explosives into the environment in contravention of Section 14(1) of the Environmental Protection Act of Ontario (EPA), R.S.O. 1990, c.E.-19. The vibrations damaged and disrupted the use and enjoyment of the Webster's' property.

> ***[3]*** *Section 14(1) of the Environmental Protection Act sets out:*
>
> > *Despite any other provision of this Act or the regulations, no person shall discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment that causes or is likely to cause an adverse effect.*
>
> ***[4]*** *"Adverse effect" is defined in the Act and means one or more of:*
>
> *(a) impairment of the quality of the natural environment for any use that can be made of it,*
> *(b) injury or damage to property or to plant or animal life,*
> *(c) harm or material discomfort to any person,*
> *(d) an adverse effect on the health of any person,*
> *(e) impairment of the safety of any person,*
> *(f) rendering any property or plant or animal life unfit for human use,*
> *(g) loss of enjoyment of normal use of property, and*
> *(h) interference with the normal conduct of business; ("conséquence préjudiciable)". [underscoring added]*
>
> ***[6]*** *"Contaminant" is defined in section 1 of the Environmental Protection Act as follows:*
>
> > *"contaminant" means any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that may cause an adverse effect".*

Chenard, a *blaster* by trade, was retained by Mr. Tulloch to excavate a trench to accommodate the installation of water and sewer lines to service a new residence on the lakefront. The Websters own the adjacent property, whose home is 30 years old, and situated approximately 114 feet (35 metres) from the blast area.

> *[10] Prior to any blasting taking place, a pre-blast survey was made at the Webster residence by a contractor who identified certain damage accepted by Mr. Webster as being caused by his own personal renovations. The damage was documented.*
>
> *[11] Mr. Chenard began a series of 30 blasts through bedrock on July 17, 2001 with the last blast planned for July 25, 2001.*
>
> *[12] Because of the fact that the first 30 blasts were insufficient to accommodate the proper flow for the sewer and water line, it was necessary to perform two more blasts on September 6, 2001 [bringing the total blasts to 32].*
>
> *[13] While there was a pre-blast inspection of the Webster residence before the start of the first series of blasts, there was no pre-blast assessment prior to the commencement of the September 6 blasting.*
>
> *[15] On the 8th of September, 2001, Mr. and Mrs. Webster discovered a leak in the basement bathroom ceiling. A pipe had bust in the ceiling, water was pouring in, and it became necessary to*

[6] *R. v. Chenard*, 2005 ONCJ 501 (CanLII), <https://canlii.ca/t/1mfqs>, retrieved on 2021-08-24.

retain the services of a local plumber on an emergency basis. Eventually the ceiling tile and the entire bathroom area had to be refinished.

Following a four-day trial, the Justice of the Peace accepted the evidence of the homeowners, which is summarized as follows:

First of all, there was a vibration. Ms. Webster's evidence about the jolt she felt was credible and it was uncontradicted. She was at the best position to feel the jolt. She was standing on a floor beneath the surface of the ground, and the foundation of their home rested on the same bedrock as that being blasted. She was within 114 feet [34.7 metres] of the blasting. Also, the evidence of the boat rocking and all of the pictures being askew in the home support the finding that there was a vibration.

The second, that the vibration was discharged into the natural environment, was also proven. Mr. Chenard put explosives into some of the holes, although not all. The Court is satisfied that Mr. Chenard discharged the contaminant, that being the vibration, into the natural environment.

Number three, that there was an adverse effect. The Court is satisfied that there was an adverse effect. There were numerous damages to the Webster home. Two days after the blast of September 6 the Websters found a major repair that they had to do in their basement bathroom.

While the homeowners' evidence was accepted by the Justice of the Peace, she had concluded that the discharge of the *vibration* contaminant occasioned by the blast on September 6, 2001 had not been proven as the cause of the *adverse effect* (i.e., damage to, and disruption of use and enjoyment of the Websters' residence).

***Finally, and this is the element that was not proven, the discharge of the contaminant on September 6 caused the adverse effect**. There was little evidence to support a finding that the Websters' loss of enjoyment of normal use of their property was directly attributable to the blast that was the substance of the charge. Witnesses describe the September 6th blast as the largest blast. However, they also admitted that their comparison took into account the fly rock that they saw, the blasting mats lifting off the blast area, and the sound of the explosion. The only witness who felt the actual vibration was Mr. Webster.* [emphasis added]

The Crown appealed against the ruling of the Justice of the Peace, and, while the appeal court accepted the findings of the Justice of the Peace, the appeal court concluded that the trial court failed to consider the secondary aspect: "or was likely to cause an adverse effect." In defining the term "likely," the appeal court relied on the following:

***[40]** The word "likely" carries with it a tremendous amount of responsibility to the trier of fact and to any appellate review. In Black's Law Dictionary (Fourth Edition) it equates to "probable" and "in all probability". In the Oxford Illustrated Dictionary "likely" is referred to as "probable" and "such as may well happen".*

***[41]** In the case of R. v. Walter Wood (28 April 1987), Provincial Offences Court, [unreported], a decision by Justice of the Peace W. G. Jacklin, he refers to R. v. Carbone, 1973, 20 Criminal Reports, New Series, 313, relating to substantial likelihood.*

The learned Judge in dealing with substantial likelihood:

> Does not mean proof beyond a reasonable doubt, but is 'more akin to the balance of probabilities in that the evidence should substantially weigh in favor of the likelihood of a repetition of the offence.

Here, we're dealing with likely. I am of the opinion that in fact likely is something less than substantial likelihood. It has been found that substantial likelihood is akin to the balance of

probabilities and in the matter of Labatt Breweries of Canada Limited, it connotes a probability.

***[42]** Also,*

Dealing with the issue under Regina v. Toronto Refiners and Smelters, the Ontario High Court of Justice, the Divisional Court, Volume 20, Ontario Reports, 2nd Series, at page 772. At page 774:

> The questions stated should be determinative of the issue before the Court. It is argued by the respondent that the words "causes or is likely to cause harm or material discomfort to any person" are descriptive of the contaminant. In our view, in order to succeed, it must be shown that the contaminant did in fact cause or was likely to cause, in the circumstances that existed, harm or material discomfort to a person.

In reversing the judgment of the lower court, the appeal court found that the Justice of the Peace had failed to consider the words "or was likely to cause an adverse effect" or to consider "the accumulative effect of **all** 32 blasts": [emphasis added]

***[43]** Based on the evidence that was adduced during the course of the four day trial, it is evident to me that the Justice of the Peace did not consider the words "or was likely to cause to an adverse effect" or to consider the accumulative effect of all 32 blasts, including those on 6th of September, 2001.*

The City of Burlington has a Noise and Nuisance by-law (No. 19-2003),[7] which, in part, states,

No noise or vibrations shall be made, caused or created so as to be heard or felt or otherwise perceived outside the property and which are, in the view of all the circumstances including the nature of the neighbourhood and the use to which adjoining properties are put and the time of day during which such noise or vibrations are made, caused or created excessive or which are, or may cause a nuisance to the public generally or to others residing or carrying on a manufacture, trade or business in the vicinity.

Domestic animals are clinically affected by rock-blasting, as testified to by Dr. Lisa Dietrich (Public hearing July 13, 2015) in the application for a permit by Tory Sand & Gravel submitted to the Town of Nassau.

…Testimony from Veterinarian Dr. Lisa Dietrich…indicates that domestic animals are clinically affected by dust, allergens and other irritants that may result from blasting at the quarry, and suffer stress from anxiety related to equipment and blasting noise. We think that those same things could also cause safety concerns for the handlers of the animals. It is reasonably foreseeable that there could be impacts on domestic animals which could result in added expenses for the household, lower the animal's quality of life, and as related to agriculture, reduce farming and agri-tourism opportunities.

The research conducted makes it abundantly clear that quarry blasting conducted within regulatory limits does not eliminate property damage from ground vibrations or airblast, and has a negative impact on health and quality of life of residents in nearby communities. The standard response from quarry operators to complaints from residents of communities impacted by blasting is "that the quarry is operating within regulatory limits"

[7] file:///C:/Users/Windows%207%20PC/Downloads/19-2003%20(5).pdf.

and, thereby, avoid acknowledging and accepting legal responsibility for payment of damages.

> *Various sources of vibrations are involved in construction and mining projects such as blasting, heavy equipment, pile driving and dynamic compaction. Elastic vibrations that are generated by these sources may harmfully affect the nearby residential areas. Their effects include annoyance of people and cosmetic and structural damage to the buildings [p. 1].*[8]

Majority of Complaints Over Blasting Quarries Within 500 to 700 Metres

As referenced in the July 2014 Department of State Development *Resource Area management and Planning Final Report*,[9] the *Urban Growth Management for Metropolitan Adelaide* (Australia) report discusses the findings of complaint data received by quarry operators, the EPA, PIRSA (Department of Primary Industries and Regions), and the City of Tea Tree Gully with regards to excavation activity within and adjacent metropolitan Adelaide, and indicates average distances of around 500 to 700 metres "capture" the majority of complaints for hard rock quarries.

> *The majority of complaints received were in relation to blasting activities, with the average distance for these complaints occurring at 489m from the mine/quarry. [2.3.2, p. 20]*
>
> *Dust was also a common complaint, the average complaint distance relating to dust from hard rock quarries occurred at a distance of 690m...indicating that blasting activity is likely to cause dust to travel further distances.* [p. 20]
>
> *The average distance for noise complaints for hard rock quarrying was 675m…[p. 20]*
>
> *The highest frequency of complaints for hard rock quarries occur between 500m and 550m…*[p. 20]
>
> *The findings in this report show that while 60% of blasting complaints were received at a distance of 500m or less, the majority occurred at around the 500m. This would suggest that for blasting operations, a separation [or setback] of at least 500m would be needed.* [p. 20]

No Safe Level of Vibration For Threshold Damage to Nearby Structures or Dwellings Caused by Blasting

The susceptibility of a structure or dwelling to damage from blasting depends on vibration levels, excitation frequencies [frequency at which body is made vibrate in forced vibration], and related site and structure factors (Singh and Roy 2010), and there is no absolute minimum vibration damage threshold whereby blasting or environmental or occupant-related vibration could precipitate a crack.[10]

> *…**The threshold level of cracking is highly dependent on the level of residual stresses present that may reduce the apparent PCV level causing damage. It is widely accepted among blast researchers that the lengthening of old cracks and formation of superficial "hair-sized new cracks constitutes a threshold damage level (Rainer 1982; Northwood et al.***

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[8] "A Case Study of Blast Vibration Modelling in The Hanason Servtex Quarry, Garden Ridge City, Texas," A Thesis by Mohamed Mahmoud Ahmed Radwan, Texas A&M University, December 2016, file:///C:/Users/Windows%207%20PC/Downloads/RADWAN-THESIS-2016%20(6).pdf.

[9] Department of State Development *Resource Area Management and Planning Final Report*, July 2014, https://energymining.sa.gov.au/__data/assets/pdf_file/0020/240662/2014-07-22_DSD_Resource_Area_Management_and_Planning.pdf.

[10] Heath, D. J., Gad, E. F. and Wilson, J. L. "Vibration and Environmental Loads Acting on Residential Structures: State-of-the-Art Review," © 2015, *American Society of Civil Engineers*.

> ***1963; Singh and Roy 2010; Siskind et al. 1980; Stagg et al. 1984; Dowding 1996). Few publications present observations of damage and corresponding ground motion measurements****. Dowding (1996) notes the only definitive method of correlating the incidence of cracking with blast vibrations is to conduct a pre- and postvibration crack survey, which will also reduce complaints and lawsuits.* ***The identification of an appropriate limit unlikely to cause any damage is made all the more difficult by the presence of residual stresses, particularly older structures, resulting from settlement, poor maintenance, weather cycles, and prior repair and renovation (Konon and Schuring 1983). For this reason, Siskind et al. (1980) note there may be no absolute minimum vibration damage threshold whereby blasting or environmental or occupant –related vibration could precipitate a crack****.* [emphasis added]

Vibrations Ruled a Public Nuisance

In *Fraser (Re)*, 2018 NSUARB 74,[11] in which the Board ruled that *vibrations* are a public nuisance, Murphy went on to explain the causation of some of the damage attributed to vibration and his reliance on the *Vibration Guidance Manual of the California Department of Transportation (Caltrans)*:

> ***When analyzing distance from the source of the vibrations to a house, the composition of the soil and ground through which the waves must travel is significant to the readings that are achieved at various distances. In every single case, it may be different because of the different subterranean composition. Consequently, distances that have been created in a laboratory do not necessarily work in the real world unless one can exactly duplicate the subterranean composition and the specific house structure [para. 184]*** [emphasis added]
>
> ***…[Murphy].stated every experiment is specific to the facts of that soil composition and the specific house structure [para. 185]****.* [emphasis added]
>
> ***…[T]here's so many factors that go into vibration and the effects on a structure. It's impossible to duplicate those in a scientific setting, to duplicate them all [para. 185]****.* [Board's emphasis]
>
> *Caltran's noted vibrations can cause damage to structures….[para. 170] The damage they can cause is dependent upon the structure (J. Pistrol, F. Kopf et. al, Ambient Vibration of Oscillating and Vibrating Roller:* ***Apart from the Characteristics of the excitation (duration, frequency, magnitude, etc.) the immission on buildings highly depends on the type of structure, material properties, stiffening elements, inherent damping, natural frequencies and other building parameters [para. 171]****.* [emphasis added]
>
> *And now there's some jurisdictions that have determined that – with experience, that there has been – damage has occurred at the 5 millimetres per second, and so they're saying – they're picking that as a safe threshold and then – but basically what they're saying is you've got to do monitoring and you have to do pre-condition surveys. These are the ways that the municipality, the province, the state – you know, that's the way they're going to have to try to ensure that things are dealt [with] fairly.* [Board's emphasis]

Strict Liability Extends to Ground Vibrations and Concussions (Airblast) From Blasting

In *Enos Coal Mine v. Schuchart et al.*,[12] the Indiana Supreme Court ruled there is no logical reason not to extend strict liability for property damage from *vibrations* simply because there is no physical trespass as in falling debris (flyrock) from an explosion on nearby land.

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[11] *Fraser (Re)*, 2018 NSUARB 74 (CanLII), <https://canlii.ca/t/hrg94>, retrieved on 2021-05-09.

[12] *Enos Coal Mining Company v. Schuchart et al.*, 243 Ind. 692 (1963) 188 N.E.2d 406, https://scholar.google.com/scholar_case?case=5259210695212382453&q=%22a+little+damage+is+reasonable%22&hl=en&as_sdt=2006.

The court ruled that the common law principle of liability in trespass applies equally where damage is caused only by *vibration*, commenting by way of analogy, as follows:

> *In these days of nuclear explosions, the breaking of sound barriers by airplanes and missiles, violent explosions from artillery and gunnery practice (to mention but a few of the advances of science), nearby buildings and property can be shattered or destroyed as effectively as by an earth quake without any physical invasion of the property.*
>
> *The United States Supreme Court has recognized these modern problems in holding that property owners are entitled to compensation for deterioration in property values caused by noise and vibration of jet planes in the use of air space near an airport. Griggs v. Allegheny County (1962), 369 U.S. 84, 82 S.Ct. 531, 7 L.Ed.2d 585.*

In *Spano v. Perini Corp.*,[13] the Court of Appeals of New York declared that "one who engages in blasting must assume responsibility and he is liable without fault for any injury he causes to neighboring property." The Spano Court overturned the use of negligence for nontrespassory blasting damages for the following reasons:

1) *Existing and out-of-state court decisions use strict tort liability for construction blasting;*
2) *Individual property rights are a concern;*
3) *Strict tort liability is used for accidental explosions;*
4) *It is difficult to prove negligence in blasting cases;*
5) *Blasting involves a substantial risk of harm; and*
6) *It is problematic to determine which party should bear liability for blasting damages [p. 209].*[14].

In *Wiley v. Pittsburg & Midway Coal Min. Co.*,[15] the Missouri Court of Appeals acknowledged that damage to property by *concussion* or *vibration* from blasting must be demonstrated by circumstantial evidence because

> ***the concussions or vibrations that travel through the air or the earth cannot be seen***. Donnell v. Vigus Quarries, Inc., 526 S.W.2d 314, 316 (Mo.App.1975); Poston v. Clarkson Construction Co., 401 S.W.2d 522, 525 (Mo.App.1966). [emphasis added]
>
> *From cases such as Summers v. Tavern Rock Sand Co., 315 S.W.2d 201 (Mo.1958), it appears that a submissible case for damages caused by blasting may be made on testimony that vibrations were felt coincidentally with the detonation of the explosive and that physical evidence of structural damage was observed thereafter. Thus, in the present case, plaintiffs' testimony of the vibrations sensed, corroborated by the calendar diaries, and the perceived cracks in walls and floors was enough at least to survive a motion at the close of plaintiffs' evidence.*

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[13] *Spano v. Perini Corp.*, 25 N.Y.2d 11 (1969), https://scholar.google.ca/scholar_case?case=17690906301222304702&q=spano+v+perini+corp&hl=en&as_sdt=2006.

[14] file:///C:/Users/Windows%207%20PC/Downloads/Is_Construction_Blasting_Still_Abnormally_Dangerou%20(2).pdf.

[15] *Wiley v. Pittsburg & Midway Coal Min. Co.*, 729 S.W.2d 228 (1987), https://scholar.google.ca/scholar_case?case=16844615106345768138&hl=en&as_sdt=2005&sciodt=2006.

In *Associated Contr. Stone v. Pewee Val. San. & Hosp.*,[16] the Kentucky appellate court upheld the lower court's injunction preventing a proposed quarry from being established a short distance southeast of the City of Pewee Valley, in a rustic neighborhood with no industry and no public water supply. The suit to prevent operation of a blasting quarry was brought by over 50 parties, with proof clustered along three salient issues:

1) *Lowering of the "water table" likely to result from drainage of underground waters, by force of gravitation, to and out of the face of the quarry when the rock formations are cut open;*
2) *Damage to the natural water supply through disturbance, by the use of explosives at the quarry, of underground barriers that now serve to impound the water; and*
3) *Disruption of the peace and quiet by vibrations from blasting.*

Apart, however, from the water phase of the case, there is other and more positive proof that the operation of the quarry will materially affect the peace and quiet of the neighbors in the enjoyment of their homes. It so happens that before the institution of this proceeding the defendants set off at the quarry site a 2,000-lb.[907 kilograms] test charge of dynamite, a quantity they admit to have been substantially smaller than they expect to use routinely. This blast was heard and the tremor felt by several of the plaintiffs in their homes nearby. One said that his television set, the chimney, and "every window in the house" shook. Another said the noise caused his wife to jump up and scream and the concussion "actually blew the curtains out." Some of the plaintiffs live directly across the road from the quarry property. ***If their homes were shaken by the test shot, it is certain that they would be repeatedly shaken by the larger shots expected to be used in the regular course of business. We think this is an interference they should not be forced to suffer****.* [emphasis added]

The appeal court concluded that the rule of nonliability for damage by *concussion* or *vibration* is inconsistent with the principles set forth in Louisville Refining Company v. Mudd, Ky. 1960, 339 S.W.2d 181, for the determination of what is a nuisance. The appeal court held that the lower court's finding that "a nuisance necessarily would result was not clearly erroneous."

…[B]y their own stipulations and admissions during the course of trial the defendants left no room to suppose that they could or would conduct their operations in any manner or on any scale that would not involve a shaking of the environs occupied by the plaintiffs. Their case was honest and forthright. They made no pretense that this particular result would not be a necessary incident of their business as they intended to operate it.

As noted in the Northern Kentucky Law Review (Vol. 8/323), in reference to an Ohio case involving blasting,

If the means employed [blasting] will, in the very nature of things, injure and destroy his neighbor's property, notwithstanding the highest possible care is used in handling of the destructive agency, the result to the adjoining property is just as disastrous as if negligence had intervened. If one may knowingly destroy his neighbor's property in the improvement of his own, it is little consolation to the neighbor to know that his property was destroyed with due care and in a scientific manner *[p. 334].* [emphasis added]

[16] *Associated Contr. Stone v. Pewee Val. San. & Hosp.*, 376 SW 2d 316 (1963), https://scholar.google.ca/scholar_case?case=5042499607404372 94&q=%22quarry%22+and+%22concussion%22&hl=en&as_sdt=2006.

In *J. P. Porter Co. v. Bell et al.*,[17] the Nova Scotia Court of Appeal upheld the trial court's ruling that Porter was responsible for structural damage from ground vibrations to three dwellings distant 1,430 feet (436 metres), 2,250 feet (686 metres) and 2,275 feet (693 metres) from where Porter conducted 198 blasts during the period of August 15, 1951 to April 3, 1952. Porter was found strictly liable for the damages caused to the Plaintiffs' houses under the rule of *Rylands v. Fletcher*.

> *From August 15, 1951, to April 3, 1952, inclusive, the defendant engaged in blasting and dredging operations at the Seaward Defence Site; but its blasting operations ceased on February 2, 1952. From this site the houses of the plaintiffs Bell, Overstone and MacDonald were situated westwardly about 1,430, 2,250, 2,275 ft, [693 metres] respectively.*
>
> *According to the trial Judge "the rock being blasted and removed was of sedimentary origin and was stratified formation and that same formation extended westerly from the point of blasting to and beyond the location of the plaintiffs' houses and dipped about 10 degrees toward the west. This stratified rock was broken or cracked approximately at right angles to the dip at various intervals."*
>
> ***There is no doubt that the detonation of the dynamite during the period in question in 198 blasts, comprising a total of 38,343 pounds of explosive, did cause vibrations in the submarine rock which extended to the adjoining land-rock formation and caused the houses to vibrate**. ["The individual blasts involved the detonation of dynamite in amounts ranging from 15 to 720 lbs. [327 kilograms in drill-holes ranging in number from 1 to 12."]* [emphasis added]
>
> *The first essential question, whether the blasts and the resultant vibrations caused the damage complained of, was answered by the trial Judge, after an exhaustive examination of direct and opinion evidence, as follows: "**I accordingly find that each of the plaintiffs' houses was substantially damaged by their vibratory motion which was in turn caused by the rock vibrations originating at the defendant's blasting operations and transmitted through rock from the point of origin to the rock beneath the houses on which they stood**." In evaluating the weight of this evidence he was quite justified in preferring the former.* [emphasis added]
>
> ***In my opinion there was ample evidence to support this conclusion on the issue of causation in fact**. The trial Judge was faced with evidence which on this issue consisted "of what a large number of credible witnesses actually saw, felt and heard" supported by competent opinion evidence on the one hand; and of competent opinion evidence to the contrary effect on the other hand.* [emphasis added]

Quarry Blasting Operations Ruled a Public Nuisance

In *Attorney-General. v. P.Y.A. Quarries Ltd.* [1958] EWCA, Civ 1[18] *flyrock, fugitive dust* and *ground vibrations* involving 28 houses, a farm and two highways, were ruled public nuisances by the appellate court, noting that the trial judge devoted a day to observe the blasting quarry operation for himself.

> *…[T]he judge devoted a day to a view of the premises, and blasting operations were carried out in his presence. In the course of his Judgment the learned Judge arrived (in brief) at the following findings. So far as the flying stones were concerned, he said that there was really no defence at all; that the case was "absolutely proved at the time the Writ was issued"; and that, notwithstanding the installation of the wagon drill, he was quite satisfied that the nuisance had not been wholly abated and that he should grant an injunction. As to vibration, he came to the conclusion "that for some reason - I cannot tell what it is - there is on occasion such vibration as to frighten people, to shake*

[17] *J. P. Porter Co. Ltd. v. Bell et al.*, 1954 CanLII 303 (NS CA), <https://canlii.ca/t/gwcvk>, retrieved on 2021-08-21.
[18] https://www.bailii.org/ew/cases/EWCA/Civ/1958/1.html.

their houses and to make them thoroughly uncomfortable, and that such vibration as that, when it is caused, is a nuisance and must cease." With regard to dust, the Judge said that it would not be right to base an injunction on the explosions, having regard to their comparative rarity since the end of 1953, but that excessive dust emanated from the secondary crusher when the door leading into it was left open, as was frequently the case. Finally he said:

> "I have no doubt that there is dust nuisance from this place - of course, only in dry weather. I have no doubt that they have not done anything to cope with it and I am going to order them to do so by injunction."

The quarry owner failed in its effort to convince the trial judge that an inadequate number of people were impacted by the blasting quarry operations to qualify as a public nuisance.

D[efendants] owned a mining [quarry operation] that caused noise and dust pollution to a section of the public, and tried to argue that since it only affected a section of her majesty's subjects [twenty-eight houses, a farm and two highways], not her subjects as a whole, it couldn't be a public nuisance. C[ourt of] A[ppeal] rejected this, saying any nuisance which materially affected the reasonable comfort and convenience of life of a class of Her Majesty's subjects was a public nuisance. Whether the no. [of] citizens affected was enough to constitute a class depends on the facts of each case. An injunction was granted.

Denning LJ: To see if it is a public nuisance, we should look at the reason of the thing and to say that a nuisance is a public nuisance which is so widespread in its range or so indiscriminate in its effect that it would not be reasonable to expect one person to take proceedings on his own responsibility to put a stop to it, but that it should be taken on the responsibility of the community at large. E.g. blocking up a public footpath that is only used by a couple of people:[is] still a public nuisance since it is indiscriminate against those who may wish to walk along it. Another example is a landowner who "permits gypsies with filthy habits to encamp in a residential neighbourhood".

Romer LJ: It does not have to be shown that all members of the class have been affected: it is enough that a representative cross section of the class has been affected.[19]

Quarry Owner's Experts Testify That Every Property Owner Near a Quarry Is Uniquely Impacted By Blasting

In *Freeman v. San Rafael Rock Quarry Inc.*,[20] pursuant to a June 2001 Marin County (California) Grand Jury report, which was critical of the county's handling of complaints about the quarry and recommended the district attorney institute a nuisance abatement action against the quarry, the homeowners were unsuccessful in their motion for a class action. The nuisances identified in the Grand Jury's report consisted of *dust, noise, blasting* and *truck traffic* attributed to a substantial unlawful expansion of the quarry in 1986 without permits. The appellate court upheld the trial court's refusal to certify the class action for the group of homeowners residing within five square miles of the quarry, which sought non-economic and economic damages based upon allegations of "public nuisance for annoyance, inconvenience, and discomfort."

In denying the motion for class certification, the trial court stated "common questions of law or fact do not predominate," and that "special injury" involves another element where

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[19] *Case summary last updated at 19/01/2020 17:42 by the Oxbridge Notes* in-house law team. https://www.oxbridgenotes.co.uk/law_cases/ag-v-pya-quarries.

[20] *Frieman v. San Rafael Rock Quarry, Inc.* 10 Cal.Pptr.3d 82 (2004) 116 Cal.App.4th 29, https://scholar.google.ca/scholar_case?case=7418002689018790095&q=san+rafael+rock+quarry+inc&hl=en&as_sdt=2006.

proof would vary significantly between the estimated 11,075 class members. The trial court's ruling was supported by two reports prepared on behalf of the quarry owner, both of which acknowledge that the noise and vibration experienced by each class member would vary considerably depending on a number of environmental and property-specific factors:

> *…[T]he Salter report found that "[t]he variation in noise is due to the wide range of distances between the noise sources and homes and shielding of the noise provided by natural terrain, intervening homes and vegetation. Because of these factors, in many locations, neighbors within a few hundred feet of each other have dramatically different exposure." The report notes that noise exposure also varies inside of individual homes due to the orientation of rooms, nature of furnishings, size and construction of windows and whether windows are open or closed.*
>
> *The…report, prepared by Blast Dynamics, Inc., analyzed how blasting at the Quarry affected neighboring residents. This report identified a number of variables in the way that different residents would experience vibration from blasting. These variables include the presence of rock or soil formations that alter the frequency of blast waves, the natural or "resonant" frequencies in each structure that changes the response to vibration, distance from the blast site and differences in the duration of the blasts. The report included a geologic map of the area showing a combination of soil, rock, sandstone, artificial fill, bay mud and marshland under the relevant area. The report noted that soil typically filters out high frequency energy, while rock transmits it. Test blasts were detonated at the Quarry and instruments were placed at various locations to evaluate the differing effects. The results of the velocity measurements showed a decrease in impact with distance from the blast site, but the frequency measurements showed no consistent pattern.* ***The report concluded that: "[t]he test data shows that it is unreasonable to expect that any two sites will experience the same blast related vibration****…."* [emphasis added]

According to Gui, et al.,[21] rock blasting can induce many adverse effects on the surrounding environment, including structural damage, business disruption and emotional traumatization of humans (pets, livestock and wildlife):

> *Explosion induces ground and structure vibration [1, 2] and annoying noise. When the explosive is detonated, an extremely high pressure pulse from the chemical reaction induced energy is generated which is transmitted into rock mass adjacent to the blast hole, producing a dilatational wave that propagates away from the charge. Stress wave due to blasts may cause damage to the surrounding rock and, furthermore, when the wave reaches a free face or open fissure (non-transmission), it will be reflected and converted into tensile wave, which may produce tensile cracking and spalling if the tensile strength of the rock is exceeded by the tensile wave [3, 4]. Also due to the fact that some rock blasting projects are close to the inhabitant area, the surrounding buildings may be damaged due to blasting induced ground vibration if large strength wave propagates in the soil foundation and shock wave propagating through the air [5]. Disruption of some business activities, possible structural damage and emotional-traumatized residents are the problems that need to be addressed.*

[21] https://eprints.ncl.ac.uk/file_store/production/243779/F23A01B2-D058-4FFB-99CD-EA91F34E1A51.pdf.

Noise From Quarry Operations Causes Negligent Infliction of Emotional Distress

In *Town of Stonington et al. v. Galilean Gospel Temple et al.*,[22] the Supreme Judicial Court of Maine affirmed the trial court's award of $5,000 to the Eatons for *Negligent Infliction of Emotional Distress* (NIED) caused by the operation of the quarry.

> *[15]…[T]he Eatons state that the defendants' operation of the quarry "generated noise, dust and interfered with Plaintiffs' possession and use of their property and residence," and that the defendants' "cutting and burning ... deprived Plaintiffs of the safe and quite enjoyment of their home." By echoing language that describes the essence of a private nuisance complaint, the Eatons' complaint provided Cormier and the Temple fair notice of a claim that the operation of the quarry resulted in a nuisance.*
>
> *[12] Competent evidence supports the court's finding that the Eatons suffered from serious emotional distress. Mr. Eaton testified that he suffered from throbbing headaches and depression. Mrs. Eaton testified that the noise has caused her neck muscles to tighten. As a result, she was given muscle relaxants and a collar. Given this testimony, the court did not err in finding that the Eatons suffered serious emotional distress. See Gammon, 534 A.2d at 1283 (holding that the evidence supported plaintiff's NIED claim where plaintiff had nightmares, his personality was affected and his relationship with his family deteriorated).*

In *Manford F. Eaton et al. v. Francis A. Cormier et al.*,[23] the trial court found Cormier and Galilean Gospel Temple jointly and severally responsible for a private nuisance and awarded $20,000 in damages to Manford and Helen Eaton. The award was affirmed by the Supreme Judicial Court of Maine.

> *[2] This is the second time this case is before us. See generally Town of Stonington v. Galilean Gospel Temple, 1999 ME 2, 722 A.2d 1269. We previously determined that the Eatons had properly pled a cause of action for nuisance against Cormier and the Temple and remanded for a trial on the issue, as well as for a determination of whether Cormier and the Temple should be held jointly and severally liable should a nuisance be found. See id. at ¶¶ 13-16,* 722 A.2d at 1272-74.
>
> *[3] Following our remand, the court conducted a hearing in which it took notice of evidence introduced in the prior proceeding and heard additional evidence regarding conditions on the Eatons' property since the prior proceeding. It also heard testimony from officials of the Town of Stonington regarding their monitoring of the noise levels generated by the quarry and testimony from Cormier's son who acts as foreman at the quarry. The court then issued its decision in which it found that the quarrying activities constituted a private nuisance…*
>
> *[7]…[A]s we noted in our last opinion in this case, a landowner is liable for a nuisance created by the activity of a third party on the land if (1) the possessor knows or has reason to know that the activity is being carried on and that it is causing or will involve an unreasonable risk of causing the nuisance, and (2) the possessor consents to the activity or fails to exercise reasonable care to prevent the nuisance. Galilean Gospel Temple, 1999 ME 2, ¶ 21, 722 A.2d at 1273 (citing RESTATEMENT (SECOND) OF TORTS § 838 (1979)); see also State v. Charpentier, 126 N.H. 56, 489 A.2d 594, 599 (1985) ("liability for common law nuisance may be established if the landowner knew or had reason to know that a public nuisance existed") (citing RESTATEMENT (SECOND)*

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[22] *Town of Stonington et al. v. Galilean Gospel Temple et al.*, 722 A.2d 1269 (1999) 1999 ME 2, https://scholar.google.com/scholar_case?case=11545182235842632857&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cvibrations%E2%80%9D&hl=en&as_sdt=2006#[2].

[23] *Manford F. Eaton et al. v. Francis A. Cormier et al.*, 748 A.2d 1006 (2000) 2000 ME 65, https://scholar.google.com/scholar_case?case=4841522329640716275&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cvibrations%E2%80%9D&hl=en&as_sdt=2006.

OF TORTS §§ 838 & 839 (1979)); Benton v. Montague, 253 N.C. 695, 117 S.E.2d 771, 776 (1961) ("the owner of land is not liable for injury caused by the acts of a licensee unless such acts constitute a nuisance which the owner knowingly suffers to remain") (emphasis added).

Probability of Damage From Blasting Operations

According to Sam Kiger, former Dean of Engineering at the University of Missouri, vibration damage from blasting is almost an absolute certainty:[24]

> *Sam Kiger…was the expert for the Bim blasting case, which was tried in court in Boone County in March 1999. Kiger is an international expert in protecting federal buildings from blasting damage. After examining 6,000 blasting logs, he testified that there is about a 95 percent chance of damage at a vibration limit of .5 inches/second, if you count each of the holes shot (50 on average) as a separate vibration. In the Bim case, he also testified that low-frequency waves (2 Hz-11 Hz) generated by some blasts can be more damaging. The frequencies can match that of a house and amplify the shaking [p. 16]..*

Freda Harris reached a similar conclusion finding that geological "hot spots" in a community can make vibrations from blasting worse:

> *Freda Harris, who had a blasting case with a mine in Indiana, gathered many documents during the case and subsequent FOIAs of OSM [Office of Surface Mining]. She wrote a manual for Citizens Coal Council. One of her most intriguing findings was that there can be "hot spots" in a community where the geography can make blasts worse. She emphasizes that damage and vibrations can feel worse if a house's natural frequency is approximately between 4 Hz and 12 Hz. The above-ground part of the house often vibrates more than the ground outside and the foundation. Yet, the DEP [Department of Environmental Protection]/OSM standard is based on ground vibration [p. 16].*

An often quoted blasting study conducted by Siskind,[25] arguing that a vibration limit at 0.5 in/sec constitutes a safe blasting limit, has been criticized by other experts and successfully challenged in the courts:

> *Most of the blasting studies of the Bureau of Mines were done by the David Siskind. The FOIAs provided much correspondence between Siskind and other experts, some of it quite critical.* ***A top official of Vibra-Tech, a leader in designing blasting technology, said: "Any criteria…which ignores the frequency of a structure and the frequency content of the ground motion is overly simplistic…Your criteria, as proposed, will neither protect the interest of the citizen and the homeowner, nor will it protect the blaster from alleged damage claims*** *[p. 16]."*[26]
>
> *After the Bureau of Mines was shut down by Congress, Siskind became a private consultant. He testified for the coal company that lost the Bim case. The majority of the blasting cases have overturned his studies, and thereby the limits used by DEP and OSM. As he wrote an OSM official on June 17, 1997: "The battles I am now seeing are not 0.5 in/sec versus 1.0 in/sec. Complainants are trying to dismiss all the science as biased, wrong or nonapplicable. For the most part, they are succeeding in ways that pay off [p. 16].*

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[24] file:///C:/Users/Windows%207%20PC/Downloads/comments-of-the-ohio-valley-environmental-coalition-ovec-po-box-6753-huntington-wv-on-the%20(1).pdf.

[25] "Investigation of Damage to Structures in the McCutchanville-Daylight Area of Southwestern Indiana, *Office of Surface Mining Reclamation and Enforcement Technical Report/1994*, Volume 2 of 3, https://www.osmre.gov/resources/blasting/docs/OSMREReports/McCutchanville-DaylightIN/M-DPart1CompositeReport.pdf.

[26] file:///C:/Users/Windows%207%20PC/Downloads/comments-of-the-ohio-valley-environmental-coalition-ovec-po-box-6753-huntington-wv-on-the%20(1).pdf.

> *Evans [, an engineer for an explosives firm in southwestern Virginia,] said they concentrate much more on the effects of the low frequencies than on per particle velocity [PPV]. The per-particle reading almost never goes higher than .3 inches, well below the regulatory limit of 1 inch per second. However, just as Sam Kiger and Freda Harris determined, the low frequencies are bothersome [p. 18].*
>
> ***Interestingly, the DEP "Surface Mine Blasting Study Guide" acknowledges that the response of the human body is greater at lower frequencies**: "This explains why people file complaints even **when the blasting is conducted at safe (no damage) levels [p. 17]."***
>
> ***The amplitude of the structure response to ground vibrations and resultant strains within building components are also dependent on the efficiency of energy transfer from the foundation to the framework and wall components. The efficiency of energy transfer increases significantly when the natural frequency of the ground vibrations matches the natural frequency of the structure** [p. 103].*[27] [emphasis added]

And, according to Sayed-Ahmed and Naji,[28] ground vibrations can have a damaging effect on residential buildings, as occurred in the two case studies undertaken:

> *Subsurface construction blasting generates ground vibration which may have a damaging effect on residential buildings. Codes of practice define damage criteria to limit the effect of the vibrations resulting from the subsurface blasting on nearby structures. All these criteria are based on the soil Peak Particle Velocity (PPV) generated due to blasting on the ground surface close to the structure. **The real culprit, however, is not the ground PPV but it is the structural response to the ground vibration**. In this paper, the currently adopted safe limit criteria of ground vibrations generated by subsurface construction blasting are presented. Two case studies have been performed on two residential houses located nearby an excavation-by-blasting construction site [ST-051-1]…*
>
> *When a charge is detonated in a solid medium (like rock), a family of waves is generated. These waves generate different particle movement and travel at different wave velocities. The resulting ground-borne vibrations may have an effect on residential buildings ranging from disturbing the occupants to causing severe threshold "cosmetic" or structural damage. Problems may occur as a result of large amplitude (low frequency) vibrations, repeated occurrence of smaller amplitude vibrations, or from differential settlement induced by soil particles rearrangement [ST-051-1].*
>
> *Two case studies have been performed and discussed for two residential houses (one and two storeys) located adjacent to an excavation where blasting was to be used for excavating the rock. Analysis of the accumulated data recorded during blasting is presented and compared to the currently adopted ground vibration safe limit criteria. The PPV and the vibration frequency due to excavation by blasting measured close to these houses satisfied the existing safe limits criteria for subsurface blasting ground vibration. Despite this fact, both houses suffered threshold cracks and one of them even had structural cracks [ST-051-2]…*

In a study of damaged residences beyond 300 metres from a Ugandan quarry undertaken by Yomekpe-Agbeno and Affam (2008),[29] the authors conclude that *frequencies* and

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[27] https://www.osmre.gov/resources/blasting/docs/OSMREReports/McCutchanville-DaylightIN/M-DPart1CompositeReport.pdf.

[28] "Residential Houses Cracking Due to Nearby Construction Blasting: Critical Review of Current Safe Limits," 1st International Structural Specialty Conference, Calgary, Alberta, May 2006, file:///C:/Users/Windows%207%20PC/Downloads/CSCE06ST-051%20(1).pdf.

[29] Yomekpe-Agbeno, S. K. and Affam, M. (2008) "Establishing Ground Vibration Threshold Level for Open Pit Mining Environment – A Case Study," *Ghana Mining Journal*, pp. 19-24, file:///C:/Users/Windows%207%20PC/Downloads/42804-Article%20Text-37701-1-10-20090519%20(2).pdf.

weather conditions are important considerations when assessing damage potential of a particular blast, as are other factors related to type and quality of construction of structures and residences, and distance from the blast site.

Since 2003, when blasting activities started at the Plant North Pit quarry, residents living close to the pit have complained of cracks and general deterioration of their buildings, damages to electrical and electronic appliances and general nuisance by way of fright and noise, In October 2005, the Environmental Protection Agency ordered the temporary suspension of blasting operations at the Plant North Pit quarry.

> *Damage caused to the building structures…cannot be attributed to a single cause alone. There are several causative agents such as; poor building materials quality, poor, foundation problems, differential settlement, ground vibration, ageing and building maintenance culture.* ***The ground vibrations from the extensive open pit blasting activities can however, worsen the already precarious conditions of the buildings or they can act as catalysts to worsen the already deplorable state of the structures*** *[p. 19].* [emphasis added]
>
> *A total of 542 blasts were recorded and out of this only 20 blasts (representing about 6% of total blasts) had ground vibration levels above 1.5 mm/s while 9 blasts had blast values in excess of 120 dB(L) which is the recommended Environmental Protection Agency (EPA) of Ghana levels. The records also show that attention was not paid to Frequencies (at vibration levels were recorded) and weather conditions at the times of the monitoring exercises. Frequencies and weather conditions are important parameters when assessing the damage potential of a particular blast in terms of ground vibration and air blast.* ***According to Konya and Walters (1990), frequency is an important factor in assessing the damage potential of vibrations as structural resonance lies in the low frequency range typically of 5 to 20 Hz and blast vibration in this frequency range can cause a resonance response in structures which produces increased displacement and strain, giving serious problems in the structures. Also air blast levels rise with increased overcast skies with a corresponding increased damage potential*** *[p. 22].* [emphasis added]

Considering the substandard quality of the buildings in the Prestea township, the authors of the study conclude that the German Standard of 8 mm/s Peak Particle Velocity (PPV) is too high, and recommend that the maximum ground vibration not exceed 2 mm/s:

> ***Even though this level [2 mm/s] can increase drilling and blasting costs considerably, it is considered a better option than expensive lawsuits in the likely event of any further damages that may be caused to building structures in the township*** *[p. 19].* [emphasis added]

Repeated Blasting Damages Property From Vibrations Especially At Low Frequencies

Repeated blasting causes damage to structures, especially at low frequencies below 20 Hz (or 20 cycles per second). Amplification factors of four (4) are reported in BOM RI 8507.[30] Dr. Sam Kiger, a now-retired Civil and Environmental Engineering professor at the University of Missouri, presented, in part, the following in connection with expert evidence in *Fontaina Scott v. Mountaineer Grading Co. – Putman Co. Civ. Act. No. 09-C-286.*[31]

> *At relatively low dominate frequencies, that is below about 20 Hz (or 20 cycles per second), blast induced ground vibrations are amplified by structures….Amplification factors of 4 are reported in BOM RI 8507. Michael J. Mann of the Ohio Department of Natural Resources Division of Mines & Reclamation investigated the response of structures at larger distances from surface mining operations where lower ground vibration frequencies are much more likely to dominate.[32] The data published by Mann…indicate measured structural amplifications as high as 10….This is the most damaging type of ground vibrations because [of] amplification induced in…homes at these low frequencies.*
>
> *Blast induced ground vibrations can be amplified by local soil and other geological conditions. For example in BOM 656[33] they report that the thickness of overburden, i.e. the thickness of the soil layer over bedrock, has a direct effect on amplitude and frequency of ground vibrations from blasting. They go on to indicate that the effect is to increase amplitude and lower frequencies. Note that both increased amplitude and lower frequencies will result in increased damage to structures. The Soil layer frequency, f, can be estimated from the textbook by Woods[34] as f = V / 4H, Hz; where V is the seismic velocity in the soil layer, H is the soil layer thickness, and the units of the frequency, Hz, is cycles per second. Whenever vibration frequencies generated by blasting operations match the soil layer frequencies, amplification will occur. The thickness of soil layers often vary significantly between hilly terrain and low lying valley terrain. Thus, unexpected local amplifications of the blast induced ground vibrations can occur resulting in peak ground motions being larger at relatively far away locations than they are at locations relatively close to the blasting.*
>
> *All homes undergo daily and seasonal dimensional changes due to things like humidity variations and changing temperatures, like the sun moving from one side of the home to the other (the warm side will expand relative to the cooler side); or seasonal variations of temperature and humidity. For example most of us have experienced a "sticking door" or a door that will not close (or easily open) during certain times of the year. These environmental effects will cause strains in the walls, ceilings, structural framing, tile covered surfaces, and etc. These strains are known by engineers as prestrains, that is strains that exist before an event like a blast induced ground vibration. The prestrain condition may be such that a very small vibration will push the item, like a wall panel, a framing connection, or piece of tile, over its strain limit and result in a crack or loosening of a structural frame connection. Once a crack is initiated the crack will grow at a much lower level of vibrations than was required to initiate the crack. This is because of the stress concentration that exist at the crack tip; envision for example a small crack in an automobile windshield where even a small bump from ones hand can cause the crack to grow. Thus, even low levels of repeated*

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[30] US Bureau of Mines RI 8507, *"Structural Response and Damage Produced by Ground Vibration From Surface Mine Blasting,"* 1980,

[31] "Scott owns property in Fraziers Bottom and says the defendant company's blasting operations on the new U.S. 35 in 2008 affected her and her property. She lists property damage, nuisance, trespass, negligence and/or gross negligences and strict liability in her complaint. She seeks compensatory and punitive damages, attorney fees, costs and other relief." https://putnam112.rssing.com/chan-8516446/all_p14.html.

[32] Michael J. Mann, Ohio Department of Natural resources, Division of Mines & Reclamation, New Philadelphia, Ohio, USA, "RESPONSE OF MANUFACTURED HOUSES TO BLAST VIBRATIONS," Copyright © 2003 International Society of Explosives Engineers, 2000 BAI.

[33] Bureau of Mines Bulletin 656, "*Blasting Vibrations and Their Effects on Structures*," 1971.

[34] Woods and Hall, "*Vibrations of Soils and Foundations*," Prentice-Hall, 1970.

occurrences of blast induced ground vibrations can cause significant damage to a home over time. For example the German vibration standard is 0.16 ips [4.06 mm/s] for buildings with visible damage and cracks in masonry. See for example Table 1 in "Vibration Criteria for Historic and Sensitive Buildings" by Konon and Schuring..[35]

The fact that these prestrain conditions can produce a condition in the home such that damage to a home will occur at even very low levels of vibrations is acknowledged in BOM RI 8507[36] *in their Conclusion 7 on page 68…This conclusion, agreed to by the 4 experts that authored RI 8507, clearly states that "…**there may be no absolute minimum vibration damage threshold…"; that is, when inevitable pre strain conditions are present in a home, any blast induced ground vibrations might cause damage to the home**.* [emphasis added]

In Bureau of Mines RI 8507 they suggest a maximum allowable ground vibration peak particle velocity [PPV] of 0.5 inches per second (ips) [12.7 mm/s] at which there is a 0.5 percent probability of damage. However, the standards in many countries are much lower; for example…regulatory agencies in Leicestershire County, UK have established the upper limit on allowable peak particle velocity (ppv) as 0.24 ips [6.1 mm/s]; [I]n Australia the common limit is 0.2 ips [5.1 mm/s] and it is 0.001 ips [0.025 mm/s] for historical buildings and monuments for frequencies less than 15 Hz. Note that frequencies less than 15 Hz are very likely in blast induced ground vibrations at large distances from the blasts. The Australian standard for historical buildings of 0.2 mm/sec (0.001 ips) implies that if a building is really important the allowable vibrations to prevent damage is extremely low.[37] *Therefore, standards in reality represent an economic decision. **Since at almost any vibration level some homes might be damaged, but for the mine to operate at an economic level, some probability of damage is tolerated. The level of 0.5 ips [12.7 mm/s] widely adopted in the US is far greater than the standards adopted in other countries**.* [emphasis added]

*The size of the blast induced ground vibration waves shaking the homes are large in comparison to the footprint dimensions of a typical home. The length of the ground vibration wave train is the duration of the blast induced ground vibration shaking at the homes, typically about 3 to 4 sec, times the speed of the ground wave, typically about 800 ft per sec [244 m per sec]. Thus, for a typical blasting event with multiple individual explosions the ground vibration wave train is about 3,000 ft [914 metres] long. These ground vibrations at long distances, i.e. more than 1,000 ft [305 metres], have a dominate frequency of the ground vibration equal to about 8 or 10 Hz (cycles per sec); for a frequency of 10 Hz a single cycle of the ground shaking is 80 ft [24 metres] in length (one cycle is up down and back up) so that the leading edge of the home is picked up then pulled down while the back of the home is being picked up; this up and down of the front and then back of the house occurs repeatedly for the full 3 to 4 second duration of the ground vibration; in this example that would be about 30 to 40 complete cycles (10 cycles per second for 3 or 4 seconds). **When these repeated distortions of the house matches the natural frequency of the house, the motions will be amplified and damage to the house will be significantly increased**.* [emphasis added]

It is recognized that the probability of damage to a home is relatively small in any single blast. However, numerous opportunities for an unlikely occurrence, like damage to the home, will result in a very likely occurrence of damage. For example, if the probability of damage to the home, Pd, in any single blasting event is 0.05, or 5 percent; then the probability of not being damaged, Pu, is 95 percent. One can use the probability Law of Independent Events to calculate the probability of damage occurring at least once in 100 events. Thus, assuming the probability of damage is the

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[35] Konon and Schuring, "Vibration Criteria for Historic and Sensitive Older Buildings," ASCE Preprint 83-501; American Society of Civil Engineers (ASCE), Houston, Texas, October 17-19, 1983.

[36] US Bureau of Mines RI 8507, "*Structural Response and Damage Produced by Ground Vibration From Surface Mine Blasting*," 1980.

[37] See Table 2, R Pesch and A Robertson, "Drilling and Blasting for Underground Space," Wollongong, NSW, 3-4, September 2007, https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.500.4403&rep=rep1&type=pdf.

*same for each event, 0.05, then the probability of **not** being damaged at least once in 100 events (explosions) is:*

Pu-100 = (0.95)100 = 0.006

*and the probability of the home **being** damaged in 100 explosions is 1 minus the probability that it is not damaged, thus:*

Pd-100 = 1 - 0.006 = 0.994

***This implies that the probability of damage in 100 events is about 99 percent and that implies damage to the home would be almost certain. Therefore, even though damage is unlikely for any single blasting event, some damage in the form of cracking of walls, ceiling, tile, concrete,...etc becomes very likely with numerous repetitions of blast induced ground vibrations. And once damage occurs (like cracking, nails pops, or framing joints loosening) that damage will increase at even lower levels of vibrations with repeated exposure to the vibrations**.* [emphasis added]

According to Jordan,[38] ground vibration levels, measured as peak particle velocity (PPV), are governed by Australian Standard AS 2187.2 (Storage and use of explosives), but no consideration is given to the frequency or frequencies in blast vibrations and their relationship with the natural frequencies of a structure or building, and the potential for damage.

***Except in an informative appendix (i.e. not forming part of the standard) to the latest edition of AS 2187.2, no consideration is given in the criteria to the frequency or frequencies in the blast vibrations and their relationship with the natural frequencies of the building or structure**.* [emphasis added]

*Resonance effects in structures are well known and form the basis for response spectrum analysis in earthquake engineering. Whilst the behaviour of whole structures is the main concern in earthquake actions analysis, the behaviour of individual elements of buildings and structures can be considered and this is applicable in determining whether, for example, a wall or ceiling panel, or even a pane of glass, may be vulnerable to damage at quite low vibration levels**….[R]esonance effects measured by the author have seen PPVs amplified by factors of more than 60× [in a single charge trial blast]**.* [emphasis added]

*…**PPV levels commonly applied, whilst designed to prevent damage, did not give any indications of a structure's likelihood of damage: in most cases no damage could be found at PPVs many times those prescribed, whereas at other times damage seemed to be occurring with vibrations of low PPV**.* [emphasis added]

Jordan also describes unexplainable damage to historical structures even when blasting is measured at lower PPVs of 5 mm/s or even 2 mm/s.

*In recent times there has been damage noted in some of the buildings being monitored which cannot be explained simply on the basis of the peak particle velocity [PPV] in the ground wave. **In particular, cosmetic cracking has been noted in some large ceilings when the recorded resultant PPV was close to the allowed maximum, which in itself has been set very conservatively**.* [emphasis added]

Elastic modelling of the ceilings and derivation of the vertical frequencies in the ground wave suggested that resonance was involved, with both ground wave frequencies and ceiling vibration

[38] Jordan, Bill. "Mine blasting vibration and its effects on buildings and structures – implementing a frequency-based approach," *Bill Jordan & Associates Pty Ltd, Newcastle NSW,* Email: bill@bjaeng.com.au, https://aees.org.au/wp-content/uploads/2013/11/29-JORDAN-Bill-MineBlastingVibration.pdf.

modes being in the 12 Hz to 16 Hz range. In general, frequencies much above 30 Hz are usually attenuated at the typical distances between workings and sensitive buildings.

It is interesting to note that individual wall panels tend to have resonant frequencies above 30 Hz, even in very large houses. Whole building vibration could be being experienced at much lower frequencies, but the difficulties of modelling such structures elastically does not give confidence in obtaining a sensible result. Even constructing a very detailed finite element model of such a building would be both costly and of doubtful accuracy.

Insurance Company Denies Homeowner Claim for Property Damage Caused by Vibrations from Off-site Quarry Blasting

In *Hernandez v. Citizens Prop.*,[39] the Florida appellate court held that insurance coverage is excluded for cracks in walls and floors that occurred due to vibrations from off-site quarry blasting operations by a policy's earth-movement/settlement exclusion.

The insured filed a claim for cracks in the walls and flooring of his house. ***The insured's engineer concluded that the damage was the result of soil underneath the house shifting from vibrations caused by blasting explosions at a nearby rock quarry****. The insurer denied coverage, asserting an earth-movement/settlement exclusion of the policy. The insured filed suit and argued that the exclusion did not apply. The insured noted that the policy lists nine causes of loss that are considered "earth movement," and that the alleged cause of loss, blasting, is not included. The insurer moved for summary judgment, which the trial court granted, finding that the policy did not cover indirect damage to property as a result of earth movement that may have been triggered by off-site explosions. The appellate court affirmed. The earth-movement exclusion of the policy excluded coverage for damage caused by earth movement "unless direct loss by explosion ensues." The appellate court found that the earth movement at the property did not cause an explosion, but rather that the earth movement was caused by explosion.* [emphasis added]

The appellate court noted that the exclusion contains anti-concurrent causation language that "loss caused directly or indirectly" by certain causes is excluded "regardless of any other cause or event contributing concurrently" to the loss. ***It held that the policy's terms excluding "earth sinking, rising, or shifting," "settling, cracking, or expansion of the foundation," "whether caused by natural or manmade activities," unambiguously precluded coverage under the policy****.*[40] [emphasis added]

Homeowners' Awards For Vibration Damage Caused By Blasting Restricted To Five-Year Limitation Period

In *Harrod Concrete and Stone Co. v. Melton III*,[41] eight homeowners and one tenant (Appellants) had their respective damage awards set aside by the appellate court of Kentucky and remanded to the lower court for further proceedings, consistent with a five-year limitation period successfully argued by Harrod (the quarry owner), restricting the computation of proven damages subsequent to August 1996. The failure to timely file the claims for damages from vibrations reduced the amount of damages to which each

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[39] *Hernandez v. Citizens Prop.*, 308 So. 3d 102 – Fla. Dist. Court of Appeals, 3rd Dist. 2020, https://www.lexology.com/library/detail.aspx?g=7a837bcd-6ebb-46b3-97d3-42fac4688214.

[40] Lenzen, Derek R., "Florida Appellate Court Holds Earth-Movement Exclusion Excludes Coverage for Cracking Damage Caused by Off-Site Blasting Vibrations," *Phelps Dunbar LLP*, August 25, 2020, https://www.lexology.com/library/detail.aspx?g=7a837bcd-6ebb-46b3-97d3-42fac4688214.

[41] *Harrod Concrete and Stone Co. v. Melton III*, Ky: Court of Appeals 2007, https://scholar.google.ca/scholar_case?case=7521342049644934355&q=harrod+concrete+and+stone+co+v+melton+iii&hl=en&as_sdt=2006.

homeowner (and one tenant) should have been entitled, had the claims been filed in the early 1980s rather than in August 2001.

> *The homes allegedly all had varying degrees of damage, including cracks in the interior and exterior walls and slabs, cracks in chimneys and joints, bowed walls, cracked drywall, nail pops, and fogged and/or cracked windows. All of the homes are located in Franklin County, Kentucky over an area of roughly two square miles.*
>
> *…[The damage here was known and present as far back as the early 1980's for some of the Appellees. We agree with Harrod that "[c]racks are not latent or inherently undetectable. Neither are nail pops, drywall cracks or cracked and fogged windows. These conditions are patently obvious." Certainly, all the Appellees had knowledge of the blasting vibrations occurring as a result of Harrod's limestone operation from the first day of moving into their respective homes. Additionally, Harrod introduced evidence at trial showing that many Appellees knew or should have known of the damages and the possible cause before August 1996.[6] For example, the Dunns and Devers filed insurance claims for blast damage and received payments before 1996. Moreover, the Olivers filed insurance claims before 1996, which were denied; however, they had been advised in June 1996 by an engineering firm that they had blast damage.*
>
> *Nor are we persuaded that Appellees were unable to determine the cause of the damage because they allegedly complained to state mining officials and to Harrod directly about the alleged blast damage and were told that the blasting was not causing their property damage.* ***The Appellees [homeowners and one tenant] are not relieved of their responsibility to exercise reasonable diligence to discover the cause of their damages merely because Harrod may have denied responsibility****. Thus, the trial court erred and its instructions to the jury should have limited the award, if any, to only those damages proven to have occurred subsequent to August 1996. Accordingly, we reverse and remand.* [emphasis added]

The property damage attributed to vibrations from quarry blasting was supported by the evidence of the Appellees' expert, Dr. Deatherage, whose qualifications were unsuccessfully challenged by Harrod.

> *Dr. Deatherage testified that he is a professor of civil engineering with a Ph.D. in civil engineering. Moreover, he has numerous peer reviewed publications which he has authored. Dr. Deatherage's education, training, and experience were sufficient to qualify him as an expert. To the extent that Harrod argues Dr. Deatherage's opinions fall outside the scope of scientific, technical or other specialized knowledge pursuant to Daubert, we disagree.*
>
> *The principles established in Daubert and its progeny concerning the admissibility of expert testimony "apply not only to expert testimony based on scientific knowledge, but are equally applicable to expert testimony based on technical or other specialized knowledge."*
>
> *…[I]n forming his opinions, Dr. Deatherage visually inspected the homes and interviewed the occupants. Dr. Deatherage also reviewed countless photographs of the alleged damage, reviewed the opinions of Harrod's experts, as well as reviewed technical publications regarding blast vibrations.*

Lafarge Fined For Mining (Blasting) and Removing Aggregate From Unlicensed Area

Lafarge pleaded guilty to conducting illegal blasting quarry operations in an unlicensed area and removing limestone adjacent to its quarry in Dawson Township, Manitoulin Island.

> *The company was fined $45,000 and was ordered to rehabilitate the vertical rock faces located on unlicensed private land and Crown land. As part of the agreement, Lafarge will pay an additional*

$45,900 in outstanding royalties to the Ontario Aggregate Resources Corporation for materials excavated from the Crown land.

The court heard that Lafarge alerted an aggregates officer that the company had removed aggregates from outside its licence. A subsequent investigation confirmed that Lafarge had extracted nearly 148,000 cubic metres of limestone outside its licence area, as well as 119,000 cubic metres from adjoining Crown land. Although the Crown land is part of an aggregate permit that the company holds, the company did not have the required approval to excavate the area at that time. [42]

Coloured Aggregates Fined For Illegally Moving Blasted Rock and For Upgrading A Road Outside Its Permitted Area

Coloured Aggregates was convicted of contravening its River Valley quarry site plan by moving aggregate outside of its permitted quarry and for upgrading a road outside of its permitted area.[43]

An Aurora-based aggregate company has been fined by the Ministry of Natural Resources and Forestry for illegally moving material outside of its permitted North Bay site….

On Sept. 16, [2019] the company was convicted of contravening its site plan contrary to the Aggregate Resources Act. The company was fined $35,000 and given 30 days to pay….

The…[Ontario Court of Justice in Sturgeon Falls] heard that between June 1 and July 31, 2017, the company extracted rock within its permitted area, then hauled it outside of the permitted area and stockpiled it there.

It also upgraded an old logging road to create a new access point to the quarry. This upgraded road was partially within the permitted area and partially outside the permitted area.

Both these actions were in contravention of its approved site plan.

This marks the second time in two months Coloured Aggregates has been corrected by the province.

In August, the company was issued four requirements from the Ministry of Labour following the death of a worker in the employ of Consbec Inc., a Sudbury-based drilling and blasting company that Coloured Aggregates had contracted for work at the River Valley quarry.

The employee was critically injured while drilling and later died of their injuries.

Property Damage Complaints Persist Over Quarry Blasting Operations

As reported in the 2017 issue of Quarry,[44] the number of complaints from communities in proximity to blasting quarries in Victoria, Australia, has been on the rise. As is typical, quarry operators/blasters always respond by denying responsibility for any property damage occasioned by blasting operations.

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[42] Adams, Kate. "Lafarge Canada Inc. fined for removing aggregate from unlicensed area," *BayToday.ca*, June 25, 2010.

[43] "Aggregate company fined for illegally moving rock," *Northern Ontario Business*, Oct 31, 2019, https://www.northernontariobusiness.com/industry-news/design-build/aggregate-company-fined-for-illegally-moving-rock-1778370.

[44] "Managing safer blasting under community scrutiny," *Quarry,* May 2, 2017, https://www.quarrymagazine.com/2017/02/05/managing-safer-blasting-under-community-scrutiny/.

Flyrock, lack of blast area security, premature blasts and misfires are the four major areas of injuries and fatalities from blasting in open cut mines and quarries….

More recently, quarries and mines close to houses, along with regulators, have been responding to complaints from the community that blasting is causing damage to their homes. Approvals of residential developments near existing quarries are contributing to the increased number of complaints.

The common response from our industry, that the ground vibrations and air blast levels measured at their property are within the limits specified in approvals, will not alleviate the concerns of householders that cracks in plaster or brickwork are attributed to blasting. [emphasis added]

On-going Complaints Over Vulcan's Blasting Quarry Operations in Lorton, Virginia

Residents within a mile or two [3.22 kilometres] of the Vulcan quarry in Lorton, Virginia, have been complaining for years about the adverse impacts caused by blasting quarry operations.[45] From the edge of the quarry, there is a separation of 320 feet (97.5 metres) to the closest homes in Occoquan Overlook and 180 feet (54.9 metres) in SouthPointe.

For years, residents within a mile or two of the Vulcan quarry in Lorton have heard the twice-weekly thuds of explosions, watched vases bounce across tables and pictures rattle on walls….[emphasis added]

Those who live near the quarry, located on Ox Road just south of the new Fairfax Water treatment plant, have two major complaints they want Vulcan to address: the amount of traffic created by trucks loaded with tons of stone leaving the quarry daily, and the impact the blasting has on their lives, through the noise and tremors caused by the explosions….[emphasis added]

Although the quarry has been in business since the 1950s, the area surrounding it has undergone drastic changes in the past few years since the prison closed, said Mike Grogan, another Southpointe resident. ***As the population has increased, homes have been built closer to the quarry, and the people who live there weren't prepared for the blasts.*** [emphasis added]

Many of the residents who live near the quarry thought they were the only ones feeling the aftershocks of the blasts in their homes, Grogan said, and didn't report their concerns or complaints to anyone. It was only at the November [2006] meeting of the South County Federation that Supervisor Gerry Hyland (D-Mount Vernon) became aware of the situation, he said. [emphasis added]

The Fairfax County requirements demand a 0.4 [inch/sec] [10.16 mm/sec] peak particle velocity [PPV] and a 130 air over pressure [airblast] decibel reading…. Vulcan detonates between 20,000 pounds and 25,000 pounds of explosives twice a week at the quarry….The operating hours for the quarry are 7 a.m. until 6 p.m. during the week…[46]

While Vulcan has never been found to be operating in excess of Fairfax County requirements, McKernan [Deputy Chief of the Fire Prevention Division] said he believes the blasting industry needs stricter regulations….[emphasis added]

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[45] "Shockwaves of Dissent from Quarry Neighbors," *The Connection Newspapers*, December 7, 2006, http://m.connectionnewspapers.com/news/2006/dec/07/shockwaves-of-dissent-from-quarry-neighbors/.

[46] "Vulcan's Uncertain Future In Lorton, Vulcan Quarry's special-use permit may not be renewed based on neighbor's complaints of structural damage," *The Connection to your community*, April 4, 2007, http://www.connectionnewspapers.com/news/2007/apr/04/vulcans-uncertain-future-in-lorton/.

McKeeman said there's a long list of books that state the damages found in these neighboring homes are common and can be found in neighborhoods that are nowhere near quarries. [emphasis added]

On-going Complaints Over Vulcan's Blasting Quarry Operations Near Hendersonville

Residents as far away as one mile have been complaining for years about the damage to their homes, which they attribute to the Rogers Group Inc. blasting quarry operations. By 2018, more than 330 residents joined a Facebook Group (Saundersville Area Blasting Concerns).

Some neighbors in Hendersonville say far too often the earth is moving beneath them and loud blasting at a nearby quarry is making them lose control of their homes. Now, the city is coming forward with something that might help.

There's a crack in a window on Saundersville Road. The homeowner believes it's not because of anything in her neighborhood, but rather the rock quarry nearby.

"I'm hearing from some of the neighbors about the impact on their homes," said Hendersonville Mayor Jamie Clary. "They're seeing that pictures are being moved, glasses are being rattled. They're worried it's having an impact on their foundations or walls or other parts of their homes." [emphasis added]

[Mayor] Clary said he lives in the area hit by blasting.

Another neighbor told News4 he feels helpless investing in a house when he has no control over damage to it. He said he would never have built in the neighborhood if he knew the problem was this bad. [emphasis added]

A lot of the worries were voiced in the Facebook group, Saundersville Area Blasting Concerns, now with more than 330 members.[47] [emphasis added]

Wyncrest resident Tasha Buttrey had just moved in three weeks prior when she first felt the ground shake in 2018. She says it wasn't long before she learned from neighbors that a quarry owned by Rogers Group was nearby.

"The house shook and knocked a mirror off the wall," she said. "We heard a pop and we watched it crack the dry wall around the door frame." [emphasis added]

Buttrey says she didn't bother filing a formal complaint with the state fire marshal's office who regulates the blasting, or Rogers Group.

"Proving the damage is directly due to blasting, is nearly impossible," she said. To make matters worse, when one files a complaint with the fire marshal's office, the state office obtains its readings from Rogers Group itself, Buttrey noted. The readings rarely if ever show the quarry is in violation of state standards. [emphasis added]

"The community is left with very little recourse," she added. "Everybody feels pretty hopeless about it."

For their part, Rogers Group and the third-party company it hires to monitor its blasting, has consistently said it is well within the state guidelines.

"We are always way under the state requirements," Rogers Group Area Vice President Bryan Ledford told the Hendersonville Standard in March of 2018. While the state requirements are one to two inches per second peak particle velocity, Rogers Group targets .5 inches [per second], he said. "just to make sure we stay below the legal limits."

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47 https://www.wsmv.com/news/neighbors-claim-rock-quarry-blasting-creates-problems-for-nearby-homes/article_cba4c58e-5ae3-51a0-a272-8431dff528c8.html.

State Rep. Terri Lynn Weaver (R-Lancaster) says she would like to see the state limits lowered to meet federal standards, and has introduced legislation that revises portions of the state's Blasting Standards Act of 1975.[48]

On-going Litany of Complaints Over Quarry Blasting From Residents As Far Away As Two Miles From the Quarry

Some forty residents within two miles (3.22 kilometres] have filed a litany of complaints against Arkhola Sand and Gravel Co.'s Roberts Quarry, a blasting quarry southwest of Tahlequah.[49]

There was a rapid series of muffled detonations, and 8,000 tons of limestone slowly peeled away for the 40-foot thick formation.

Over ***a ridge, roughly 4,800 feet [1,463 metres] west of the explosion, Elsie Torix noted the blast on her calendar****.* [emphasis added]

*"****I felt everything start to shak[e]," she recounted later that afternoon. "It was just like an earthquake. It was a small one, compared to what they usually put off****."* [emphasis added]

Superintendent Darwin Tackett said Friday's [March 15, 1985] "shot" was typical of a normal working day at Arkhola Sand and Gravel Co.'s Roberts Quarry…

Friday's blast couldn't possibly have damaged Elsie and Louie Torix's mobile home, Arkhola officials said. Neither could any of the other shots that since 1978 have opened up the limestone quarry, Tackett said.

But the Torixes and 39 other property owners in around the Zeb community cite a litany of grievances against the quarry. Residents blame the blasting for drying wells, dirtying well water, cracking brick veneer, breaking windows and wrecking mobile homes*.* [emphasis added]

Confronted with claims of structural damage in homes one and two miles from the quarry*, Arkhola officials point to their cinder-block control block building at the very edge of the quarry.* [emphasis added]

If the blasting damaged buildings, they say, it would certainly have damaged the control house by now….

1n a 1980 jury trial, the Torixes won a $31,000 judgment against Arkhola. They said Arkhola's blasting ruined their well and destroyed their mobile home*.* [emphasis added]

At the 1980 trial, expert witnesses for Arkhola testified that the blasting could not possibly have affected the well and trailer.

The Torixes' first trailer sat atop a ridge overlooking the quarry.

The Torixes said when the blasting ruined that trailer, they mortgaged a new mobile home and set it up below the ridge, away from the blasting. Still, they claim, the trailer is beginning to show the same structural stresses that eventually destroyed the other trailer*.* [emphasis added]

When the Torixes sued Arkhola in 1980, the firm offered to buy them out for $500 an acre. The Torixes spurned the offer. The farm is worth twice that, they said*.* [emphasis added]

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[48] https://www.hendersonvillestandard.com/news/blasting-complaints-about-local-quarry-prompts-bill-to-revise-state/article_f59581dc-5f34-11ea-9a0e-6fc489384d49.html.

[49] Palmer, Griff. "Quarry Blasts Rattle Residents, Stir Up Lawsuit," *The Oklahoman*, March 17, 1985, https://www.oklahoman.com/article/2101866/quarry-blasts-rattle-residents-stir-up-lawsuit.

The Torixes said they took a live-and-let-live attitude when they first learned Arkhola had leased 900 acres from a nearby landowner. But the Torixes' benevolence quickly faded.

*"**The first shot they put off out there, those damned dishes fell out of the cabinet**," Louie Torix said….*[emphasis added]

Complaints of Property Damage From Quarry Blasting Vibrations Ignored by Council and Considered a "Civil Matter"[50]

Residents in the communities surrounding Roadstone's Belgard quarry complaining of damages to their houses from blasting operations were advised by South Dublin County Council that their only remedy was to pursue costly and time-consuming civil actions against the owner of the quarry.

SOUTH Dublin County Council has advised that alleged damage to residential properties from the operation of commercial activities "are a civil matter", when asked about alleged damage to houses near Roadstone's Belgard quarry.

*As previously reported in The Echo, **a resident near the quarry claimed that the routine blasting that is carried out has worsened in recent months, causing the windows and mirrors in his house to shake**.* [emphasis added]

When the story went online, a number of commenters claimed that reverberations from the quarry blasts, which occur on Friday afternoons, could be felt further afield in Hazelgrove, Citywest, Kingswood, Brookview, Fettercairn and Ard Mor. [emphasis added]

The issue was raised at Monday's monthly meeting of the Tallaght Area Committee, when Fianna Fáil councillor Charlie O'Connor asked the council's CEO if he was "dealing with complaints from local residents claiming alleged damage to their homes from constant blasting at the Roadstone Quarry." [emphasis added]

The council advised that, "damage to residential properties from the operation of commercial activities are a civil matter."….[emphasis added]

…Brownsbarn resident Michael Fogarty claims that the blasting at the site started occurring twice a week for several months last year, and the level of disruption to nearby residents has increased.[51] [emphasis added]

Mr Fogarty, who has lived in the area for 14 years, told The Echo: "When we first moved here there was always an explosion on a Friday – you got used to it.

"But a few months ago, they started doing them on Tuesdays as well.

"Having explosions once a week was horrible, but twice a week is a disaster.

"I was at home on a Tuesday before Christmas and the mirror fell off the fireplace, the windows shook and my four-year-old started bawling crying. The houses were shaking. [emphasis added]

"Some of the explosions aren't bad, but some of them are really, really bad.

[50] O'Flaherty, Aideen. "Alleged damage to property from blasting is a 'civil' matter,'" *Echo.ie*, March 29, 2021.
[51] https://www.echo.ie/residents-claim-explosions-at-belgard-quarry-have-worsened/.

Developer Refuses to Exercise Option to Purchase Land Next to Blasting Quarry Due to Dangers of Flyrock and Vibration Damage to Foundations of Homes Expressed by the Quarry Owners

Braddock Park Homes, Inc. had entered into an agreement to purchase 45 acres, which included a five-and-a-half acre portion referred to as the Enoe Mountain Village (EMV property) located adjacent to a blasting quarry, conditional on Town approval for a 118-unit subdivision of townhouses.

The Town of Hillsborough approved rezoning of the entire 45 acres, including the 5.5-acre EMV property adjacent to the blasting quarry, to permit the proposed development. After owners of the quarry raised objections to the rezoning expressing health and safety concerns over the prospect of a residential subdivision next to a blasting quarry, the developer chose not to exercise the purchase option on the 5.5-acre EMV property.

> *In the fall of 2013, the Town began a series of hearings to allow the public to express their views about the rezoning petition….[R]epresentatives attended the public hearings and opposed the rezoning of the EMV Property….[R]epresentatives told the Town that (1)…[Resco Products, Inc. and Piedmont Minerals] operate an active mine adjacent to the EMV Property; (2) they regularly engage in explosive blasting at the mine; and (3) they conduct the explosive blasting operations roughly 300 feet [91.44 metres] from the EMV Property [para. 3].*[52]

The quarry operators expressed the following specific concerns over the prospect of residential development of the adjoining EMV lands:

> ***During a public hearing on the rezoning, representatives of the quarry owners argued that their future neighbors 'could be endangered by fly rock, excessive air blasts, and excessive ground vibrations from the blasting operations,' according to the court record.***[53] [emphasis added]

Quarry Application Denied Over Anticipated Vibration and Property Value Impacts

In *Sand Springs Materials LLC v. The City of Sand Springs*,[54] the Oklahoma Court of Appeal upheld the judgment of the district court to deny Sand Springs Material's (SSM) a permit to operate a quarry on 1,000 acres. The denial of the permit was, in part, based on anticipated vibration impacts and diminution in property value of a 150 property owners.

> *[15]…SSM's reliance on In re Volunteers of America, Inc., 1988 OK 8, 749 P.2d 549, is misplaced.[4] That case holds that denial of a special exception to a city ordinance cannot be "based on fears `which may or may not have a basis in fact.'" Id. at ¶ 12, 749 P.2d at 552. "[A]ctual*

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[52] *Cheryl Lloyd Humphrey Land Investment Company, LLC v. Resco Products, Inc, and PiedMont Minerals Company, Inc.,* 2021 NCSC 56, https://scholar.google.com/scholar_case?case=10039052016572520713&q=%E2%80%9Cfly+rock%E2%80%9D&hl=en&scisbd=2&as_sdt=2006.

[53] Kokai, Mitch. "Chief justice highlights right of petition in N.C. Supreme Court Ruling," *Carolina Journal*, 14 June 2021, https://www.richmondobserver.com/national-news/item/12494-chief-justice-highlights-right-of-petition-in-n-c-supreme-court-ruling.html.

[54] *Sand Springs Materials LLC v. The City of Sand Springs*, 243 P.3d 768 (2010) 2010 OK CIV APP 128, https://scholar.google.com/scholar_case?case=5244406433361108630&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cvibrations%E2%80%9D&hl=en&as_sdt=2006#[4].

> *evidence must be presented to show that the [special use] will be `injurious to the neighborhood or otherwise detrimental to the public welfare.'" Id. Here, actual evidence was presented. For example, evidence was presented that a potential buyer decided not to pursue the purchase for fear that the quarry would be approved and his property value would diminish.* ***SSM argues that: "One citizen's decision to no longer buy a home in this area is hardly evidence that property values will be adversely affected." Therefore, SSM concludes that the "fears" of 150 property owners that their property values would decline should be disregarded pursuant to Volunteers because there is no actual evidence property values will decline. In essence, SSM argues that until the quarry is in operation and is shown to adversely affect property values, the quarry must be approved. Volunteers requires evidence supporting a landowner's "fears" that property values will decline. It does not require evidence that property values have actually declined before a proposed use can be denied****.* [emphasis added]
>
> *[16]* ***Finally, although it was the opinion of SSM's expert that blasting operations would not physically damage nearby residential structures, he also stated that there was "no doubt" that occupants would feel the vibrations caused by the proposed blasting. A home owner is qualified to testify regarding the value of the owner's property****. H.D. Youngman Contractor v. Girdner, 1953 OK 277, ¶ 0, 262 P.2d 693, 694 (Syllabus 3).* ***SSM cannot simply dismiss, as unsubstantiated fears, the evidence provided by 150 property owners****.* [emphasis added]

Concern was also expressed by the Environmental Protection Agency over a landfill, designated a supersite, located approximately 2,000 feet (610 metres) away from the proposed quarry.

> *[T]he EPA "remained concerned" that blasting operations at the quarry would compromise efforts to secure the existing hazardous contamination at the landfill and create subsurface fissures that could promote downward offsite migration of landfill contaminates [para. 13].*

Diminution in Property Value and Loss of Property Use Occasioned by Blasting

In *Clay v. Missouri Highway Transp. Com'n* (MHTC) et al. (Rieke),[55] the Missouri Court of Appeal awarded the Clays $19,640 as the diminution in property value caused by blasting of rock either against MHTC or Rieke, the contractor, and $2,700 for the loss of use against Rieke only.

The Clays' residence sits above an aquifer, and the aquifer had supplied a well on their property with unusually high-quality drinking water since 1945. In November 1989, MHTC retained Rieke to cut a roadway for a new highway. Rieke used explosives to break up and remove rock from the roadway site, and caused damage to the Clays' property, which is 0.85 miles (1,368 metres) from the blasting site.

> *Rieke tried to blast in a controlled fashion. Specially-placed explosive charges cut the rock and left smooth walls of rock for the sides of the highway. At trial, some experts testified that this controlled blasting only caused shock waves to move about twenty feet [6.1 metres] into the rock. The Clays alleged, however, that the blasting caused vibrations at their home some .85 miles [1,368 metres] away and that it affected the quality and quantity of the water coming from the aquifer. More specifically, they alleged that due to cracks in the aquifer caused by the blasting, sediment such as sand and oil contaminated the aquifer and, ultimately, their well-water, that the water level of their well dropped, and that the water flow in their well was drastically reduced.*

[55] *Clay v. Missouri Highway and Transp. Com'n*, 951 S.W.2d 617 (1987), Mo: Court of Appeals, Western District, https://scholar.google.com/scholar_case?case=6636206402696025097&q=Clay+v.+Missouri&hl=en&as_sdt=2006.

> *…[T]here was evidence to support the submission that vibrations or concussions resulting from the explosion entered the plaintiffs' property, for there was testimony that the Clays and their neighbors felt and heard the blasting. They also testified that they began to have problems with their water supply after the blasting. Thus, they do claim a trespass, and they do claim their damage resulted from the blast. What they do not claim, however, is that the vibrations or concussions which they felt directly caused their damage. Rather, they claim that the same blasting that caused the vibrations also, but separately, split and cracked rock outside their property, and that as a result, it caused a lowering of the water level in the entire aquifer, including that on their property, and polluted the aquifer that supplied their well.*

The Clays were not required to prove that the vibrations and/or concussions were the direct cause of the damage to their property, but only that blasting caused the damage.

> *…[T]he trial court properly refused to require the Clays to prove that it was the vibrations or concussions from the blasting that directly caused their damage; they were required to submit only that it was the blasting that caused their damage. We so rule because we conclude from a review of the history of the doctrine of strict liability for blasting that, while such a claim may be established by proof of vibration and concussion, see Wiley v. Pittsburg & Midway Coal. Mining Co., 729 S.W.2d 228, 232 (Mo.App.1987), it may also be established by other methods of proof.*

As a matter of public policy, innocent parties whose properties have been damaged should not bear the costs of blasting by either the state or an industry.

> *Policy considerations support such imposition of strict liability for blasting even though no physical invasion of the premises has taken place. Neither an industry nor the State should be allowed to use its property in an abnormally dangerous way that injures the property of its neighbors with impunity, because to do so is effectively an appropriation of the neighbor's property for the industry or State's use. The blaster, and not the wholly innocent party, should assume the costs of its blasting. See Atlas Chem. Indus., 514 S.W.2d at 316 (characterizing the damage inflicted on other people's property as inverse condemnation); Branch, 657 P.2d at 275.*
>
> *…[T]hese principles have application here, where the Clays similarly claim that the blasting caused physical damage to their property by damaging the rock formations underlying nearby property, thereby causing injury to the aquifer or to other subterranean aspects of the property in question. They presented expert testimony by Dr. Paul Hilpman, a Professor Emeritus of Geology at the University of Missouri and the Director of the Center for Underground Studies, to support this theory. He testified that the blasting damaged geological structures that resulted in the contamination of the Clays' well. Dr. Hilpman testified that the blasting fractured rock and sandstone layers in the aquifer and that these fractures in turn caused the water table to drop and allowed oil to migrate up into the water-producing area of the rock strata. This resulted in a lower water level in the Clays' well and in pollution of their well water. This type of damage is equally serious and equally likely to affect the value of property as is damage caused by vibrations or concussions on the property. We find the Clays' proof of damage was sufficient to support their strict liability for blasting and inverse condemnation claims.*
>
> *Dr. Hilpman testified that some of the rock had to be blasted and that the blasting would cause more subterranean fracturing than simple cutting. He also testified that the oil showed up in the Clays' well because it was able to migrate up into the water zone through fractures in a limestone layer that were caused by blasting.*

Denial of Quarry Permit Supported By Material, Competent and Substantial Evidence as to Land Use Incompatibility

In *Vulcan Materials Co. v Guilford County. Board. Of Cty. Com'Rs*,[56] the Board denied Vulcan's application for a quarry comprising approximately 235 acres, with an initial 10-acre quarry pit 300 feet deep, and eventual expansion to 17 to 20 acres. Vulcan's appeal resulted in the reversal of the Board's decision by the Superior Court, which then led to a further appeal by the Board to the North Carolina Appeals Court, which restored the Board's decision to deny the quarry permit.

Those opposed to the issuance of the quarry permit offered competent and material evidence as follows in summary form:

- there are 119 homes within 3,000 feet [914 metres], and 450 homes within one mile [1,609 metres], of the quarry site; [underscoring added]
- Mt. Hope Church Road, a two lane paved road, is traveled twice a day by ten school buses;
- the area immediately surrounding the quarry site is residential and agricultural, although a commercial business, Replacements Ltd., has a 100,000 square foot facility some 11,000 feet [2.08 mites] from the proposed quarry site;
- area residents obtain their water from wells which are generally 80 [feet] [24.4 metres] to 140 feet [42.7 metres] deep;
- the proposed quarry site is located in part of a watershed for a planned drinking water source;
- one area resident testified that when she put her home, which is located directly across from the site, up for sale and disclosed that a quarry was proposed for the site, no one even looked at the house; [underscoring added]
- the Guilford County Comprehensive Plan adopted in 1986 reserves the area of the site for residential use;
- neighbors of a Vulcan quarry in Elkin, North Carolina, stated through affidavits that they have suffered broken windows, cracked walls, dried up wells, dust, noise and falling rocks as a result of the operation of that quarry; [underscoring added]
- Vulcan was fined $10,000 by the United States Department of Labor for an incident in which a man was killed by flying debris [flyrock] from a quarry blast while mowing his lawn some 900 feet [274 metres] from a Vulcan quarry in Weston, Illinois; [underscoring added]
- there are several quarries already operating in Guilford County; and, according to the National Environmental Journal, Vulcan is the seventh worst emitter of toxic chemicals in the United States, based on air, water, land, underground, public sewage, and off-site releases. [underscoring added]

The Carolina appeal court rejected Vulcan's argument that because "quarrying" is a permitted use within the context of the zoning ordinance, it necessarily is in "harmony with the area." As concluded by the Carolina appeal court, the proposed quarry is not in harmony with the character of the area.

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[56] *Vulcan Materials Co. v Guilford County. Board. Of Cty. Com'Rs,* 444 S.E.2d 639 (1994) 115 N.C. App. 319, https://scholar.google.ca/scholar_case?case=7278696103547714002&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cconcussion%E2%80%9D&hl=en&scisbd=2&as_sdt=2006.

…[C]ompetent, material, and substantial evidence reveals that the use contemplated is not in fact in "harmony with the area in which it is to be located" the Board may so find. See 3 Robert M. Anderson, American Law of Zoning § 21.13, at 682 (3d ed. 1986); 3 Rathkopf § 41.13, at 41-83; see Triple E. Assocs. v. Town of Matthews, 105 N.C.App. 354, 358, 413 S.E.2d 305, 307-08, disc. rev. denied 332 N.C. 150, 419 S.E.2d 578 (1992); Piney Mountain Neighborhood Assoc., Inc. v. Town of Chapel Hill, 63 N.C.App. 244, 251, 304 S.E.2d 251, 255 (1983); People's Counsel for Baltimore County v. Mangione, 85 Md.App. 738, 584 A.2d 1318, 1322-23 (1991).

On-going Complaints and Environmental Concerns Over Votorantim Cimentos St. Marys Bowmanville Blasting Quarry Operations

A sampling of homeowner complaints and environmental damage attributed to Votorantim Cimentos, the owners of the Bowmanville blasting quarry are summarized as follows:

- "Many complaints are related to blasting and come from outside the immediate surrounding area." (Sept 11, 2018 Community Relations Committee Minutes). [underscoring added]
- Received eight complaints (vibration, noise and dust) in third-quarter of 2017 (to October 4). (Oct 3, 2017 Community Relations Committee Minutes)
- Received four complains (noise, flooding and odour) in the second quarter 2017, and St. Marys refused to discuss shoreline erosion with community members on advice of legal counsel due to legal proceedings, an issue that had been raised at previous community meetings. "**Community believes that St. Marys should not be able to decline a new member to the committee, and that discussion should be allowed to continue even if the member chosen was involved in legal action against St. Marys**." "Complaints reported to MNRF/MOECC etc can't be reviewed with the complainant unless he/she authorizes the MNRF/MOECC." (June 6, 2017 Community Relations Committee Minutes) [emphasis added]
- Received 26 complaints (blasting, plume, noise and dust) in 2016 (Nov 29, 2016 Community Relations Committee Minutes)
- "St. Marys Cement reported exceedances in air emissions on five occasions in 2015.[57] "According to St. Marys "it is not abnormal to have exceedances." "St. Marys' operations released 4,096 tonnes of sulphur dioxide between January 1 and December 31, 2015," whereas, "[t]he Ministry of Environment and Climate Change allows for 3,511 tonnes."[58]
- "Clarington council…heard there were 13 community complaints in 2015."
- In 2014, St. Marys' Bowmanville operation was the 10th largest emitter with 7,135 tonnes (combined emissions for a group of contaminants known as "criteria air contaminants" that cause air-quality-related issues such as smog and acid rain). These contaminants include sulphur oxides, nitrogen oxides, volatile organic compounds, carbon monoxide and ammonia.[59]

[57] Swinson, Stefanie. "St. Marys Cement reports several exceedances in air emissions in 2015," *toronto.com*, Jun 15, 2016, https://www.toronto.com/news-story/6722518-st-marys-cement-reports-several-exceedances-in-air-emissions-in-2015/.

[58] https://www.toronto.com/news-story/6722518-st-marys-cement-reports-several-exceedances-in-air-emissions-in-2015/.

[59] Ministry of the Environment and Climate Change, Chapter 3, Section 3.05, p. 337, https://www.auditor.on.ca/en/content/annualreports/arreports/en16/v1_305en16.pdf.

- Received "a large number of complaints about blasting during the 2010 winter [Christmas] holidays."[60]

Conclusions

Blasting quarry operations cause untold adverse effects, and the only effective remedies are minimum setbacks and separation distances, or an outright ban of blasting quarries.

- Blasting rock is an ultrahazardous activity, and has the potential to injure or kill onsite workers and people offsite.
- Blasting within regulatory limits does not prevent property damage, even at great distances.
- Vibrations and airblast from blasting rock can cause damage at great distances from the blast site.
- Blasting can traumatize people (especially children, the elderly and disabled), including those suffering from Post-traumatic Stress Disorder (PTSD), and pets and wildlife.
- Commercial and homeowner insurance policies do not cover property damage caused by blasting.
- Citizen complaints and private law suits are common occurrences in response to the adverse effects occasioned by blasting rock, as provincial oversight is often ineffective or non-existent.
- Owners whose property is damaged or depreciated by airblast and ground vibrations from blasting operations are forced to initiate time-consuming and costly civil litigation.
- Blasting that injures or relies on the use of the property of its neighbours, directly or indirectly, with immunity, is effectively an appropriation (de facto taking) of the neighbours' property without compensation.
- Current residents and future generations lose control over what happens once a blasting quarry operation is established, and are forced to endure the adverse effects of quarry operations for the rest of their lives, as quarry operations can last for 100 years or more (five generations); in Ontario, a permit or licence to extract aggregate typically has no expiry date.
- Blasting quarry operations depreciate the value of nearby non-residential and residential property, and erode investor and homeowner equity.
- Non-residential and residential properties near blasting quarries are more difficult to sell, and mortgage financing on good terms and conditions is not readily available.

[60] Hatherly, Tara. "St. Marys Cement to stop blasting during winter holidays this year," *DurhamRegion.com*, August 3, 2011, https://www.durhamregion.com/news-story/3452188-st-marys-cement-to-stop-blasting-during-winter-holidays-this-year/.

BLAST VIBRATION DAMAGE CASES

Blast Vibration Damage 1

In *Alonso v. Hills et al.*,[61] as a consequence of recurrent quarry blasting operations, the California appeal court upheld the trial court's damages award of $2,650, consisting of $1,650 for damage to and depreciation of the property, and $1,000 for the plaintiff's distress in body and discomfort, annoyance, fright and shock.

According to the homeowner, the residence is located in Rockaway Beach, a community of 300 homes and 200 yards (183 metres) distant from the quarry. The evidence that there were 85 homes and the distance was 300 yards (274 metres) from the quarry had no bearing on the outcome of the case.

Blasting conducted at the quarry on November 2, 1946, February 3, 1947, and on many occasions before and after caused violent concussions in the nature of earthquake thereby injuring plaintiff's real property and building, and disturbed the enjoyment of the dwelling by plaintiff and his family, shocked plaintiff's nerves and injured his health, and caused his children great fear.

The February 3, 1947 quarry blast launched a 3-pound rock (flyrock) that destroyed a bench on the property near which one of the plaintiff's daughters was standing, causing the plaintiff to lose sleep and fear for his security and that of his family.

> *[2] The recurrent blasting in the operation of defendant's quarry, causing cumulative injury to plaintiff's property and interference with its enjoyment and requiring injunctive relief could conceivably be considered as one line of conduct in the character of a nuisance giving rise to one cause of action, without necessity of separate statement of separate blastings.*

On the issue of the relevance of expert evidence argued by the quarry owner, the appeal court ruled that expert testimony was not entitled to preference over testimony as to facts, and that inferential evidence can overcome direct evidence:

> *…[R]regular scientific expert testimony is not entitled to preference over testimony as to facts; the relative weight must be decided by the trier of facts. (Rolland v. Porterfield, 183 Cal. 466,469 [191 P. 913].)*
>
> *[8] The finding that on November 2, 1946 [before the blast], plaintiff's property was of the reasonable value of $5,000 finds competent support in plaintiff's testimony that he figures the valuation of his house at that time in the neighborhood of $5,500. (Isenberg v. Sherman, 212 Cal. 454, 483 [298 P. 1004, 299 P. 528], 10 Cal.Jur. 1023.) Appellant's attack on plaintiff's evidence on the ground of contradictions in his statements as to his cost price go to the weight of this evidence only, of which the trier of facts is the sole judge.*
>
> *[9] It is true that there was no direct evidence as to structural weakening. However, plaintiff testified that after the November 2 blast there were cracks all through the exterior of the house, the stucco outside was buckled, the window sills and frames all knocked out of proportion, the plumbing leaking, barbecue pit and terrace ruined. From such evidence of visible injury an inference can be*

[61] *Alonso v. Hills*, 95 Cal.App.2d 778 (1950) 214 P.2d 50, https://scholar.google.ca/scholar_case?case=4442811314394772785&q=Alonso+v.+Hills&hl=en&as_sdt=2006.

drawn that also the general structural strength of the building must have suffered. Whether the inference should be drawn in this case was again for the trier of facts. (Blank v. Coffin, 20 Cal. 2d 457, 461 [126 P.2d 868]; 10 Cal.Jur. 738,739.) Such inferential evidence can also overcome direct evidence to the contrary. "[I]t is elementary that direct evidence may be disbelieved and contrary circumstantial evidence relied upon to support a verdict or finding." (Gray v. Southern Pacific Co., 23 Cal. 2d 632,641 [145 P.2d 561].)

Blast Vibration Damage 2

In *Davis v. L & W Construction Company*,[62] air concussions and ground vibrations from blasting at a quarry about six-eighths of a mile (1,207 metres) away damaged the Davis residence. Their two-storey residence, measuring 32' × 32', is a stucco covered and hollow tile structure, with basement, and was in "good solid condition prior to the blasting" by the quarry operator. When quarrying operations were in progress, which had worsened by 1966, the Davis' house shock, a window broke, and structural cracks began to appear.

An experienced building contractor testified on behalf of the homeowners, stating that one time while in the home the building was in good condition, and that during a second visit he found cracks, "both diagonal and vertical." He concluded,

> ***[V]irtical or horizontal cracks cannot result from settling and are usually caused by jar, shaking or possibly wind***. [emphasis added]

Neighbours Albert Poli and John Head also testified as to the damages each sustained to their home as a consequence of the blasting quarry operations.

- *Albert Poli stated he lives about three-fourths mile [1,207 metres] west of the quarry, in a 24' × 48' frame house with cement block basement. The structure had never settled, but the foundation is shaken and cracking all over.*
- *John Head testified he resides approximately 70 rods [352 metres] southeast of plaintiffs [Davises], or about one and a fourth miles [2,012 metres] from the quarry. He had seen cracking and hairline cracks in the Davis home. His more remote residence trembled whenever there was blasting at defendant's quarry, and every room reveals damage to plaster and paper.*

The appellate court ruled in favour of the Davises and awarded damages, measured as the loss in market value, based on a before- and after-blasting analysis, while holding the quarry operator "liable without fault" for engaging in a notoriously hazardous activity.

> ***Surely it is a matter of common knowledge, and we accord judicial notice to the fact, that blasting by use of dynamite or other explosives is a hazardous activity and as such likely to damage others.*** *See Boyce v. United States, D.C., 93 F.Supp. 866, 868; 31 C.J.S. Evidence § 9, page *226 824; and 29 Am.Jur.2d, Evidence, section 23, page 60. [emphasis added]*
>
> *Since 1916 we have consistently adhered to that concept sometimes previously referred to as strict liability, but in cases of the nature here involved, now more appropriately termed "liability without fault". See Lubin v. City of Iowa City, 257 Iowa 383, 131 N.W.2d 765; Monroe v. Razor Construction Co., 252 Iowa 1249, 110 N.W.2d 250; Pumphrey v. J. A. Jones Construction Co., 250 Iowa 559, 94*

[62] *Davis v. L & W Construction Company,* 176 NW 2d 223(1970) Iowa Supreme Court, https://scholar.google.com/scholar_case?case=13093628744042978336&q=quarry+blasting+concussion&hl=en&as_sdt=2006&as_vis=1.

N.W.2d 737; and Watson v. Mississippi River Power Co., 174 Iowa 23, 156 N.W. 188. Also Annos. 20 A.L.R.2d 1372, 1375.

*…**[I]f one engages in an activity on his own land of such hazardous nature as to involve risk of harm to the person, land or chattels of neighboring parties, he is liable for the consequences proximately resulting therefrom without regard to degree of care, scientific manner in which done, purpose or motive.** Watson v. Mississippi River Power Co., supra, at 174 Iowa 29-31, 156 N.W. 188; Davis v. Georgia-Pacific Corporation, Or., 445 P.2d 481; Harper and James on the Law of Torts, section 14.6, page 815; and Restatement, Torts, section 520.* [emphasis added]

And, as stated in Monroe v. Razor Construction Co., supra, loc. cit., 252 Iowa 1252, 110 N.W.2d 252: "Under this rule, negligence of the defendant need not be shown as an essential element of plaintiffs' recovery." See also Cronk v. Iowa Power & Light Co., 258 Iowa 603, 613, 138 N.W.2d 843.

***Consequently the user of explosives acts at his own peril and is liable if damage proximately results to another, either from the direct impact of debris thrown by the blasting, or from consequential concussions or vibrations**. In addition to authorities cited, supra, see Exner v. Sherman Power Const. Co., (2 Cir.) 54 F.2d 510, 512-513; Garden of the Gods Village v. Hellman, 133 Colo. 286, 294 P.2d 597, 600-601; Morse v. Hendry Corporation, Fla.App., 200 So.2d 816, 817; Berg v. Reaction Motors Div., 37 N.J. 396, 181 A.2d 487, 492-494; Davis v. Georgia-Pacific Corporation, supra, loc. cit., 445 P.2d 483; Bedell v. Goulter, 199 Or. 344, 261 P.2d 842, 845-846; and Annos. 20 A.L.R.2d 1372, 1377.* [emphasis added]

Blast Vibration Damage 3

From January 2007 through January 30, 2009, 104 complaints were filed against White Rock Mining in connection with noise and property damage from ground vibration caused by blasting quarry operations in South Florida, for which the quarry owner denied responsibility.[63]

In every case, the fire marshal visited the homes, took pictures of the damages, and interviewed the homeowners. Some described the noise as "very loud and frightening," and others said the house shook like an earthquake, with vibrations causing pictures to fall off the wall and dishes in the cabinets shaking.

The fire marshal inspector then verified the blasting schedules at the different blasting sites and found they had not exceeded the requirements established by Florida law.

In every case the result was "no violation…."

That White Rock is responsible for the blasting damage is further emphasized by the fact that when the blasting stopped, so did the claims for property damage.

Blast Vibration Damage 4

On June 25, 2007, the Town of Niagara, New York, served LaFarge with an injunction ordering it to "cease and desist operations" detrimental to residents of the nearby Tuscarora Village mobile home community.[64]

[63] Quarry blasting will cause severe damage - Shelby County Reporter | Shelby County Reporter, February 10, 2010.

[64] Forgione, Rick. "Town of Niagara: Town halts quarry blasts," *Niagara Gazette*, Jun 25, 2007, https://www.niagara-gazette.com/news/local_news/town-of-niagara-town-halts-quarry-blasts/article_c2fa654c-44f7-5e67-86a6-674269df72e4.html.

The order claims the quarry has violated town law by creating dust and other safety hazards harmful to nearby residents. In addition, the noise and vibrations from the blasting have hurt residents' quality of life and damaged portions of their homes, the order said. [emphasis added]

A resident of Tuscarora Village suffered a concussion and a lower back sprain Friday after falling in the shower while the quarry was blasting. She was treated at Mount St. Mary's Hospital and is now recovering at home.

[Town Supervisor] Richards was on site during that blast and immediately contacted Town Attorney Michael Risman to research possible action against LaFarge to halt future blastings.

"It crossed the line at that point," Richards said.

Tuscarora Village residents realized something was different at the quarry almost immediately Monday when everything was silent as they walked outside, said Sharon Ruth, who is among the residents who have opposed the blastings.

"We're glad that steps are being taken, but they're only temporary steps," she said, adding that residents still ask for what they've wanted all along. "We don't want to get hurt, we don't want to get sick and we don't want our houses caving in."

Bill Poole, general manager of the quarry, could not be reached for comment Monday afternoon [June 25, 2007]. He said Friday the quarry has taken steps to reduce the level of blasting, despite being within legal limits according to federal regulations.

Blast Vibration Damage 5

On November 18, 2013, a blast at Lafarge's Spyhill quarry in Calgary sent shockwaves that shook the homes of countless residents in the nearby communities.[65]

The Calgary Fire department says routine blasting at a gravel pit was the cause of a loud explosion that was felt by many in nearby communities on Monday afternoon.

Emergency operators were flooded with calls from people in the northwest reporting a loud boom and smoke in the sky at about 1:40 p.m.

As it turns out, Lafarge was conducting routine, permitted, blasting at its quarry on 85 Street N.W.

A spokesperson for Lafarge says the cold and dry conditions caused the noise and dust from the blast at its Spyhill site to carry further than normal.

Blast Vibration Damage 6

On November 5, 2013, a blast at a McCook quarry sent tremors that shook the western suburbs of the Village of La Grange, Illinois, which the quarry operator dismissed as a "routine blasting operation." Blasting at the quarry has been a rocky road for thousands of residents for more than a decade in dealing with the fallout from quarry blasting.

According to the Village of La Grange, the company denies its blast was out of the ordinary and behind the tremor that shook the western suburbs just after 12:35 p.m.

"Hanson Material Service quarry has stated that they were preforming routine blasting operations at 12:35 p.m. today and that the blast was consistent with their typical operations. The quarry reports that the recorded seismic readings related to the blast were below regulatory limits," according to a message posted on the village website.

[65] Schmidt, Colleen. "Blast rocks northwest neighbourhoods," *CTVNEWS*, November 18, 2013, https://calgary.ctvnews.ca/blast-rocks-northwest-neighbourhoods-1.1549013.

"Further, the quarry states that approximately seven seconds after the blast, a separate seismic event was recorded. Hanson is in the process of reviewing the seismic readings in order to better understand what may have occurred, but at this time they are denying any correlation between their blast and the seismic event."

The U.S. Geological Survey (USGS) says the magnitude of Monday afternoon's blast in the western suburbs registered at 3.2, down from an initial estimate of 3.7 earlier in the day.

Patch readers have shared comments about the blast, which caused "pictures to jump off walls," and entire houses to shake, according to commenters.

Here's what people had to say on the La Grange Patch Facebook page:

- ***Dawn** said she felt it downtown, near the train station. "We thought a truck hit the building in the alley, because that is a common occurrence."*
- ***Liliana** said, "My mom heard it and felt it at 50th and Ashland. She says she wouldn't be surprised if there are cracks in the walls of her house. Direct quote: 'It felt like the house shook right off of its foundation."*
- ***Monique** said, "We're real close to the quarry and felt a normal blast followed by the house levitating about 5 seconds later."*
- ***Jamie** said, "(It) Totally shook my house. Heard the blast. Felt the shake."*
- ***Sean** said, "Felt and heard it on Stone. Shook all the glassware in the cabinets."*
- ***Karen** said, "No way[,] it was the quarry... Oak Brook, downers Grove, Hinsdale all reporting it too."*
- ***Catrina** said, "Not understanding how they can deny that the blast wasn't out of the ordinary!?! The apparently "ordinary blast" was heard before the tremor that shook our home and literary made me jump just from the sound. Now I'm not used to earthquakes, but do they normally make an explosion noise first?"*
- ***Claudia** said, "The entire 300 block Leitch ave shook."*
- ***Karen** said, "Foundation shook, felt like a truck hit the house, LaGrange Country Club area!"*
- ***Tom** said, "Felt on Hillgrove"*
- ***Christine** said, "We felt it in La Grange, whole house shook for several seconds. 0-100 blk N Spring"*
- ***Bill** said, "Felt strong in LGP (wife) and Wheaton (me) for a sec."*
- ***Becky** said, "All the neighbors in 100 block S Catherine."*
- ***Melissa** Felt it in Brookfield."*

For thousands of residents in and around southwest suburban McCook, it has been a rocky road for more than a decade in dealing with the fallout from quarry blasting.[66]

Although some quarry operations have been there for a century-- using explosives to dislodge limestone-- the testy battle between community groups, companies and public officials is more recent and ongoing….

The I-Team obtained photos from one Countryside resident who says Monday's blast cracked walls and she thought her house was going to collapse. She and other residents who live around here say the concussion on Monday was the worst in years, although the ground shakes on a regular, sometimes daily, basis.

There was such damage to Joliet Road along the Vulcan Quarry in McCook that in 1998 state officials closed the roadway after determining it was unsafe for public use.

Three years ago --- without admitting any wrongdoing — Vulcan paid a $40 million settlement to the Illinois Department of Transportation. A repair project is now in its infancy-- with Joliet Road remaining closed-- and affecting motorists and rail traffic every day. [underscoring added]

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[66] "Recent quarry blast not the first to shake McCook," *abc30*, November 5, 2013, https://abc30.com/archive/9315049/.

Blast Vibration Damage 7

On April 25, 2017, a blast at the 54-acre Jefferson Quarry in Mankato, Minnesota, struck with such force that it was initially thought to be an earthquake. The quarry owner refused to accept financial responsibility for the widespread damage caused to the homes of 128 nearby residents,[67] despite evidence of flyrock debris. The quarry blast was amplified by atmospheric conditions to create the equivalent of a magnitude 2.8 earthquake, and was heard miles away.[68]

> ***A blast at a locally owned quarry here two months ago struck with surprising power. An earsplitting boom was followed by a violent trembling that shook homes and garages to their foundations, toppled lamps off tables and knocked one man over as he tended his backyard garden***. [emphasis added]
>
> *In the investigations that followed, a government scientist said the ground shook because of an explosion at the Jefferson Quarry. But the mining company said its own research found that an earthquake had struck the city seven seconds after it set off charges.*
>
> *The resulting standoff has left homeowners wondering who will pay for all the cracked plaster and other damage, and whether it will be months or even years before legal action can resolve who's at fault.*
>
> *"Nobody wants to take responsibility for anything," said Ann Helgeson, who bought her house adjacent to the quarry just weeks before the ground shook. She was home with her young son that day when the house started to shake from the cellar up.*
>
> *Now, the freshly painted walls are cracked and portions of the once-flat floor dip. Gaps can be seen where the living-room ceiling meets the wall. "We've got cracks upstairs everywhere," said her 6-year-old son, Gage.*
>
> *Helgeson's insurance company inspected the damage in early May and left her thinking that it would be covered. It wasn't until a letter arrived in the mail last week that she learned the company had determined the cracks were caused by natural settling and therefore were not insured. What's more, the company wrote, they were dropping her completely after noticing that a portion of her home's exterior had asbestos shingles, which they don't cover.*
>
> ***Left without other options, Helgeson said she's hoping someone from the city will step in to help her and some of the other 128 homeowners who reported damage***. [emphasis added]
>
> *"I myself have been saying the city should start a class-action lawsuit against [quarry owner Jordan Sands]. We need somebody impartial to come in," she said.*

Blast Vibration Damage 8

On May 13, 2015, a quarry blast, which prompted the city of Augusta, Maine, to file a lawsuit, caused damage to the homes of neighbouring residents.[69] As expected, the quarry operator denied responsibility for the damage.

> *Some residents near a quarry operation in a pit off West River Road that has been controversial with its neighbors say a May blast that prompted the city to file a lawsuit also caused cracks in the floors of their homes.*

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[67] McKinney, Matt., "Was Mankato boom a mine blast or an earthquake?", *Star Tribune*, July 2, 2017.
[68] https://www.duluthnewstribune.com/news/4256859-mankato-quarry-blast-rocks-city-feels-earthquake.
[69] Edwards, Keith., "Augusta quarry pit neighbors say blasting damaged Homes," *Kennebec Journal*, September 21, 2015, https://www.pressherald.com/2015/09/21/augusta-quarry-pit-neighbors-say-blasting-damaged-homes/.

A resident who lives about two-tenths of a mile north of the pit's entrance on West River Road and roughly 2,000 feet [610 metres] away from the pit itself says she believes the concrete floors and walls of the basement in her 8-year-old home were cracked by the May 13 blast, which she said felt and sounded like a bigger blast than other blasts at the pit owned by Steve McGee Construction.

Donna Bonenfant said gaps of roughly a quarter-inch opened up between several of the floor joists and the main support beam of the main floor of her home, visible from the basement, gaps which she said weren't there before the blast. What appear to be water stains are visible around some of the cracks in her basement walls.

"I don't know what to do about these. What if it leaks?" Bonenfant said, pointing to one of several cracks spread across parts of the concrete basement floor of her home. "I know to expect some cracks, but this many? ***A cement contractor looked at it and said there is no way all these cracks would come from just the house settling****."* [emphasis added]

Across the Kennebec River from the pit site, Riverside Drive resident John Liacos said he noticed hairline cracks in some of the ceramic floor tiles installed when his home's kitchen was redone in the spring of 2014, which he doesn't believe were there before the May blast. He said he's also discovered small cracks in the drywall of the kitchen ceiling.

Liacos acknowledged he's not sure of the date when he first noticed the cracks, but said a contractor who looked at the cracks said they had to have been caused by "something serious," and Liacos suspects it was the blast.

Bonenfant and Liacos both said they contacted the company that did the blasting, Maine Drilling and Blasting, to file claims for the damage. Both said their claims were rejected.

"We got a letter saying, sorry, we're not responsible for it," Liacos said. "If nobody is willing to admit it, what are you going to do? I want to be treated fairly. I was hoping to get some sort of resolution from Maine Drilling and Blasting."

Blast Vibration Damage 9

In *School District No. 162 et al. v. Grosshans & Petersen, Inc.*, the trial court found the quarry operator responsible for damages to the plaintiffs' properties caused by ground vibrations stemming from quarry blasting, a ruling upheld by the Supreme Court of Nebraska. The blasting activities which led to the vibration damage are described as follows:

Beginning about December 23, 1955, and at various times until April 27, 1956, defendant used dynamite to blast rock in the 603 quarry. The blasting was so done as to break the rock into pieces sufficiently small to go through a crusher so that the rock could be used in highway construction. Defendant often prepared as many as 48 holes for one explosion. These were drilled to depths of as much as 20 feet. Dynamite was placed in these holes to within 30 to 36 inches of the top. Dirt was then tamped in the holes to lessen any upward push of the explosion. The dynamite was so wired that it exploded in "delays" of 25/1000 of a second, and there were from two to four delays in each explosion. Beginning December 23, 1955, and ending April 27, 1956, defendant exploded dynamite 2 days in December, 9 days in January, 10 days in February, 21 days in March, and 11 days in April. On several days there were two and sometimes three and four explosions a day.

The age and condition of the schoolhouse prior to the quarry blasting operations, and the damage to the schoolhouse from the ground vibrations are described as follows:

The school building was built about 1920. It was of brick construction on a concrete foundation. There was no steel reinforcement. Sometime prior to 1954 a settlement crack appeared in the east wall. That was repaired in 1954. There is also evidence of some replastering that was done prior to that time. The building was inspected, repaired, and repainted in 1954.

During the months of the blasting large cracks appeared in the walls of the schoolhouse where the brick separated, and cracks appeared in the plaster on walls and ceiling and in the concrete tunnel in the basement. Bricks pulled away from joists at the top of the walls. The extent of these cracks need not be recited as the extent of the damage to the building is not an issue here. It is sufficient to point out that they appeared to a large extent in that part of the building that received the first impact of vibrations from the quarry.

The quarry is located about one-half mile (805 metres) from the schoolhouse and lay witnesses within a 2½ mile (4.02 kilometre)radius of the schoolhouse and other witnesses closer to the schoolhouse testified as to the damage caused by ground vibrations emanating from blasting operations at the quarry.

Plaintiffs offered evidence of lay witnesses living within a radius of 2½ miles of the schoolhouse, and other witnesses who were close to or in the schoolhouse when blasts occurred. These witnesses described the effects of explosion blasts at the quarry which they observed as "the house shook"; "vibration" was felt when a car was driven near the quarry; "barn vibrated"; the "house commenced to quiver and the windows rattled"; "dishes rattled in the cupboard"; an elevator building "shook," windows rattled, and "the bars on my scale * * * rattled"; "could feel the ground shake"; cans on the shelves of a store "shook" and the floor "shook"; china in a cabinet "shook"; large rocks were blown out and upon land of one of the witnesses; the blast "shook the earth"; a furnace rattled; in the school building the blast "shook us"; light fixtures swayed; and there was rattling of the windows and vibration in the schoolhouse. [emphasis added]

The above paragraph is not an all-inclusive statement of the evidence of what lay witness after witness testified as to what they saw and observed.

The testimony of the quarry operator's expert witness that "there is no direct evidence that explosions in the quarry caused the damage to the school building" was rejected in favour of the plaintiffs' expert, whose credentials and testimony were accepted by the trial court:

Plaintiffs' expert witness was examined and cross-examined extensively and often as to his qualifications. He was a graduate of the College of Engineering of the University of Nebraska; he worked for several years as a structural engineer designing power plant buildings; he worked with a consulting engineering firm doing structural design and cost estimates on schools, churches, dwelling houses, warehouses, and factory buildings; his work involved the structural soundness of masonry walls; in training and practice he had made a study of the various causes of structural failures in buildings in order to avoid their recurrence in buildings designed; he had had formal training in the effect of vibration on structures and in dealing with the loads which come or fall on structures caused by vibration; he had studied writings devoted solely to the subject 604 *of ground vibrations; in his practical experience he had noted the effect of forces upon buildings; he had read technical articles and books upon building failures; he had knowledge of the nature of the ground between the quarry and the schoolhouse; he had examined the exposed soil profile at the quarry and made a soil boring at the schoolhouse; and he explained the types of vibrations which occur in the soil when an explosion occurs.* ***He testified that in his opinion the damage was caused by a horizontal movement of the bearing walls; as to the effect of a repetition of vibrations, which singly might not cause a failure but if repeated eventually could do so; and that the appearance of the damage may be delayed***. [emphasis added]

The witness was permitted to testify as to the age, in his opinion, of the cracks in various parts of the building. His testimony in this regard was largely corroborative of the custodian's evidence. He gave as his reason the difference of color of the surface in contrast with the surface of the cracked area, the absence of dust or debris, etc. The witness was also permitted to testify that in his opinion the damage to plaintiffs' building (other than the settlement cracks which appeared earlier and

which no one claims were caused by defendant) was caused by a horizontal force which was vibration in the ground.

On cross-examination the witness testified that wind was not the cause of the failure and that the only other possible source of failure was a ground movement exerting force upon the building. He distinguished a settlement crack from the cracks here involved. He testified that the ground vibrations were the only possible cause of the cracks and other conditions that appeared in the building during and after the blasting operations of the defendant. [emphasis added]

In fixing the quantum of damages, items requiring repair which existed prior to the quarry operator's blasting operations were excluded from the trial court's award.

Plaintiffs' expert witness on damages excluded any items requiring repair which existed prior to the defendant's blasting operations. He fixed the fair and reasonable cost for the repairs, including architect's fee, at $53,900. Defendant's expert witness made like exclusions and fixed the reasonable cost of repairs at $23,100. Defendant here states that there is no evidence that repairs to preexisting damage were required in order to effect repairs to the damage claimed to have resulted from the blasting. The jury fixed the damages at $25,750.

Blast Vibration Damage 10

Residents in an upscale suburb of Masvingo, Zimbabwe, had their homes damaged by blasting at the nearby Chifen Quarry, which became operational in 2019.[70]

Scores of houses in Zimre Park, an upmarket suburb in Masvingo have allegedly been damaged by quarry blasts taking place on the outskirts of the city, a charged meeting of residents heard yesterday.

Zimre Park Residents Association is now demanding compensation from Chifen Engineering and Hardware for houses whose window panes were shattered, buildings walls and pillars that developed cracks and ceilings that collapsed as a result of the mining process.

The residents also want Chifen to immediately stop blasting at the mine until its operations are rectified and considered safe.

The worst blast took place on August 29, 2020 and lawyers representing residents and Chifen have exchanged letters on the issue.

One of the residents who declined to be named said that his child survived death when a ceiling that fell during the blast missed his head by a whisker. [emphasis added]

The meeting of stakeholders held at Chifen Quarry mining site along Harare Masvingo Highway yesterday [March 9, 2021] sought to resolve the issue. Residents complained that in addition to the damages, their houses shook heavily each time there is a blast at the quarry which is 3km from the suburb.

The meeting also attended by The Mirror brought together representatives of the association including the chairperson Farai Makunike, officials from the Ministry of Mines, a representative of Ward councillor Against Chiteme, Masvingo City Council officials and officials from the Environmental Management Authority.

Chifen was represented by the mine manager Ephraim Mutemachani, ***What irked residents is that Chifen management allegedly accepts responsibility for the damages during face to face meetings but refuses the same once the matter is reduced to writing.*** [emphasis added]

[70] Mandigora, Mike., "Quarry mine blasts damage Masvingo houses," *The Mirror*, March 10, 2021, https://masvingomirror.com/quarry-mine-blasts-damage-masvingo-houses/.

Chifen lawyers Mutendi, Mudisi and Shumba Legal Practitioners refused responsibility for the damages in a letter written to residents.

However, residents said the same company had already repaired councillor Against Chiteme's house in the same area that was damaged by the blasts.

The letter from the lawyers said that the damage to the houses could have been caused by vibrations from vehicles using Harare Masvingo Highway, swelling and shrinkage of building material or chemical changes in mortar, bricks and plaster.

Chifen however, said that they were bringing in blasting experts to look into the matter and ensure that their work will be safe….

"We are also doing an assessment on the damages and will only act when the results are out," said Mutemachani. [emphasis added]

Blast Vibration Damage 11

Despite evidence of extensive property damage from ground vibrations (clearly visible in the CBS 42 video) to homes in Alabama within a half-mile (805 metres), the nearby quarry owner, Vulcan, denies responsibility for the damage.

If you've ever experienced an earthquake, it's probably something you'll never forget. For neighbors in Tarrant who live within a half-mile of Vulcan Materials, that's how they described what it feels like when the company blasts every week.

…The company uses explosives at its quarry to make gravel, sending off shots about once or twice a week, sometimes more.

"If you're in the homes it feels like dynamite has went off at your house," Tarrant resident Emma Walters said.

The foundation of Walters' home is crumbling. She told CBS 42 she fears that it will cave in one day. Cracks along the front of her house send water flooding into her basement when it rains, and the inside is marked with splits along the walls.

"I know ***they have a right to make a living, but they don't have a right to destroy my home. My home is all I've got," she said. "My husband and I worked for years for that****."*…[emphasis added]

Despite falling within the proper legal limits, resident[s] are now giving their complaints to city officials. During the Tarrant City Council meeting last week, several residents shared stories of startling sounds, trembling homes and damages they believe were all the result of blasting.

*"****You all come to our neighborhoods, and you tear up and you tear up and you tear up, under the auspices of the guise of the government," said Tarrant Mayor Pro Tem Tracie Threadford. She explained blasting is even impacting her own home.*** [emphasis added]

Randy Jones, area operations manager at Vulcan Materials, was at the meeting, where he told neighbors while the blasts may cause loud sounds and homes to rattle, the vibrations are monitored and are not strong enough to cause damage.

Residents did not react well to that statement. Many were visibly upset, and soon after shared their stories. One woman even handed out photos showing her ceiling caved in, claiming it was from a blast. She said she now wants to sue….

Since that public hearing, Fleming reported several residents called with complaints, and Vulcan Materials had seismographs installed near their homes to monitor vibrations for future blasts. He added that has been their protocol all along, but there was an influx in phone calls since the

hearing. Several seismographs are already installed throughout nearby neighborhoods and monitored for every blast….[71]

We first told you about neighbors concerned about blasting damage in Tarrant last week.

Since then, ***CBS 42 has heard from more residents claiming the blasts from Vulcan Materials are causing their foundations to crumble and causing cracks all throughout their homes****.* [emphasis added]

Cynthia Hurd Threatt says the blasts caused her ceiling to cave-in twice.

*"****I heard this thud by the time I got to my bedroom and I came back and looked and my whole living room ceiling was raining sheetrock****," she told CBS 42.* [emphasis added]

The Alabama State Fire Marshall, who regulates blasting in the state, says he is aware of the growing concerns for residents living near Vulcan Materials. He says he spoke with the Tarrant Fire Department and as of now, they will handle the reports about damages locally.

An official with Vulcan Materials says, since a City of Tarrant public hearing last month about the blasting, they have received more phone calls from those living nearby and additional calls after CBS 42's Your Voice Your Station report.[72]

Blast Vibration Damage 12

A group of more than 200 homeowners filed a class action lawsuit against Rinker Materials and six other companies over the effects of blasting limestone in Northwest Miami-Dade County.[73]

The group is seeking $22 million in damages, claiming the blasting has badly damaged houses, cracking walls, foundations and swimming pools*.* [emphasis added]

*"****We have a right to live in our homes and enjoy peace and quiet without having them violently shaken. We want this to stop and to also get some compensation for our damages,****" said Michael Pizzi, president of Citizens Against Blasting and a Miami Lakes community council member.* [emphasis added]

David M. Wells, an attorney for Rinker Materials, said the Ocala-based company has been blasting in West Dade for 30 years and complies with Miami-Dade law. "We are completely confident that we have not caused any homeowners damages," he said. "We look forward to reading the lawsuit and hopefully sitting down with residents to do some talking."

He said there has always been blasting in the area and the problem is that more homes are being built closer to the blasting site.

The other companies named in the suit are Vecellio Realty Inc., WRQ Property Associates, Tarmac Florida Inc., Sunshine Rock Inc., Sawgrass Rock Quarry Inc. and Pelmad Corp. All are Florida-based and run operations in Northwest Dade.

Although two of the firms are not blasting companies, Gonzalo Dorta, an attorney for Citizens Against Blasting, said they are also liable.

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[71] Vincente, Chloe. "Can Blasting in Tarrant damage your home? Residents say yes, company says no," *CBS42*, April 30, 2021," https://www.cbs42.com/your-voice-your-station/can-blasting-in-tarrant-damage-your-home-residents-say-yes-company-says-no/.

[72] Vincente, Chloe. "More neighbors report blasting damage following CBS 42 investigation," *CBS42*, May 7, 2021, https://www.cbs42.com/your-voice-your-station/more-neighbors-report-blasting-damage-following-cbs-42-investigation/.

[73] Yee, Ivette M., "200 Residents File Suit Over Blasting," *MiamiHerald.com*, 200 Residents File Suit Over Blasting. | Dorta Law.

"Those companies either subcontracted the blasting companies or own the land and pulled the permits to blast," said Dorta. He noted that ***under Florida case law the companies are responsible for any negligence resulting from ultra-hazardous activities, including explosions***. [emphasis added]

Residents of the affected areas, which include Country Club of Miami, Palm Springs North, Miami Lakes and Hialeah Gardens, said blasting has continued unabated for the past two years. They said they have called county officials on numerous occasions to take action – all to no avail.

*"****There was this one humongous blast recently, three to four times stronger than all the others. It felt like the earth moved," said Nanette Maccari, who lives in Country Club of Miami. "I could hear my house creaking. My bookshelves came crashing down and the chairs in my house were wobbling from side to side. I felt dizzy and I burst into tears****."* [emphasis added]

Maccari showed a notebook in which, she said, she has logged the time, day and damage of each blast for the past year.

Some homeowners claim they've lost personal items as well.

"See here, this is a picture of my daughter when she was 6 years old. It was shattered because of a blast," said Yolanda Arroyo, a resident of Palm Springs North.

Pizzi said builders and real estate companies failed to notify some homeowners about the blasting. A Miami-Dade ordinance requires that prospective buyers be told if blasting is occurring within a two- mile radius of the home they contemplate buying. [emphasis added]

Blast Vibration Damage 13

On December 7, 2018 Goldston, North Carolina residents near the 220-acre Daurity Springs Quarry expressed their concerns after being subjected to the consequences of a quarry blast.[74] Goldston is a small town of 500 acres and one mile in diameter.

There was a terrible explosion that rattled and shook my house, sending me out the back porch, thinking Goldston was experiencing an earthquake. Once outside, I could see a cloud of dust just behind the tree line. (Marian Norton, Goldston Resident)

Goldston resident and Army veteran James Womack…spoke of the effect the blasting had on him.

"Later [last week], there was a single blast and I hit the deck," Womack said. "I was in artillery, when you hear the blasts, you hit the deck, and I got out of the army 50 years ago."

Residents repeated concerns about the possible damage to their homes and foundations as a result of the blasting.

The Daurity Spring Quarry is right behind Goldson resident Primrose Sutton's home.

"My whole house shakes," Sutton said. "My question is if I have house damage, who is going to be responsible to pay for that?"

Other residents voiced concerns about the quality of their well water due to the blasting and subsequent excavation at the quarry.

"I'm sure my water will be affected by this," Goldston resident Kenneth McIntosh said. "How am I protected with the well water that I have?"

Concerns were also raised about the stability of the town's water and sewer infrastructure which was installed less than five years ago because of the blasting….

[74] Mann, Casey. "Goldston neighbors speak out against quarry's nuisance," *Chatham News+Record*, January 3, 2019, https://www.chathamnewsrecord.com/stories/goldston-neighbors-speak-out-against-quarrys-nuisance,1299.

Goldston area property tax values spiked unrealistically with the last county re-evaluation. Our home is currently valued at over four times what we paid for it. Realistically, we probably won't get a return on our investment. Another older home on South Main Street recently sold for less than half of its appraised value (and that was before blasting began)[75]….[emphasis added]

We're going to have to adjust to a lifestyle of no peace and quiet, devalued properties, and dangers involved with nearby blasting of heavy truck traffic, increased noise, jarring blasts, dust and flying rock. My porch is no longer a haven, nor my yard a safe playground for the grandchildren. [emphasis added]

Blast Vibration Damage14

On December 5, 2019, vibrations from a blast at a quarry in Raleigh County, West Virginia, shook homes and caused damage to property in nearby neighbourhoods.[76]

A series of explosions that have rocked Maxwell Hill residents for two years are the result of blasting at a rock quarry on Sand Branch Road, Raleigh County Emergency Operations Center officials said Thursday [December 5, 2019].

Maxwell Hill resident Jim O'Dell, 79, said that he and his neighbor, Mary Peters, heard the blast at 4:07 p.m. on Thursday. ***He said that, for the past two years, he has heard loud blasts that tend to start at 4 p.m***. [emphasis added]

The blast on Thursday was bigger and shook his house.[emphasis added]

"I always thought, 'That's manmade,' " he said. "But today, it almost shook the roof off of my house.

"I've been living here for 47 years, and that's the heaviest blast I've ever felt."

Several more residents called The Register-Herald to report the blasts. One caller was from the Bluefield area of Mercer County….[emphasis added]

Officials reported that the EOC does not receive prior notification from Appalachian Aggregates on days that the blasts are planned.

They do receive calls from citizens, they reported….

Another EOC official reported that several citizens had called EOC Thursday to report the blasts, which is not uncommon when the company is blasting. [emphasis added]

O'Dell said Thursday evening that the Thursday blast was not considerate of area residents or property owners.

"Why are they shaking everybody's houses around here?" *O'Dell asked. "That's too big of a blast.* [emphasis added]

"It's bad enough to crack a concrete floor."

O'Dell suggested that The Register-Herald call Del. Mick Bates (D-Raleigh). Bates owns Bodyworks, a health club in Maxwell Hill.

"He doesn't want his chandeliers shook out of the ceiling," O'Dell added.

Bates said he also heard the blast.

"That was a pretty loud bang," Bates said. "I was doing other things.

"I didn't feel anything here, but the percussion was pretty intense.

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[75] https://www.chathamcountync.gov/home/showpublisheddocument/42504/636809132850100000.

[76] Farrish, Jessica. "Quarry blasts cracks neighbors' ceilings," *The Register-Herald*, Dec 5, 2019, https://www.register-herald.com/news/quarry-blast-cracks-neighbors-ceilings/article_4eecbd93-1963-588e-a213-dfb7bf6c9a6b.html.

"I didn't have any issues with power or equipment," he added.

O'Dell's wife said the couple's ceiling ***was cracked after the explosion***. [emphasis added]

Blast Vibration Damage 15

In November 2016, vibrations from a blast at the Sarawak quarry, Kemble, Ontario, then owned by Harold Sutherland, caused damage to the neighbouring Wilcox's home, for which they were inadequately compensated, and that terrified the family.[77]

We live at…Grey Road 1, Kemble….directly south of the proposed Sarawak Quarry Expansion. E lines of our property butt against this proposed expansion site.

We built our home in 2006. The quarry we were told at the time was 'dead' by our real estate agent, and as such we purchased the land and built our dream home. Over the years we have built a couple of structures on our property…We recently completed renovations to the inside of our home, upgrading our kitchen….and created a walk-out basement only a few years ago…. and spent several thousand dollars on concrete driveways and sidewalks….[emphasis added]

The expansion of this quarry means that trying to sell our property will become impossible because nobody will want to buy our house with quarry equipment stored in plain site [sic] of the house, as we currently have to view daily. Nobody will want to pay what our house is worth to look at this eyesore daily. Nobody will want to buy our house for fear the property (open field) to our north will become littered with more machinery, equipment, piles of things, trailers, rubble, rock, gravel, etc. And nobody will want to buy our house because of the constant noise experienced when these pieces of equipment and machinery come to and from this space. [emphasis added]

A blast occurred at the existing quarry in November 2016…That blast scared the living daylights out of my husband who was in the upstairs of our big garage when it went off, causing the drywall in the upstairs loft he was in to crack along most every seam. At the time this occurred, the Ministry, Township and County were all contacted by us, and we got the same story from everyone – that the blast was in acceptable limits. [emphasis added]

We call bull on that – because acceptable limits do not cause my husband to flee from his place out of fear, and it certainly would NOT cause damage to our property Harold Sutherland sent an inspector to view the damage, and we were paid by them $500 to fix the damage. Our quote was more than twice this amount. So not only did this blast cause damage, it also caused us financial setback, distress, worry and fear it will keep happening, only for use to be told 'it['s all acceptable'. [emphasis added]

Blast Vibration Damage 16

In a 2003 lawsuit against Vulcan Materials, 57 residents sought to be compensated for damages to their homes from vibrations caused by blasting at the 137-acre Bellwood Quarry in northwest Atlanta.[78]

Neighbors say blasting by quarry damages homes. Lawsuit by 57 residents calls for home repairs, end of detonations…

Mary Hollifield says she had to nail this painting to the wall to keep it from falling from the detonations at the nearby county-owned quarry. Officials of Vulcan Materials, which rents the quarry, deny their work causes damage.

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[77] https://pub-georgianbluffs.escribemeetings.com/filestream.ashx?DocumentId=1422.

[78] "Neighbors say blasting by Vulcan damages homes," *Aggregate Rsesearch.com*, May 9, 2003, https://www.aggregateresearch.com/news/neighbors-say-blasting-by-vulcan-damages-homes/.

Kitchen cabinets are coming loose from the walls, linoleum floors are sinking and ceilings are cracking. All this and more from dynamite blasts at the Bellwood Quarry in northwest Atlanta, say residents of the neighborhood next door. "I thought it was some kind of earthquake," said Anne Johnson, a 63-year-old part-time school crossing guard who lives in the adjacent Grove Park area. "I just want to be comfortable. That's all." Johnson and her husband, a retired cabdriver of 30 years, are still paying off their home on Francis Place that they bought for $8,500 in 1969….

The homeowners want Vulcan to stop blasting at Bellwood and to pay for damages to their homes….

The residents' lawsuit comes a month after state Insurance Commissioner John Oxendine said his office would examine the 1978 state code that governs commercial blasting to determine if it is too weak. The state decided to look into regulations after complaints from people who live near Hartsfield International Airport, where blasting has taken place to build a fifth runway. Residents there also want the blasting stopped….Residents are mostly low-income and predominantly black. Many residents are retired. "it's been traumatic," said Mary Hollifield, president of the Grove Park Neighborhood association and a retired teacher whose kitchen floor is sinking. "I like it here. I don't want to go anywhere else."…

The previous quarry renter, C.W. Matthews Contracting Co….sold that company's quarry rights to Vulcan in 1997. Before the sale, Matthews set aside $150,000 for a "residential neighborhood claim fund." The fund was "established for the payment of damages to any residence located adjacent" to the quarry. Residents found out about the money last year, when they sought help form Fulton County Commissioner Emma Darnell, who represents the area. The Grove Park Residents' lawyer, Cooper Knowles, said Darnell told the residents that a board would have to be appointed to decide if money was due….[emphasis added]

Neighborhood residents say the blasts are occurring less frequently – weekly rather than daily as was the case when Matthews mined the quarry. ***Still, residents say in their lawsuit, the blasting violently shakes homes, causing structural damage including, but not limited to, cracks and holes in walls, ceilings, beams and foundations, broken water and sewage pipes, and broken windows.,,,*** [emphasis added]

Residents of Grove Park said they didn't begin to realize that the blasting was so destructive until many of them grew older and retired, meaning they were home more during the day when blasting occurred. What they discovered are walls that rumble and pictures falling off the walls, they say*. "I wish they'd stop," said Dorothy Mayes, 72. "I'm too old. I don't want to sell.* [emphasis added]

Note: On June 30, [2006,] the city [Atlanta] bought Vulcan's interest in its long-term lease for $25 million and Fulton County's underlying fee interest for $15.2 million. The quarry occupies 137 acres….[and] will be converted into a new 300-acre park and greenspace…[79]

Blast Vibration Damage 17

In *Whitney v. Ralph Meyers Contracting Corporation*, 118 S.E.2d 622 (1961),[80] ground vibrations from blasting rock in connection with the construction of Highway 64, near Huntington, West Virginia, caused damage to the Whitneys' home, located 1,800 feet (549 metres) from the blasting operation. The Whitneys' house had been moved to its new location about January 15, 1959, and after reoccupying the house, "cracks began to appear in the basement walls and continued to increase in number and size until April 10, 1959, when the basement walls, or, at least, the larger part thereof, collapsed, permitting the

[79] https://www.atlantaga.gov/home/showpublisheddocument?id=1677.
[80] https://scholar.google.com/scholar_case?case=6394650802472535198&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cvibrations%E2%80%9D&hl=en&as_sdt=2006.

house to fall." [underscoring added] The appeal court of West Virginia upheld the damages awarded to the Whitneys by the trial court.

> *In the instant case, the facts detailed are sufficient to permit a jury to infer that the damages were the direct result of the blasting done by the defendant, by the vibrations through the earth occasioned by such blasting. Plaintiffs were not required to show that the damages to the basement walls were the result of any particular or isolated explosion, but only to establish facts that would fairly raise an inference as to the cause thereof.* ***That repeated vibrations of the earth, at or in the vicinity of plaintiffs' property, occasioned*** *625* ***by the blasting operations, occurred during times material, appears to be clearly established by the proof and, we believe, the evidence sufficiently establishes that the damage to the basement walls did not occur because of normal pressures or circumstances****. In Scranton v. L. G. De Felice & Son, Inc., 137 Conn. 580, 79 A.2d 600, 601, a case decided on facts very similar to the instant case, involving the question here being considered, the Court said: "* * * The finding that the blast in question was followed immediately by a marked and noticeable shaking of the plaintiff's buildings and that cracks then appeared in the exterior and interior plaster is ample under the circumstances to justify the conclusion that the cracks resulted from the blast."* [emphasis added]
>
> ***Several witnesses testified to the nature and severity of the vibrations resulting from the blasting operations of defendant, which reached plaintiffs' property and its vicinity, and of complaints made to defendant relating thereto****. No witness saw any crack or break in the basement walls appear simultaneous with experiencing any vibration.* [emphasis added]

Blast Vibration Damage 18

In *Aikman v. George Mills & Co. Ltd. et al.*,[81] the trial judge held that ground vibrations from blasting to deepen the Livingstone Channel in the Detroit River caused damage to the Aikman Residence in Amherstburg, Ontario, a ruling which was upheld on appeal. The Aikmans' residence, newly constructed in 1931, is located about 3,500 feet from the closest point at which work was commenced by George Mills & Co.in 1932. Both George Mills & Co. and the blaster (Arundel Corporation) were found strictly liable for the damage done by the escaping vibrations, pursuant to the principle of *Ryland v. Fletcher* (1868), L. R. 3 H.L. 330, and held jointly and severely responsible for the full amount of the damages awarded by the court to Aikman.

> *The first of the work in the channel with which we are concerned in this case was done by the defendants George Mills & Company on section B. The method followed on this section was spoken of as the "dry" method. Coffer-dams were built…around the part of the channel that was to be deepened, the area was dewatered, and the rock was blasted away to the required depth. The first blasting was done on December 17, 1932, and there was blasting on many later days in December; but the charges of explosion used were relatively small, and it was not until January 11, 1933, that any charge was used that, on the evidence, can reasonably be found to have been heavy enough to cause damage to the plaintiff's house. On January 11 there were two blasts in each of which more than 2,000 lbs [907 kilograms]. of dynamite were used; and from that time until August 2, blasts of that magnitude were of very frequent occurrence…. The heaviest seems to have been on July 18, when 5751 lbs [2,609 kilograms] were used. After August 2 there were only (relatively) light blasts on any part of the work until the Arundel Corporation began work in section C. on September 27. From that time until the end of October there was blasting in section C. almost daily, on some days several blasts, until the latter part of October; but the work on this section was done under water, the drills being operated from scows, and the area blasted, and consequently the quantity of dynamite used, in any one blast being less than in the "dry" work done in section B. On*

[81] *Aikman v. George Mills & Co. Ltd. et al.*, 1934 CanLII 99 (ON SC), <https://canlii.ca/t/g1g6g>, retrieved on 2021-08-24.

> *only three occasions was as much as 2,000 pounds [907 kilograms] of dynamite exploded at one time; but explosions of 1,500 or 1,600 pounds [726 kilograms] weight were frequent.*

Mr. Aikman described the extent of the damage to his home as follows:

> *…[I]n the summer he found some 200 cracks, of which seventeen were in the foundation where he had found two on his first examination and one was in the stone work; that in November there were twenty cracks in the stonework, and that all cracks had opened considerably; that he glued strips of paper across some of the cracks and a fortnight later found some six or eight of these strips broken. He says that on one occasion a crack appeared at the moment of a blast and that on another occasion some article was jolted from a shelf in the kitchen. Both he and the plaintiff swear to the trembling of the house at the time of blasts, and the plaintiff speaks of windows and dishes rattling.*

While the Aikmans' evidence of damage lacked some specificity, other homeowners in the area were able to corroborate the timing of various blasts and the impact to their homes.

> *Neither the plaintiff nor Mr. Aikman gives any very precise evidence as to the time of the appearance of the several signs of damage; but a witness, Mrs. Teeter, who lives in the neighbourhood and who, apparently, has in contemplation a claim for damage done to her house, had kept some notes and was able to tell of the rattling of the crystals of a lamp, almost at the moment of the explosion of a heavy charge of dynamite by George Mills & Company on April 20, and of the appearance of a crack in one of the walls of her house at the time of the firing of a much lighter blast (2,027 lbs.) [919 kilograms] on February 20; and Mrs. Wilson, who is not a claimant but is tenant of an old and solidly constructed building tells of much damage caused and of vibration at the time of blasts sufficient to shake articles from a table and a picture from its place; and other witnesses give evidence upon which it is perfectly certain that houses in Amherstburg were shaken by the blasts and were to a greater or less extent damaged.*

As to the cumulative effect of repeated blasting on the Aikmans' residence, the court had this to say:

> *The fact is, however, that what the plaintiff sues for is not the damage done to a wall by a certain blast, to a chimney by another, to the foundations by a third, and so on, but for the damage done to the house as a whole by the whole series of blasts, and that a finding that any part, or any definable part, of that damage was caused by the blasting done by the Arundel Corporation in section C. (where no very heavy charges were used;…) would be speculative in the extreme. Indeed, it is probably correct to describe the plaintiff's house in its present condition as a house the fabric of which has suffered from the cumulative effect of a series of shocks, rather than as a house in which there are many defects each of which is attributable to a shock.*

The judge was unimpressed by the evidence presented by the defendant's expert:

> ***The impression created by the evidence was that such investigation as there was superficial, and that there was too much reliance upon theoretical opinion****.* [emphasis added]

And, while it was possible that shrinkage could cause damage to the residence, the judge favoured the expert opinion of Mr. Allan, testifying on behalf of the homeowner, who found no indication of shrinkage.

> *…I have come to the conclusion that it is safe to adopt the opinion expressed by Mr. Allan when called in reply and cross- examined, to the effect that while it cannot be said that there was no shrinkage of timber, or no cracks caused by shrinkage, it can be said that more than half of the cracks are attributable to something other than shrinkage. Mr. Allan would not swear positively that*

it was impossible that 90 per cent. of the cracking had been caused by shrinkage; but he said that he could find no evidence of shrinkage, and, as has been stated, that he believed that the greater part of the cracking seen must be attributed to another cause. It cannot be found that there had been any settlement (or unusual settlement) of the house; and, as I have said, my conclusion is that the opinion that at least the greater part of the damage was caused by the blasting is well supported by the evidence.

Blast Vibration Damage 19

In *Phillips v. California Standard Company*,[82] damages were awarded to the farmer whose well water quantity and quality was damaged by vibrations 770 feet (235 metres) from the nearest hole where blasting had taken place. The well had been drilled in 1940 to a depth of 270 feet (82.3 metres), and produced "clear, odourless, drinkable water, pumping approximately 300 gallons (1,136 litres) per hour," and was in good condition prior to the blasting undertaken by the defendant on October 25, 1956.

There was evidence that on October 25, 1956, the plaintiff's mother-in-law was in the kitchen of the plaintiff's home having breakfast at about…8:00 a.m. when she heard a terrific explosion which jarred the house and dishes, and that her daughter felt there had been an earthquake. There were admittedly several explosions. At all events, at approximately 5:30 to 5:45 p.m. on October 25, 1956, the plaintiff visited the well. He heard a gurgling sound which he said sounded like air in the well, drew off some two pails of water which was highly discoloured and highly odiferous, smelling highly of sulphur and, as said by some of the witnesses, like a smell of rotten eggs. The odour and sedimentary pollution rendered it totally unfit for human or animal use.

The evidence is overwhelming and overpowering linking the plaintiff's loss with defendant's explosions, the vibrations of which would extend a mile deep and horizontally for some 2,400 feet [732 metres]. The strata injury from the shot or shots need not necessarily have occurred in the immediate vicinity of the well in question and may have occurred some distance from the same, but the shots undoubtedly did cause strata damage which affected the well's production. Obviously there was a strata injury beneath the plaintiff's farm, probably caused by the intensity of the seismic explosions and it is noteworthy that the quantity and quality deterioration in the plaintiff's well water commenced only after the explosions set off by the defendant. The production from the plaintiff's well was reduced almost to zero.

Blast Vibration Damage 20

Vibrations from blasts at a granite quarry is impacting Sungai Ara, Malaysia, a community of 8,000 people, and have caused roof tiles, walls and floors to crack, and in August 2021 flyrock debris hit the roof of a neighbouring house.[83]

GEORGE TOWN: A granite quarry has been causing sleepless nights for some 8,000 residents at a suburb in Sungai Ara, with explosions and tremors shaking their homes since early this year.

The residents, who moved in five years ago, were told that the quarry has been dormant and would soon make way for a bungalow project.

However, since February [2021], the digging and detonation work from the quarry site has caused roof tiles, walls and floors to crack*….*[emphasis added]

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[82] *Phillips v. California Standard Company*, 1960 CanLII 525 (AB QB), <https://canlii.ca/t/gcwlh>, retrieved on 2021-08-24.

[83] Namblar, Predeep. "Residents blast quarry activities in their backyard," *Free Malaysia Today*, August 24, 2021, https://www.freemalaysiatoday.com/category/nation/2021/08/24/residents-blast-quarry-activities-in-their-backyard/?__cf_chl_jschl_tk__=pmd_BDucwK0Lp2V__tFF1z_nxHqI6db8nyZDFF4FMyd8ziM-1630458943-0-gqNtZGzNAnujcnBszQiR.

Besides structural damage, there is dust and noise pollution. Lorries carrying materials to and from the quarry have also suffered mishaps – flipping over a hill and another crashing into a traffic light, residents told FMT. [emphasis added]

One resident, Askin Meera, 55, said the tremors from the quarry have become more frequent and more intense since February, after a rather quiet last five years.

He said the residents' associations of Setia Pearl Island, Setia Pulau Mutiara 3 and Stramax Residence had written to the chief minister for help last month after a two-year discussion with local representatives, a Penang official and the quarry operator fell through.

Askin said that under present environment department guidelines, a minimum 500m buffer was required between a quarry and any residential area. Their homes are less than 150m from the quarry. [emphasis added]

He said there were three landslips at the same hill site about four weeks ago near Persiaran Nuri.

"My house is less than 100m away from the quarry fencing. Last week, flying rocks from the quarry hit the roof of a neighbour's house.

"We didn't know a quarry existed there when we bought this place as it was dormant. We saw a signboard showing that the site would be developed for bungalows," he told FMT.

At a meeting, a Penang exco had told the residents that the quarry had been in existence since the 1990s and they were told to "live with them"….[emphasis added]

BY – LAW No. 22-__

The Corporation of the United Counties of Leeds and Grenville

A BY-LAW TO ADOPT AMENDMENT NO. 3 TO THE OFFICIAL PLAN FOR THE UNITED COUNTIES OF LEEDS AND GRENVILLE

WHEREAS on February 19, 2016, the Official Plan for the United Counties of Leeds and Grenville was approved by the Ministry of Municipal Affairs and Housing; and,

WHEREAS the Planning Act, R.S.O, 1990, c.P.13, as amended, in Sections 17 and 21 authorizes the United Counties of Leeds and Grenville to pass by-laws for the adoption of Official Plans and Official Plan Amendments; and,

WHEREAS Amendment No. 3 to the Official Plan for the United Counties of Leeds and Grenville is exempt from approval of the Minister of Municipal Affairs and Housing by Ontario Regulation 525/97, as amended, made pursuant to Section 17(9) of the Planning Act; and,

WHEREAS a public meeting was held regarding this amendment on December 14, 2021;

NOW THEREFORE THE COUNCIL OF THE CORPORATION OF THE UNITED COUNTIES OF LEEDS AND GRENVILLE HEREBY ENACTS AS FOLLOWS:

1. **THAT** Amendment No. 3 to the Official Plan for the United Counties of Leeds and Grenville, attached hereto as Schedule "A", is hereby adopted.

2. **THAT** the Manager of Planning Services is hereby authorized and directed to give Notice of Adoption of Amendment No. 3 to the Official Plan for the United Counties of Leeds and Grenville, in accordance with the requirements of the Planning Act.

3. **THAT** this By-law shall come into force and effect on the date of its final passing.

By-law read a first, second and third time and finally passed this XXth day of February 2022.

_____
Roger Haley, Warden

_____
Lesley Todd, Clerk

Schedule "A"

OFFICIAL PLAN AMENDMENT NO. 3
TO THE OFFICIAL PLAN
FOR THE UNITED COUNTIES OF LEEDS AND GRENVILLE

(Aggregate Resources)

Red – Denotes changes to current Official Plan Policy

Purple – Denotes changes to Official Plan Amendment following Public Notification

Bold Blue – Changes after Public Meeting

February 9, 2022

Amendment No. 3
to the Official Plan for the
United Counties of Leeds and Grenville
Table of Contents

INTRODUCTION

PART A - THE PREAMBLE

TITLE

PURPOSE AND EFFECT

LOCATION

BASIS

PART B - THE AMENDMENT

INTRODUCTION

DETAILS OF THE AMENDMENT

IMPLEMENTATION AND INTERPRETATION

SCHEDULE A

INTRODUCTION

The following Amendment to the Official Plan for the United Counties of Leeds and Grenville consists of two parts.

PART A - THE PREAMBLE consists of the purpose and effect, location and basis for the Amendment and does not constitute part of the actual Amendment.

PART B – THE AMENDMENT sets out the actual Amendment along with the specific policy changes to be made to the Official Plan for the United Counties of Leeds and Grenville.

PART A – THE PREAMBLE

TITLE

The title of the Amendment is "Official Plan Amendment No. 3 to the Official Plan for the United Counties of Leeds and Grenville", herein referred to as Amendment No. 3.

PURPOSE AND EFFECT

This is a Counties initiated Amendment to the Official Plan for the United Counties of Leeds and Grenville. The main purpose of this Amendment is to incorporate additional policies into the Official Plan on mineral aggregate resources and to amend Schedule 'B' to add information that identifies Selected Bedrock Resource Areas and which modifies the extent of Selected Sand and Gravel Areas of Primary, Secondary and Tertiary Significance.

LOCATION

Official Plan Amendment No. 3 includes policies and mapping that will apply to all lands in the United Counties of Leeds and Grenville.

BASIS

Official Plan Amendment No. 3 has three components. The first component involves the identification of Selected Bedrock Resource Areas on Schedule 'B' in the Official Plan. The second component involves the modification of the extent of the Selected Sand and Gravel Resource Areas of Primary, Secondary and Tertiary Significance. The third component involves the inclusion of additional policies on mineral aggregate resources in the Official Plan. Below is the rationale for these proposed changes.

Selected Bedrock Resource Area Mapping (Screening Tool)

The 2020 Provincial Policy Statement ('2020 PPS') requires that all Official Plans contain mapping that shows the location of known deposits of mineral aggregate resources.

In the case of the United Counties of Leeds and Grenville Official Plan (as approved by the Province on February 19, 2016), Schedule 'B' already identifies the location of Selected Sand and Gravel Resource Areas of Primary, Secondary and Tertiary Significance. However, Schedule 'B' does not include mapping showing the location of Selected Bedrock Resource Areas. At the time that the Official Plan was being prepared, a number of concerns were raised about the extent of bedrock resources in the Counties of Leeds and Grenville and its impacts on rural development. The United Counties of Leeds and Grenville was also faced with a compressed timeline to complete the Official Plan Review that did not allow for a comprehensive exercise to refine the delineation of bedrock resource areas.

On the basis of the above, the Official Plan for the United Counties of Leeds and Grenville was modified through the approval process to indicate that the Counties must complete an Aggregate Resources Master Plan ('ARMP') to address specific aggregate and bedrock issues within three years of approval of the Official Plan. In this regard, this Official Plan Amendment No. 3 is required to implement the ARMP.

Following the adoption of the Official Plan for the United Counties of Leeds and Grenville, the Province through the Ministry of Northern Development, Mines, Natural Resources and Forestry ('MNDMNRF') provided the United Counties of Leeds and Grenville with accurate and up to date information on the location of Selected Bedrock Resource Areas in the Counties, as mapped in the Aggregate Resources Inventory Paper 183 ('ARIP 183') and through annual updates completed by the MNDMNRF.

An updated Schedule 'B' to the Official Plan for the United Counties of Leeds and Grenville has been prepared showing Selected Bedrock Resource Areas that include a drift thickness of between 0 metres and 8 metres. Lands within settlement areas, Provincially significant wetlands and Provincially significant Areas of Natural and Scientific Interest were not included. In addition, lands within 500 metres of the boundary of a settlement area or major river or lake and within 120 metres from the edge of a Provincially significant wetland and Provincially significant Areas of Natural and Scientific Interest were also not included. Schedule 'A' to this Amendment includes the Selected Bedrock Resource Area that will be added to Schedule 'B' of the Official Plan for the United Counties of Leeds and Grenville.

As a consequence of the above, the outstanding concern about the accuracy of the mapping has been resolved. It should be noted that the identification of Selected Bedrock Resource Areas on Schedule 'B' is not intended to establish the principle of developing a mineral aggregate operation. In fact, an application to establish a mineral aggregate operation does not depend on the subject lands being identified a being the site of a resource in the first place. While the mapping shows where bedrock resource areas are, the mapping will be used primarily as a screening tool to trigger the potential need for an assessment of the impacts of an alternative land use on the feasibility of extracting the resource.

Selected Sand and Gravel Resource Areas Mapping (Screening Tool)

The extent of the Selected Sand and Gravel Resource Areas of Primary, Secondary and Tertiary Significance on Schedule 'B' is modified by this Amendment as they relate to settlement areas, rivers, lakes, Provincially significant wetlands and Provincially significant Areas of Natural and Scientific Interest in the same manner as described above as it relates to Selected Bedrock Resource Areas. Schedule 'A' to this Amendment includes the Selected Sand and Gravel resource Areas of Primary, Secondary and Tertiary Significance that will replace the existing Sand and Gravel Resource Areas shown on Schedule 'B' of the Official Plan for the United Counties of Leeds and Grenville.

Proposed Policy Changes

According to Schedule 'B', significant amounts of land are identified as being the site of Selected Bedrock Resource Areas in particular and concerns have been expressed about the implications of including so much land in this category on the potential for development of other forms of development in rural areas.

This is because once Selected Bedrock Resource Areas are identified on an Official Plan schedule, Section 2.5.2.5 of the 2020 PPS is then triggered. Section 2.5.2.5 is reproduced below:

In known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if: a) resource use would not be feasible; or

b) the proposed land use or development serves a greater long-term public interest; and c) issues of public health, public safety and environmental impact are addressed.

As set out in Section 2.5.2.5, an assessment of the impacts of proposed development on resource extraction is required to be carried out whenever development is proposed with development being defined as development requiring Planning Act approval.

It is noted that items a) and b) in Section 2.5.2.5 are separated by the word "or". This means that a case can be made that a proposed land use or development serves a greater long-term public interest than a proposed resource use even if it is determined that a resource use would be feasible. This means that the potential exists as part of the review of any application to make a determination on what use is in the greater long-term public interest to consider. In addition to the above, it is noted that one of the tests is *"The resource use would not be feasible."* In this regard, the presence of a resource is not in of itself a determinant of whether it is feasible to extract. There are a number of factors that need to be considered to determine feasibility and these are identified in this Amendment.

As noted above, Section 2.5.2.5 of the 2020 PPS is triggered when "development" as defined by the 2020 PPS and "activities" (which are not defined) are proposed. Given that "development" means a change in land use requiring a Planning Act approval, this section is triggered by an application to amend the Official Plan or Zoning By-law, and by an application for a Plan of Subdivision/Condominium, consent and minor variance.

On the basis of the above, applications to construct a dwelling or any other use on any property that is zoned to permit the use would not trigger Section 2.5.2.5 of the 2020 PPS since a Planning Act approval is not required. In addition, any application for development as per the Planning Act within the boundary of a settlement area would not trigger the application of Section 2.5.2.5 of the 2020 PPS.

Given the above, the purpose of this Amendment is to minimize the impact of Section 2.5.2.5 on future Planning Act approvals in the Agricultural Area and Rural Lands designations. In this regard, this Amendment will exempt the following types of development from requiring an assessment as per Section 2.5.2.5 of the 2020 PPS:

1. Any form of development within clusters of non-agricultural development outside of settlement areas will be exempted, with the determination of where such clusters are located to be made by the local municipalities, with some guidance provided by the Counties.
2. The development and/or expansion of an agricultural use, an agriculture-related use and/or an on-farm diversified use, whether it involves the development of buildings or structures or not is exempted, regardless of whether a Planning Act approval is required.
3. The following applications are also exempted:
    - The creation of a new lot for an agricultural use or an agriculture-related use;
    - The creation of a lot to accommodate an existing habitable farm dwelling that has become surplus to a farming operation;
    - The adjustment of a lot line for legal or technical reasons;
    - The re-zoning or land for the development or expansion of a commercial, industrial or recreational use in the Agricultural Area or Rural Lands designations provided an amendment to the local Official Plan is not required and provided the use does not include the establishment of dwelling units or accommodation units;
    - The expansion of a legal non-conforming use, provided such an expansion meets all of the other tests in the local Official Plan; and,
    - Any application for a site plan or minor variance, regardless of location.

In addition to the above, this Amendment adds policies into the Official Plan that establish assessment requirements and criteria to be considered by a local municipality in determining whether a study in accordance with Section 2.5.2.5 of the 2020 PPS is required to support an application for development that is not exempted.

In this regard, this Amendment adds policies that provide local municipalities with the ability to make professional judgements that have the effect of scoping and/or waiving any of the assessment requirements if the local municipality is satisfied that the information is not required or relevant to assess an application for development. If a study is in fact required, the Amendment requires a proponent to submit a mineral aggregate resources study completed by a qualified professional to demonstrate that the criteria has been satisfied.

A number of new policies are also included in the Amendment that address new and/or expanding mineral aggregate operations and they are intended to enhance existing policies in the Official Plan. The policies ensure the continued protection of mineral aggregate operations from development that would preclude or hinder their expansion and provide clarity for the continuation of existing mineral aggregate operations. A policy encouraging the co-location or grouping of recycling facilities has also been included in the Amendment.

PART B – THE AMENDMENT

INTRODUCTION

Part B – The Amendment, outlines the changes that constitute Amendment No. 3 to the Official Plan for the United Counties of Leeds and Grenville.

DETAILS OF THE AMENDMENT

The Official Plan for the United Counties of Leeds and Grenville is hereby amended as follows:

1. That Schedule "B", Mineral and Mineral Aggregate Resources, to the Official Plan is hereby amended by deleting the Sand and Gravel Resource Area (Primary), Sand and Gravel Resource Area (Secondary) and Sand and Gravel Resource Area (Tertiary) data and replacing it with the Selected Sand and Gravel Resource Area and Selected Bedrock Resource Area as shown on Schedule "A" to this Amendment and the constraints and buffers as follows:
    i. Lands within 500 metres of the boundary of a settlement area;
    ii. Lands within a Provincially significant wetland or within 120 metres of the boundary of a Provincially significant wetland;
    iii. Lands within a Provincially significant Area of Natural and Scientific Interest or within 120 metres of the boundary of a Provincially significant Area of Natural and Scientific Interest; and,
    iv. Lands within 500 metres of the boundary of lakes or rivers.

2. **That Schedule "B", be amended by adding the following note:**

    Lands within 300 metres of a Selected Sand and Gravel Resource Area and 500 metres of a Selected Bedrock Resource Area may also require an aggregate assessment. Refer to Section 3.5.2 of the Official Plan for the policies that apply to Mineral Aggregate Resources.

3. That the Preamble in Section 3.5.2, to the Official Plan, is hereby modified as follows:

Deposits of mineral aggregate resources, including primary, secondary and tertiary sand and gravel resources and bedrock resources, are identified by the Province in the Aggregate Resources Inventory of the United Counties of Leeds-Grenville, Southern Ontario, Paper 183 (2009). Selected Sand and Gravel Resource Areas, which includes ~~P~~primary, secondary and tertiary sand and gravel resources, and Selected Bedrock Resource Areas are identified as a Potential Development Constraint Overlay (Screening Map) on **Schedule B** of this Plan. ~~As the extent of the bedrock resource areas identified by the Province is expansive and covers the majority of the Counties, Counties Council has directed that bedrock resource areas as depicted in the Schedules of the local municipal Official Plans will represent a detailed interpretation of the boundaries of viable bedrock resource areas until such time that a Counties' Aggregate Resources Master Plan is prepared. A Counties' Aggregate Resources Master Plan will be carried out by the County in consultation with local municipalities, the Province and other agencies, and the public. Such a study shall be undertaken within 3 years of the approval of this Plan, and, subsequently, the product of that review shall result in an amendment to this Plan. A Counties' Aggregate Resources Master Plan will consider all available mapping, potential constraints to resource extraction, and the associated policy framework, which may identify the criteria that should be considered when an application is submitted.~~

4. That Section 3.5.2 a) of the Official Plan is hereby modified as follows:

In accordance with provincial policy and the policies of this Plan, viable *mineral aggregate resources* will be protected for long-term use. Selected Sand and Gravel Resource Areas, which include ~~P~~primary, secondary and tertiary sand and gravel resource areas, and Selected Bedrock Resource Areas are identified as a Potential Development Constraint Overlay (Screening Map) on **Schedule B**. ~~Bedrock resource areas will be identified in the local municipal Official Plans.~~ The identification of *deposits* of *mineral aggregate resources* on **Schedule B** and in the local municipal Official Plans does not presume that all lands located within these areas are suitable for the establishment of new or expansions to existing *mineral aggregate operations.*

Furthermore, the *deposits of mineral aggregate resources* identified on **Schedule B** and in the local municipal Official Plans are not intended to be reserved in totality for extraction of these resources over other potential land uses in these areas. The effect of the overlay is to establish a screening tool to trigger the potential need for an assessment of the impacts of an alternative land use on the feasibility of extracting the resource.

5. That Sections 3.5.2 c), d) and g) of the Official Plan are hereby deleted in their entirety.

6. That Section 3.5.2 e) of the Official Plan is hereby renumbered Section 3.5.2 c) and is modified as follows:

~~Until such time that an Aggregate Resources Master Plan has been prepared and implemented through an amendment to the Counties Official Plan, l~~Local municipalities in their local municipal Official Plans may adjust or make minor refinements to the extent of the Selected Bedrock Resource Areas and/or Selected ~~s~~Sand and ~~g~~Gravel ~~r~~Resource ~~a~~Areas ~~identified on Schedule B and the bedrock resource areas identified by the Province~~, in consultation with and to the satisfaction of the Counties in consultation with the Ministry of Northern Development, Mines, Natural Resources and Forestry ~~and the extent to which the policies associated with deposits of mineral aggregate resources apply within these areas~~, without an amendment to the Counties Official Plan. ~~Refinements or adjustments to the extent of the sand and gravel resource areas and the bedrock resource areas may be based on the consideration of the viability of the local resources, the location of *settlement areas* and existing development, the location of natural heritage features and areas, and setbacks from waterbodies, among other matters, and will be subject to provincial approval~~.

7. That Sections 3.5.2 f) and Section 3.5.2 h) of the Official Plan are hereby renumbered Sections 3.5.2 d) and 3.5.2 e).

8. That Section 3.5.2.1 of the Official Plan is hereby amended with the new title of 'New or Expanding Mineral Aggregate Operations'.

9. That Section 3.5.2.1 a) of the Official Plan is hereby amended as follows:

a) New *mineral aggregate ~~resource~~ operations* or any expansion to an existing *mineral aggregate ~~resource~~ operation* that extends beyond the licensed boundary ~~identified in the local municipal Official Plan will require an amendment to the local municipal Official Plan, and~~ will conform to the policies of this Plan and the local municipal Official Plan. An amendment to this Plan will not be required for new or expanding *mineral aggregate ~~resource~~ operations*. The local municipal Official Plan shall indicate if an Official Plan Amendment is required for new or expanding *mineral aggregate operations* in their municipality. The licensed boundaries of existing *mineral aggregate ~~resource~~ operations* are identified on **Schedule B** of this Plan, and their boundaries will be identified in the local municipal Official Plans. An amendment to this Plan will not be required to identify a new *mineral aggregate ~~resource~~ operation* or changes to existing boundaries. New *mineral aggregate ~~resource~~ operations* and changes to existing boundaries will be updated at the time of the review of the Counties Official Plan under Section 26 of the *Planning Act*.

10. That Section 3.5.2.1 b) of the Official Plan is hereby amended as follows:

b) In considering new *mineral aggregate ~~resource~~ operations* or any expansion to an existing *mineral aggregate ~~resource~~ operation*, the Counties and local municipality will be satisfied that prior to approval of a local municipal Official Plan amendment and/or zoning by-law amendment that the impacts are minimized with respect to the following:

i. Surrounding land uses and siting of extraction operations, including demonstrating compatibility with the rural character and landscape, including visual impacts;
ii. Surrounding sensitive uses through adequate buffering, screening, and other mitigation measures;

iii. Transportation *infrastructure*, particularly as it relates to County Roads and Provincial Highways;
iv. Social and community considerations;
v. Demonstration that the ~~final~~ rehabilitation plan is consistent with the policies of this Plan and the local municipal Official Plan; ~~and~~
vi. Requirements under the *Aggregate Resources Act*;~~.~~
~~vii. Hydrologic function of Provincially Significant Wetlands;~~
viii. On significant natural heritage features, including ~~ANSI, significant woodlands~~, locally significant wetlands, and other wetlands;
ix. On watercourses and fish habitat;
x. On species at risk habitat;
xi. Drinking water sources including municipal and private drinking water sources;
xii. The impact of noise,~~ odour,~~ dust**, fly rock** and vibration; and,
xiii. The impact of a mineral aggregate operation on agricultural resources cultural heritage resources and water resources.

11. That Section 3.5.2.1 of the Official Plan is hereby modified by deleting sub-section c) and re-numbering the remaining sections accordingly.

12. That Section 3.5.2.1 of the Official Plan is hereby modified by adding the policies below into new sub-sections f), g), h) and i), as follows:

f) Mineral aggregate operations shall be protected from development and activities that would preclude or hinder their expansion or continued use or which would be incompatible for reasons of public health, public safety or environmental impact.
g) Existing mineral aggregate operations that are licensed pursuant to the Aggregate Resources Act shall be permitted to continue without the need for official plan, zoning by-law or community planning permit amendment under the Planning Act. Where the Aggregate Resources Act applies, only processes under the Aggregate Resources Act shall address the depth of extraction of new or existing mineral aggregate operations. When a license for extraction or operation ceases to exist, Section 3.5.2 d) of this Plan continues to apply.

h) When considering a new mineral aggregate operation, the co-location or grouping of such facilities and recycling of materials and progressive rehabilitation should be encouraged by the Counties and/or local municipality to be addressed by the Provincial approval authority.

i) Extraction shall be undertaken in a manner which minimizes social, economic and environmental impacts.

13. That Section 3.5.2.3: Assessment Requirements for Development in a Mineral Aggregate Resource Area and Adjacent Lands is hereby introduced as a new section into the Official Plan as follows:

3.5.2.3 Assessment Requirements for Development in a Mineral Aggregate Resource Area and Adjacent Lands

a) **Schedule B** identifies deposits of mineral aggregate resources, including Selected Sand and Gravel Resource Areas and Selected Bedrock Resource Areas, throughout the Counties. However, the identification of these deposits on **Schedule B** does not necessarily mean that all areas identified are appropriate for the development of mineral aggregate operations, because of reasons such as natural heritage, land use compatibility, transportation, accessibility, quantity and/or hydrogeological constraints nor does it imply that the quality of the mineral aggregate resource at any given location is also suitable. The effect of the mapping is such that it acts as a screening tool for the purposes of this section of the Plan.

b) For the purposes of the policies in Section 3.5.2 d) of this Plan, adjacent lands means:

   i. Lands within 300 metres of Selected Sand and Gravel Resource Areas and 500 metres of Selected Bedrock Resource Areas within the boundary of the Potential Development Constraint Overlay (Screening Map) as identified on **Schedule B** of this Plan;

   ii. Lands within 300 metres of the licensed boundary of an existing pit and lands within 500 metres of the licensed boundary of an existing quarry and,

iii. Notwithstanding i. above, adjacent lands do not apply to:
    i. Lands within 500 metres of the boundary of a settlement area;
    ii. Lands within a Provincially significant wetland or within 120 metres of the boundary of a Provincially significant wetland;
    iii. Lands within a Provincially significant Area of Natural and Scientific Interest or within 120 metres of the boundary of a Provincially significant Area of Natural and Scientific Interest; and,
    iv. Lands within 500 metres of the boundary of lakes or rivers.

c) In cases where a proposed development is not exempt under Section 3.5.2.3 b) of this Plan or in accordance with Sections 3.5.2.4, 3.5.2.5 and 3.5.2.6, the local municipality may require studies to demonstrate that the proposed development will not preclude or hinder current or future extraction operations and/or access to the resources or in the alternative that resource use would not be feasible or alternatively that the proposed land use or development serves a greater long-term public interest and that issues of public health, public safety and environmental impact are addressed.

d) In addition to the above and in cases where a proposed development is not exempt under Section 3.5.2.3 b) of this Plan or in accordance with Sections 3.5.2.4, 3.5.2.5 and 3.5.2.6, the local municipality, may scope or waive any of the assessment requirements in Section 3.5.2.3 e) as a result of undertaking a desktop analysis of the available information against the criteria in Section 2.5.2.5 of the Provincial Policy Statement to justify that no further information is required to assess the proposed development, if the local municipality is satisfied that the information is not required or not relevant to assess an application for a proposed development on lands that have been identified as deposits of mineral aggregate resources or adjacent lands.

e) The following factors shall be considered by the local municipality, where relevant and appropriate, in determining whether an

assessment is required in support of an application for development on lands that have been identified as deposits of mineral aggregate resources in accordance with the applicable Aggregate Resource Inventory Paper for the Counties, and adjacent lands on Schedule B and the criteria to be considered in an assessment if it is determined to be required:

i. The nature and location of other aggregate and non-aggregate resource uses in the area and their potential impact on the feasibility of establishing a mineral aggregate operation on the subject lands and adjacent lands;
ii. The nature and location of the potential land uses in the area based on the land use policies in the local Official Plan and zoning bylaw particularly if the land uses have yet to be established;
iii. The nature of the current road network in the area, consideration of future roads being added to the road network in the area and the ability to potentially accommodate mineral aggregate operations in the future. It is recognized the provincial highway network is the main transportation route to markets;
iv. The configuration of the parcels of land in the area and whether the parcels are individually or collectively large enough and of a shape that would support mineral aggregate operations;
v. The depth of the overburden on the subject lands and on adjacent lands and whether the depth precludes the economical extraction of the mineral aggregate resource;
vi. The quality of the mineral aggregate resource on the subject lands and in the immediate area;
vii. The nature and potential impact of natural heritage features and areas in the immediate area on the potential for mineral aggregate operations in the area in the future;
viii. The nature and location of any sensitive surface water and ground water features in the area and its impact on mineral aggregate operations; and,

ix. The presence of significant built heritage resources, protected heritage properties, significant cultural heritage landscapes and significant archaeological resources on the subject lands or in the immediate area.

f) Where an assessment is determined to be required, proponents shall submit a mineral aggregate resources study completed by a qualified professional to demonstrate that the criteria of Section 3.5.2.3 e) have been met to the satisfaction of the local municipality. The Counties and/or the local municipality may look to the Province to provide information with respect to proposals affecting deposits of mineral aggregate resources. Aggregate resource testing and statements from local industry representatives may be recommended to better assess the viability of the resource.

g) In cases where the Counties is the approval authority, the Counties has the ability to request an assessment, the methodology and conclusions of which shall be to the satisfaction of the Counties. The Counties also has the ability to have the mineral aggregate resources study peer reviewed at the applicant's cost.

14. That Section 3.5.2.4: Exemption #1 to Section 3.5.2.3 – Clusters of Development in the Agricultural Area and Rural Lands Designations is hereby introduced as a new section into the Official Plan as follows:

3.5.2.4 Exemption #1 to Section 3.5.2.3 – Clusters of Development in the Agricultural Area and Rural Lands Designations

a) Any form of development within clusters of non-agricultural development outside of settlement areas is exempted from Section 3.5.2.3 of this Plan, with the determination of where such clusters are located to be made by the local municipalities on a site-specific basis based on policies contained in the municipal Official Plan.

b) Local municipal Official Plans shall contain policies that address clusters of development. Until such time, the policies contained in the Counties Official Plan shall provide guidance on the determination of a cluster of development, to be made on a site-specific basis.

c) Examples of clusters include 4 or more lots near the intersection of two roads (on one or more corners), 3 or more lots that are close together on the same side of the road or across from each other.
d) Factors to consider in making a determination on whether a cluster exists are below:
    i. For such a cluster to be a cluster, the residential and other non-agricultural uses in the cluster should be predominately located on smaller lots that do not exceed ~~1.0 to~~ 2.5 hectares in size.
    ii. If one or more uses inside the cluster were located on lots that have a considerable depth, only the portion of the lots in the cluster would be considered.
    iii. Vacant and potentially developable land within the cluster would be included in the cluster provided the residential and other non-agricultural uses are located close enough together.
    iv. Lands between the edge of a cluster and a nearby physical feature such as a watercourse can be included in the cluster as well.

15. That Section 3.5.2.5: Exemption #2 to Section 3.5.2.3 – Agricultural Development is hereby introduced as a new section into the Official Plan as follows:

3.5.2.5 Exemption #2 to Section 3.5.2.3 – Agricultural Development

The development and/or expansion of an agricultural use, an agriculture-related use and/or an on-farm diversified use, whether it involves the development of buildings or structures or not, is exempted from Section 3.5.2.3 of this Plan, regardless of whether a Planning Act approval is required.

16. That Section 3.5.2.6: Exemption #3 to Section 3.5.2.3 – Types of Planning Act Applications is hereby introduced as a new section into the Official Plan as follows:

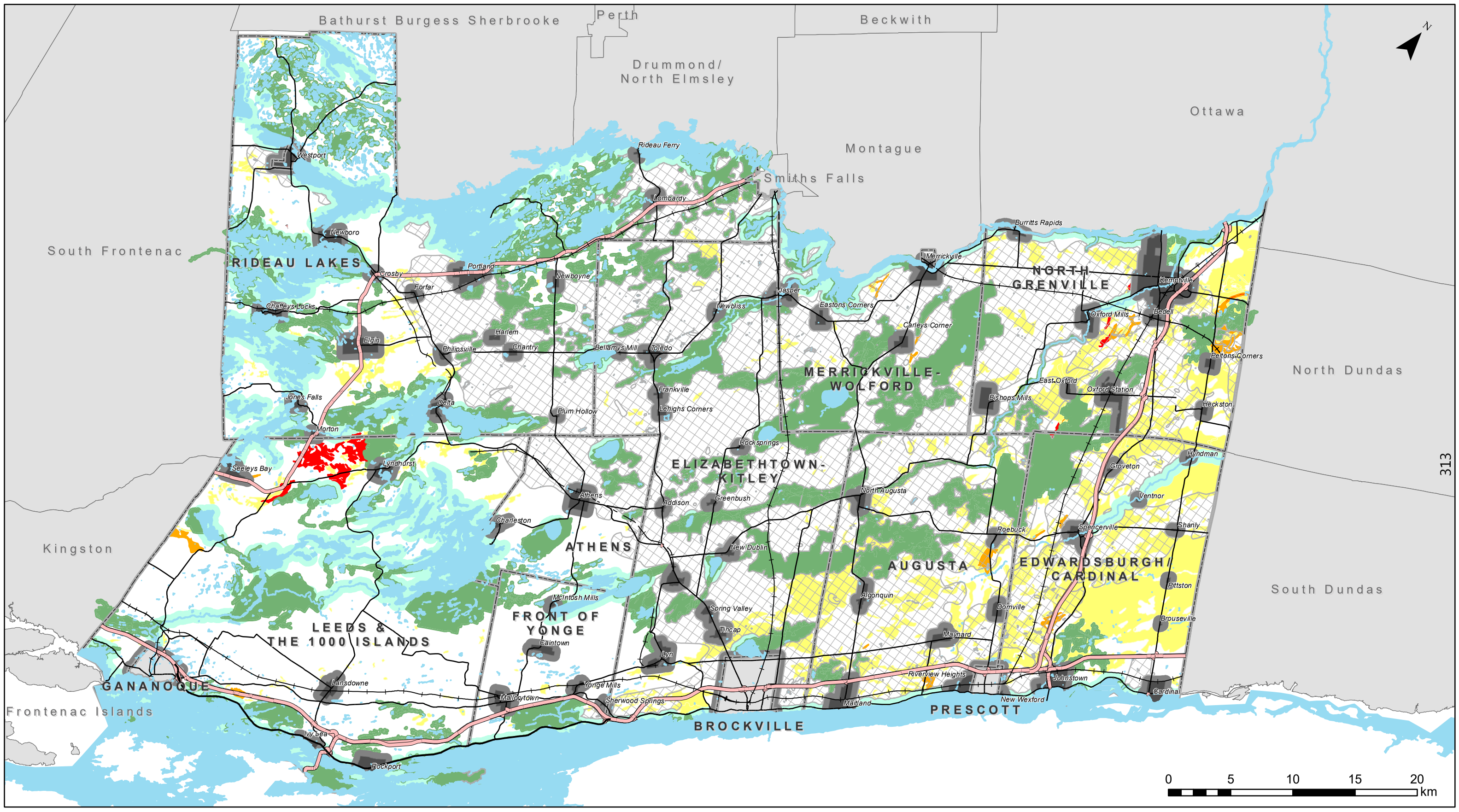
3.5.2.6 Exemption #3 to Section 3.5.2.3 – Types of Planning Act Applications

The following applications are exempted from Section 3.5.2.3 of this Plan:

a) The creation of a new lot for an agricultural use or an agriculture-related use;
b) The creation of a lot to accommodate an existing habitable farm dwelling that has become surplus to a farming operation;
c) The adjustment of a lot line for legal or technical reasons;
d) The re-zoning of land for the development or expansion of a commercial, industrial or recreational use in the Agricultural Area and Rural Lands designations provided an amendment to the local Official Plan is not required and provided the use does not include the establishment of dwelling units or accommodation units;
e) The expansion of a legal non-conforming use, provided such an expansion meets all of the other tests in the local Official Plan; and,
f) Any application for site plan or minor variance, regardless of location.

IMPLEMENTATION AND INTERPRETATION

The provisions of the Official Plan for the United Counties of Leeds and Grenville, as amended from time to time, shall apply in regard to this Amendment.



Schedule A to Official Plan Amendment No. 3 for the Counties of Leeds and Grenville

Resources

- Selected Bedrock Resource Area
- Selected Sand and Gravel Resource Area (Primary)
- Selected Sand and Gravel Resource Area (Secondary)
- Selected Sand and Gravel Resource Area (Tertiary)

Constraints and Buffers

- PSW/ANSI including 120 metre buffer
- Settlement Area
- Settlement Area 500m Buffer
- Lake/River
- Lake/River 500m Buffer

Lands within 300 metres of a Selected Sand and Gravel Resource Area and 500 metres of a Selected Bedrock Resource Area may also require an aggregate assessment. Refer to Section 3.5.2 of the Official Plan for the policies that apply to Mineral Aggregate Resources.

Source: Mineral Aggregate Resource Areas from ARIP 183, 187 and 189. Constraints from MNRF Land Information Ontario dataset as well as local and regional GIS datasets.
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Leeds Grenville

January 19, 2022



Aggregate Resources Master Plan
for the
United Counties of Leeds and Grenville

January 19, 2022

Draft



1. Introduction 4

2. Legislative and Policy Context 7
2.1 Planning Act 7
2.2 Provincial Policy Statement 8

3. Overview of ARIP 183 14
3.1 Selected Sand and Gravel Resource Areas 15
3.2 Selected Bedrock Resource Areas 16

4. Overview of the Counties Official Plan 21

5. Review of Local Official Plans 34
5.1 Township of Athens 35
5.2 Township of Augusta 40
5.3 Township of Edwardsburgh Cardinal 43
5.4 Township of Elizabethtown-Kitley 47
5.5 Township of Front of Yonge 48
5.6 Township of Leeds and the Thousand Islands 50
5.7 Village of Merrickville-Wolford 53
5.8 Municipality of North Grenville 56
5.9 Township of Rideau Lakes 57
5.10 Village of Westport 59
5.11 Summary of Mapping in the Local Official Plans 59

6. What We've Heard 62
6.1 Technical Steering Committee Meetings 62
6.2 Industry Stakeholder Meetings 63
6.3 Open House Meeting 64
6.4 Summary of Other Comments 65
6.5 Statutory Public Meeting 71

7. Proposed Mapping 76
7.1 Proposed Selected Bedrock Resource Area Map 76
7.2 Proposed Selected Sand and Gravel Resource Area Map 78

8. Official Plan Recommendations 79
8.1 Assessment Requirements 81
8.2 Assessment Exemptions 86

Draft



8.3 New or Expanding Mineral Aggregate Operations 87
8.4 Mapping (Screening Tool) 89

Appendix A: Bedrock Resource Constraints
Appendix B: Sand and Gravel Resource Constraints

Draft



1. INTRODUCTION

Aggregates are required for virtually all types of construction and infrastructure and according to the Ontario Aggregate Resources Corporation in 2020, *"the economic activity generated by the industry begins with the aggregate production itself but also feeds industries which receive and use the raw materials: including cement and concrete products, other aggregate-based products (asphalt, chemical, clay, glass, etc.) and construction."* In 2020, there were 3,601 licenses for pits and quarries on private lands in southern and central Ontario and 167 million tonnes of aggregate was extracted, which equates to about 14 tonnes per person in Ontario.

The establishment of new pits and quarries has long been a polarizing process in Ontario. While extraction is intended to be an interim use and aggregates are required for virtually all types of construction and infrastructure, opposition to almost every new pit or quarry is commonplace, even though there is a need for aggregates. In recognition of this need, Provincial land use policies are very supportive of aggregate extraction. However, the current application process for new or expanding resource uses in Ontario requires an investment of several years and significant resources for detailed technical studies, with most applications ending up at the Ontario Municipal Board (now the Ontario Land Tribunal ('OLT')).

The Planning Act identifies mineral aggregate resources as a matter of Provincial interest and requires that the Province and municipalities integrate consideration for such resources in land use planning decisions. The Provincial Policy Statement ('PPS') requires municipalities to identify and protect mineral aggregate resources in their respective Official Plans for long-term use.

The PPS defines deposits of mineral aggregate resources as follows:

Deposits of mineral aggregate resources: means an area of identified mineral resources, as delineated in Aggregate Resource Inventory Papers or comprehensive studies prepared using evaluation procedures established by the Province for surficial and bedrock resources, as amended from time to time, that has a sufficient quantity and quality to warrant present or future extraction.

The above means that municipalities are required to identify mineral aggregate resources on a map and include a policy framework that establishes what can happen on lands that contain mineral aggregate resources as well as on adjacent lands.

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On July 23, 2015, the United Counties of Leeds and Grenville ('UCLG') adopted its first Official Plan. The Ministry of Municipal Affairs and Housing ('MMAH') approved the Official Plan ('Counties OP'), with modifications, on February 19, 2016.

As part of the Official Plan review process a Background Report containing policy options, dated August 2014, was prepared. This Background Report included a Draft Schedule B1 – Mineral Aggregate Resource Areas, Constraints Areas and Waste Disposal Sites ('Draft Bedrock Schedule'). This Draft Bedrock Schedule included the locations of primary, secondary and tertiary sand and gravel resource areas as well as bedrock resource areas, among other layers. It is noted that at the time the Ministry of Natural Resources and Forestry ('MNRF') (now referred to as the Ministry of Northern Development, Mines, Natural Resources and Forestry ('MNDMNRF')) required that primary, secondary **and** tertiary sand and gravel resources be identified, given that there are only a small number of primary and secondary sand and gravel resource areas within the UCLG.

On the Draft Bedrock Schedule described above, bedrock resource areas were identified on approximately two thirds of the UCLG and it was the thinking at the time that this information was to be portrayed as an overlay in the Counties OP and not a land use designation. A number of concerns were raised during the Counties OP Review process about the extent of bedrock resources in the UCLG and concerns over minimizing the impacts of new or expanding mineral aggregate operations. In addition to this, the UCLG was faced with a compressed timeline to complete the Counties OP Review that did not allow for a comprehensive exercise to refine the delineation of bedrock resource areas. As a result, bedrock resource areas did not end up being identified on any schedule in the adopted Counties OP.

On the basis of the above, the Counties OP was modified through the approval process to indicate that the UCLG must complete an Aggregate Resources Master Plan ('ARMP') to address specific aggregate and bedrock issues within three years of the approval of the Counties OP. In this regard, an Official Plan Amendment is required to implement the ARMP once complete.

The development of an ARMP provides the UCLG with an opportunity to protect mineral aggregates for long-term use while being proactive on what the UCLG's expectations are in terms of where extraction is potentially anticipated to occur in the future and under what conditions. In addition, an opportunity exists for the UCLG to take the lead on policy approaches to minimize social, economic and environmental impacts that

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reflect UCLG objectives. In this regard, the Counties established a number of objectives for the ARMP and these included:

- Use existing data and mapping to review mineral aggregate resources, including bedrock resources, in the UCLG;
- Examine and identify viable mineral aggregate resource deposits for protection and extraction examining environmental, social and economic factors
- Identify and discuss potential constraints to extraction of mineral aggregate resources;
- Refine the identified mapping of mineral aggregate resources in areas of potential conflict and potential non-viable deposits, if needed; and,
- Review and update existing Counties OP policies for mineral aggregate resources, including bedrock resources, using current best practices. This review may also result in criteria that should be considered when an application is submitted.

The intent of the ARMP is to provide more certainty for the industry and the public when making property investment decisions, reduce conflict and the time and resources required to process individual applications.

There is also an opportunity to re-enforce a number of key policies in the Counties OP that have worked well for managing resource extraction. In addition to this is the opportunity to incorporate new policies that strike a balance between competing environmental, social and economic interests in order to ensure a high quality of life for current and future generations.

On the basis of the above, the purpose of this Aggregate Resources Master Plan is to provide:

- An overview of the applicable policies in the Planning Act, PPS and the current Counties OP framework;
- An overview of the Provincial Aggregate Resource Inventory Paper 183 that establishes the extent of sand and gravel and bedrock resources within the UCLG;
- An overview of the policy framework in the local Official Plans as it relates to mineral aggregate designation(s) and select relevant policies;
- A description of the proposed sand and gravel and bedrock mapping; and,
- A number of policy recommendations for the Counties OP that apply to sand and gravel and bedrock resource areas.

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2. LEGISLATIVE AND POLICY CONTEXT

2.1 Planning Act

The Planning Act establishes the basic framework for making land use planning decisions in Ontario. Section 1.1 of the Planning Act states that the purposes of the Act are:

a) *To promote sustainable economic development in a healthy natural environment within the policy and by the means provided under this Act*
b) *To provide for a land use planning system led by provincial policy*
c) *To integrate matters of provincial interest in provincial municipal planning decisions*
d) *To provide for planning processes that are fair by making them open, accessible, timely and efficient*
e) *To encourage co-operation and co-ordination among various interests*
f) *To recognize the decision-making authority and accountability of municipal councils in planning.*

Sub-section (a) above is intended to support sustainable economic development while providing for a healthy natural environment.

Sub-section (b) above clearly articulates the Provincial requirement that the 'land use planning system' in Ontario be 'led by Provincial policy'.

Subsection (c) builds upon sub-section (b) by indicating that matters of Provincial interest should be integrated into Provincial and municipal planning decisions.

Sub-section (d) provides for an open planning process while sub-section (e) encourages co-operation among various interests. This includes the Province, the UCLG, the local municipalities, landowners, industry and the broader public.

Lastly, sub-section (f) recognizes the decision-making authority and accountability of municipal councils in making planning decisions.

Section 2 of the Planning Act sets out the responsibilities of the Council of a municipality and the OLT. Sub-section (c) identifies mineral aggregates as a matter of Provincial interest, as follows:

The Minister, the council of a municipality, a local board, a planning board and the Tribunal, in carrying out their responsibilities under this Act, shall have regard to, among other matters, matters of provincial interest such as:

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(c) The conservation and management of natural resources and the mineral resource base;

Section 3(5)(a) of the Planning Act states the following:

A decision of the council of a municipality, a local board, a planning board, a minister of the Crown and a ministry, board, commission or agency of the government, including the Tribunal, in respect of the exercise of any authority that affects a planning matter, shall be consistent with the policy statements issued under subsection (1) that are in effect on the date of the decision.

On the basis of the above, land use planning decisions are required to be consistent with the PPS.

2.2 Provincial Policy Statement

The current PPS came into effect on May 1, 2020. The PPS provides policy direction to municipalities on matters of Provincial interest related to land use planning and development. Part IV of the PPS establishes the vision for Ontario's land use planning system and it clearly indicates that one of the keys to the long-term prosperity and social well-being of Ontario is a strong economy. Of particular relevance to the ARMP is the following section:

The Province's natural heritage resources, water resources, including the Great Lakes, agricultural resources, mineral resources, and cultural heritage and archaeological resources provide important environmental, economic and social benefits. The wise use and management of these resources over the long term is a key provincial interest. The Province must ensure that its resources are managed in a sustainable way to conserve biodiversity, protect essential ecological processes and public health and safety, provide for the production of food and fibre, minimize environmental and social impacts, provide for recreational opportunities and meet its long-term needs.

In this regard, there is an overall public interest in ensuring that sources of aggregate such as sand and gravel and bedrock are as close to market as possible to ensure costs are low and that there is competition in the marketplace. Given that it is the public that generally pays for infrastructure through taxation from one level of government or another, there is a clear public interest in ensuring that the cost to the general public of infrastructure is kept low when feasible and practical.

Section 2.5 of the PPS includes policies that address mineral aggregate and petroleum resources. Section 2.5.1 requires the long-term protection of mineral aggregate resources and it reads as follows:

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2.5.1 Mineral aggregate resources shall be protected for long-term use and, where provincial information is available deposits of mineral aggregate resources shall be identified.

As noted previously, the PPS defines deposits of mineral aggregate resources as follows:

Deposits of mineral aggregate resources: means an area of identified mineral resources, as delineated in Aggregate Resource Inventory Papers or comprehensive studies prepared using evaluation procedures established by the Province for surficial and bedrock resources, as amended from time to time, that has a sufficient quantity and quality to warrant present or future extraction.

On the basis of the above, the mapping contained within Aggregate Resource Inventory Paper 183 ('ARIP 183') identifies a number of Selected Bedrock Resource Areas and Select Sand and Gravel Resource Areas within the UCLG. In this regard, the above means that following the completion of the ARMP, the Counties OP will need to be amended to include a map of resources as shown in the ARIP 183.

There are two PPS policies in particular that have a significant impact on aggregate policy development and the review of applications since they require decision makers to consider how the Provincial interest in the *"conservation and management of natural resources and the mineral resource base (Sec. 2 of the Planning Act)"* will be balanced against other matters of Provincial interest that relate to the protection of ecological systems, the orderly development of safe and healthy communities and the appropriate location of growth and development, among others. These two policies are Sections 2.5.2.1 and 2.5.2.2, both of which are reproduced below:

Section 2.5.2.1 - As much of the mineral aggregate resources as is realistically possible shall be made available as close to markets as possible.

Demonstration of need for mineral aggregate resources, including any type of supply/demand analysis, shall not be required, notwithstanding the availability, designation or licensing for extraction of mineral aggregate resources locally or elsewhere.

Section 2.5.2.2 - Extraction shall be undertaken in a manner which minimizes social, economic and environmental impacts.

Section 2.5.2.1 recognizes that mineral aggregate resources are an integral component of the economy and that the transportation of this resource to market is

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cost sensitive. There is no definition of "realistically possible" in the PPS.

The use of word 'shall' in the context of this policy makes it clear that planning authorities must take this direction into account when making planning decisions. The second component of the policy makes it clear that the demonstration of need for mineral aggregate resources is not a factor in the development of resource strategies or in the consideration of individual applications, regardless of the municipality or location.

Section 2.5.2.2 of the PPS then acts as the 'control' over where new resource uses are to be located and is intended to ensure that the policy in Section 2.5.2.1 is balanced against the expressed desire to minimize impacts. In this regard, Section 2.5.2.2 provides the basis for the establishment of criteria to identify potential resource areas and to assess applications to establish resource uses. It is noted that the word 'shall' is also used in this section. This section also uses the word "minimize" with no definition of "*minimize*" provided in the PPS. As a result, the determination of whether extraction minimizes social, economic and environmental impacts is the most important consideration in making a decision on an application to establish a new resource use. It is also noted that the use of the word 'minimize' assumes and recognizes that some impacts will occur.

There are a number of other policies in the PPS that are directly or indirectly supportive of the mineral aggregate industry and the extraction of mineral aggregate resources, recognizing the important role that it plays in our economy and in the availability and efficient delivery of needed services and infrastructure. However, there are other policies that indicate that development and land use patterns which may cause environmental or public health and safety concerns should be avoided and that uses such as resource extraction activities and sensitive land uses are appropriately designed, buffered and/or separated from each other to prevent adverse effects.

The challenge in developing a policy framework relating to aggregates is determining how to apply the many polices in the PPS that potentially apply. For example, Section 2.1.4 indicates that development and site alteration shall not be permitted in certain natural heritage features. Section 2.2.2 indicates that development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions "*will be protected, improved or restored.*" Section 2.5.2.1 of the PPS then indicates that, as much of the mineral aggregate resources as is realistically possible shall be made available as close to markets as possible. It is then noted in Part



III of the PPS indicates that the PPS shall be read in its entirety and all relevant polices are to be applied to each situation. The use of the word 'shall' in each of these policies indicates that the policy is 'mandatory'.

All of the 'shalls' mentioned above will need to be balanced in developing an updated policy framework.

As noted earlier, one of the main purposes of the ARMP is to identify Selected Bedrock Resources on a map. During the preparation of the current Counties OP, there had been a number of concerns raised about the extent of land in this category and its impact on potential future development. This is because once the Selected Bedrock Resource Areas are identified in an Official Plan, Section 2.5.2.5 of the PPS is triggered. Section 2.5.2.5 of the PPS reads as follows:

In known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if: a) resource use would not be feasible; or b) the proposed land use or development serves a greater long-term public interest; and c) issues of public health, public safety and environmental impact are addressed.

As set out in Section 2.5.2.5 of the PPS, an assessment of the impacts of proposed development on the feasibility of resource extraction is required to be carried out whenever development is proposed with development being defined as development requiring a Planning Act approval. It is noted that items a) and b) in Section 2.5.2.5 are separated by the word "or".

This means that it could be considered that a proposed land use or development serves a greater long-term public interest than a proposed resource use even if it is determined that resource use would be feasible. This means that the potential exists as part of the review of any planning application to make a determination on what use is in the greater long-term public interest. In addition to the above, it is noted that one of the tests is: *"The resource use would not be feasible"*. In this regard, the presence of a resource is not in of itself a determinant of whether it is feasible to extract. There are a number of factors that need to be considered to determine feasibility and these will need to be considered in the policy framework of the future Counties OP Amendment.

The Province has not provided municipalities with a formal Terms of Reference for preparing the required assessment by Section 2.5.2.5 of the PPS. However, the Province has prepared a draft terms of

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reference for an aggregate study with the focus being on severances. This draft document is a locally developed consolidation of direction that draws upon the Ministry of Natural Resources Non-Renewable Training Manual (1997) and aggregate study components that have been used in the past.

The draft document clarifies when a development application triggers the completion of a study or studies and sets out the information required to assess the impact of a proposed development application. In this regard, the following types of information could be requested to assist a planning authority in determining the impact of a development application:

- Introduction (includes policy rationale, scope of work, site description, existing aggregate use analysis);
- Topography and drainage;
- Geological setting;
- Aggregate resource mapping;
- Site inspection results;
- MOE well record data review;
- Compatibility analysis;
- Constraint assessment;
- Mitigation studies; and,
- A number of figures such as general location plan, topography and drainage plan, aerial photography plan, physiography map, surficial geology map, aggregate resource area, site photographs, map of MOE well locations.

The above information is intended to provide the planning authority with the necessary information to make one of the following four decisions:

1. Determine that the development will not have any negative impact on the aggregate resource;
2. Determine that the development will have negative impact on the aggregate resource that can be overcome by appropriate modifications to the design or construction phases and/or the adoption of appropriate mitigation techniques;
3. Determine that the development will result in negative impacts to extraction that cannot be overcome by planning, design or construction changes; or
4. Determine there is still insufficient information to determine negative impacts.

While the provision of an official Terms of Reference by the Province would be helpful, it could only be construed as being generic at best since the nature of each development proposal in relation to the nature of the resource is potentially unique each time.

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This is because in addition to the nature of the development proposal, the arrangement, location and nature of other land uses in the area are all site-specific considerations. With respect to the bedrock resource itself, the nature of the resource is also potentially different each time with factors such as the quality of the resource, the type of the resource, limitations on the extraction of the resource for environmental or access reasons all being conceivably different each time as well.

As noted above, Section 2.5.2.5 of the PPS is triggered when 'development' as defined by the PPS and 'activities' (which is not defined) are proposed. Given that 'development' means a change in land use requiring a Planning Act approval, this section is triggered by an application to amend the Official Plan or zoning by-law, and by an application for Plan of Subdivision/Condominium, consent or minor variance. It is not triggered when the only approval required is for a building permit pursuant to the Ontario Building Code to build a new home on a vacant lot.

On the basis of the above, applications to construct a dwelling or any other use on any property that is zoned to permit the use would not trigger Section 2.5.2.5 of the PPS since a Planning Act approval is not required. In addition, any application for development as per the Planning Act within the boundary of a settlement area would not trigger the application of Section 2.5.2.5 of the PPS.

Given the above, the future Official Plan Amendment should include policies that aim to minimize the impact of Section 2.5.2.5 on future Planning Act approvals in the Agricultural Area and Rural Lands designations. Consideration should also be given to the types of development that should be exempt from completing an assessment as required by Section 2.5.2.5 of the PPS.

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3. OVERVIEW OF ARIP 183

The purpose of this section of the ARMP is to review the nature and location of mineral aggregates in the UCLG. It is noted that this section discusses information that is sourced primarily by the Ontario Geological Survey ('OGS') of the MNDMNRF.

The OGS is responsible for the Aggregate Resources Inventory Program ('ARIP'), the purpose of which is to provide the basic geological information required to include potential mineral aggregate resource areas in land-use planning strategies and decision-making processes. According to the MNDMNRF website, the OGS has existed for over 125 years.

In 2009, the OGS released ARIP 183 that includes an inventory and evaluation of sand and gravel and bedrock resources in the UCLG. It is noted in the ARIP 183 that overall production had remained close to 2 million tonnes per year between 1996 and 2005. According to The Ontario Aggregate Resources Corporation (TOARC), the 2020 Production Statistics Report indicates that production rates in the UCLG have been around 2 million tonnes per year between 2010 and 2020. The following table provides a summary of aggregate production in the UCLG between 2010 and 2020.

Year	Tonnage (million tonnes)
2010	2.6
2011	2.0
2012	2.2
2013	1.9
2014	2.2
2015	1.9
2016	2.0
2017	2.2
2018	2.1
2019	2.1
2020	2.0

The ARIP 183 also indicates that population and aggregate production trends over the last decade have been relatively stable and that this suggests that similar production rates may be expected for the foreseeable future. This suggestion from the ARIP 183 appears to be correct based on the production rates published in the TOARC production statistic reports.

With respect to the quantity of aggregate within the UCLG, ARIP 183 also noted that:

Reserves of sand and gravel are in very short supply within the county and it will be necessary to use crushed bedrock to meet the demand for most aggregate products.

With respect to the location of mineral aggregate deposits, the ARIP 183 indicates the following:

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Although mineral aggregate deposits are plentiful in Ontario, they are fixed-location, non-renewable resources that can be exploited only in those areas where they occur. Mineral aggregates are characterized by their high bulk and low unit value so that the economic value of a deposit is a function of its proximity to a market area as well as its quality and size. The potential for extractive development is usually greatest in areas where land use competition is extreme. For these reasons the availability of adequate resources for future development is now being threatened in many areas, especially urban areas where demand is the greatest.

The ARIP 183 then indicates that:

The report is a technical background document based for the most part on geological information and interpretation. It has been designed as a component of the total planning process and should be used in conjunction with other planning considerations, to ensure the best use of an area's resources.

The ARIP 183 identifies selected resource areas in the UCLG that represent areas in which a major resource is known to exist. Below is an overview of the Selected Sand and Gravel Resource Areas and the Selected Bedrock Resource Areas as detailed in the ARIP 183.

3.1 Selected Sand and Gravel Resource Areas

At the time that the ARIP 183 was prepared, there were 83 licensed sand and gravel pits operating in the UCLG. According to the MNDMNRF Pits and Quarries Online database (ontario.ca/page/find-pits-and-quarries), there are currently 74 pits in operation that comprise a licensed area of 1,629.21 hectares.

In the UCLG, the ARIP 183 identifies eight Selected Sand and Gravel Resource Areas at the primary significance level, which occupy a total area of 799 hectares. The ARIP 183 indicates that once licensed resources are removed and cultural, environmental and other land use constraints are considered, there are an estimated 707 hectares that remain for possible resource extraction. The ARIP 183 indicates that this land area is estimated to include approximately 106.3 million tonnes of sand and gravel. The ARIP 183 does not indicate the area of land that is included as secondary and tertiary resource areas.

As discussed further in **Section 7.1** of this ARMP, the proposed sand and gravel resource mapping is based on the mapping included in the ARIP 183 as well as additional land area that has been identified as resource area from annual updates that have been completed by the MNDMNRF.

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The proposed sand and gravel resource area mapping includes area calculations based on data from the MNDMNRF. In this regard, there is 1,266 hectares of primary sand and gravel resource, 1,664 hectares of secondary sand and gravel resource and 48,497 hectares of tertiary and gravel resource. It is noted that these area calculations do not take into account the pre-emptive constraints as discussed in **Section 7.1** of this ARMP.

Map 1 in the ARIP 183 provides an inventory and evaluation of Selected Sand and Gravel Resource Areas in the UCLG. The ARIP 183 indicates the following with respect to this map:

Each area of primary significance is coloured red on Map 1 and identified by a deposit number that corresponds to numbers in Table 3. … Selected Sand and Gravel Resource Areas of primary significance are not permanent, single land units. They represent areas in which a major resource is known to exist and may be reserved wholly or partially for extractive development and/or resource protection. In many of the recently approved municipal Official Plans, all or portions of resources of primary significance, and in some cases resources of secondary significance, are identified and protected.

Deposits of secondary significance are coloured orange on Map 1. Such deposits are believed to contain significant amounts of sand and gravel. Although deposits of secondary significance are not considered to be the "best" resources in the report area, they may contain large quantities of sand and gravel and should be considered as part of the overall aggregate supply of the area.

Deposits of tertiary significance are coloured yellow on Map 1. They are not considered to be important resource areas because of their low available resources or because of possible difficulties in extraction. Such areas may be useful for local needs or extraction under a wayside permit, but are unlikely to support large-scale development.

Map 1: Sand and Gravel Resources for the United Counties of Leeds-Grenville, as shown in the ARIP 183, is included at the end of this section of the ARMP.

3.2 Selected Bedrock Resource Areas

At the time that the ARIP 183 was prepared, there were 37 licensed quarries that comprise an area of 1,390 hectares. According to the MNDMNRF Pits and Quarries Online database (ontario.ca/page/find-pits-and-quarries), there are currently 28 aggregate quarries in

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operation that comprise a licensed area of 917.81 hectares.

It was further noted in the ARIP 183 that the majority of the quarries were producing bedrock-derived crushed stone for use in the road building and construction industries. The Selected Bedrock Resource Areas identified in the ARIP 183 are those that are covered by less than 8 metres of overburden, which is a depth that is generally assumed to be the maximum amount of overburden that can be removed while still producing viable product. These areas occupy a possible resource area of 179,156 hectares in the UCLG and have a possible aggregate resource of 71,188 million tonnes.

As discussed further in **Section 7.1** of this ARMP, the proposed bedrock resource area mapping is based on the mapping included in the ARIP 183 as well as additional land area that has been identified as resource area from annual updates that have been completed by the MNDMNRF. In this regard, the proposed bedrock mapping includes area calculations based on data from the MNDMNRF and there is approximately 176,103 hectares of bedrock resource area within the UCLG. It is noted that this area calculation does not take into account the pre-emptive constraints as discussed in **Section 7.1** of this ARMP.

The ARIP 183 identifies 7 Selected Bedrock Resources Areas and these areas are restricted to a single level of significance (unlike the Selected Sand and Gravel Resource Areas). The ARIP 183 provides the following reasoning for this difference as follows:

First, the quality and quantity variations within a specific geological formation are gradual. Second, the areal extent of a given quarry operation is much smaller than that of a sand and gravel pit producing an equivalent tonnage of material, and third since crushed bedrock has a higher unit value than sand and gravel, longer haul distances can be considered.

The ARIP 183 states the following with respect to the type of geology that exists within the UCLG:

The study area is underlain by Precambrian rocks, the Cambro–Ordovician Potsdam Group, and the Ordovician March, Oxford and Gull River formations. The central and eastern portion of the study area is part of the Ottawa–St. Lawrence Lowlands, a large basin lying between the Canadian Shield to the north and west and the Adirondack Mountains to the south. The western boundary of this basin is the Frontenac Axis, which trends southeast through the Thousand Islands area and underlies the western part of the county. The eastern extent of the basin is at the Beauharnois

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Anticline near the junction of the Ottawa and St. Lawrence rivers.

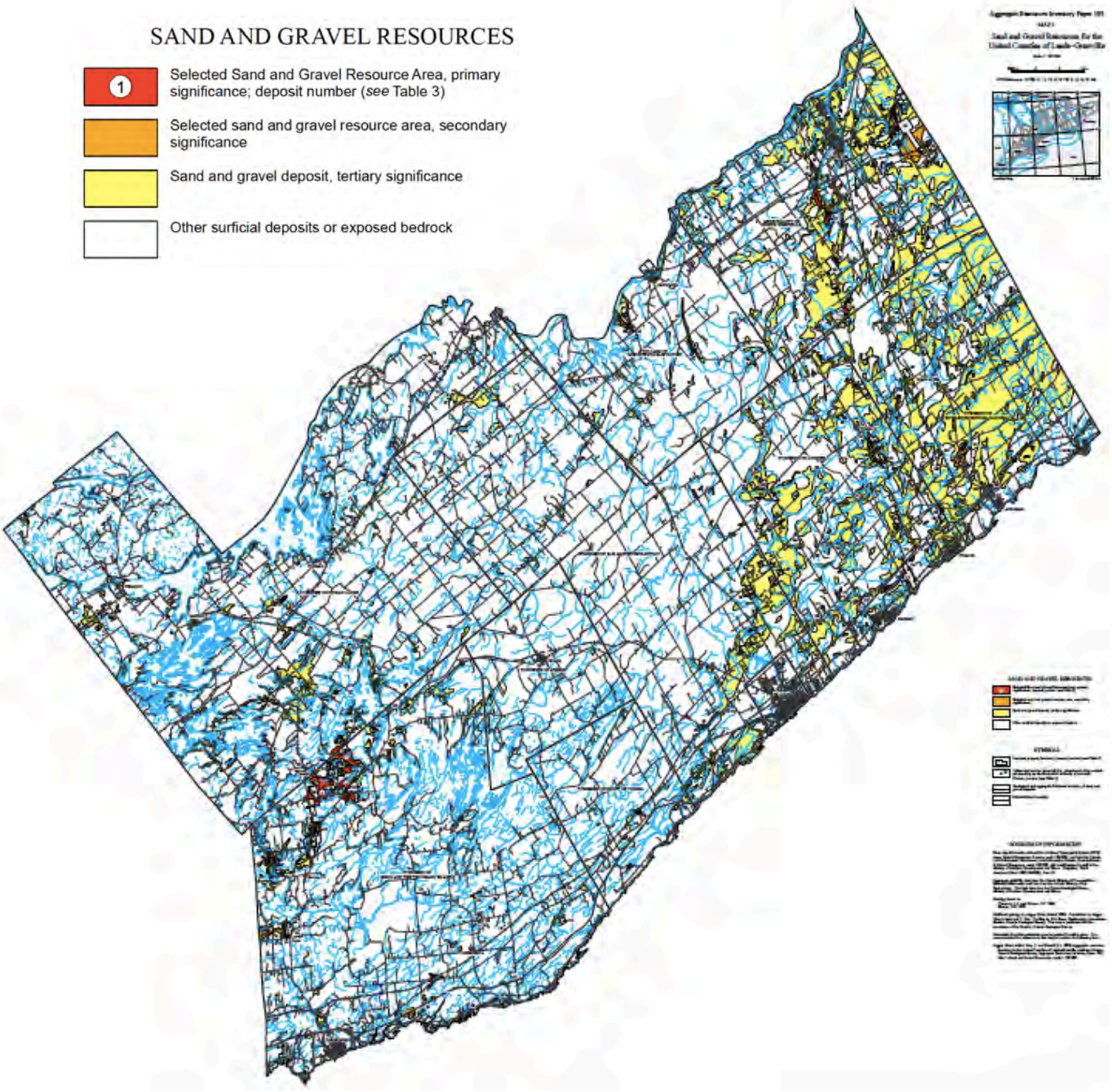
Map 2 in the ARIP 183 identifies Bedrock Resource Areas and it shows the distribution of bedrock formations and thicknesses of overlying unconsolidated sediments. The ARIP 183 indicates the following with respect to this map:

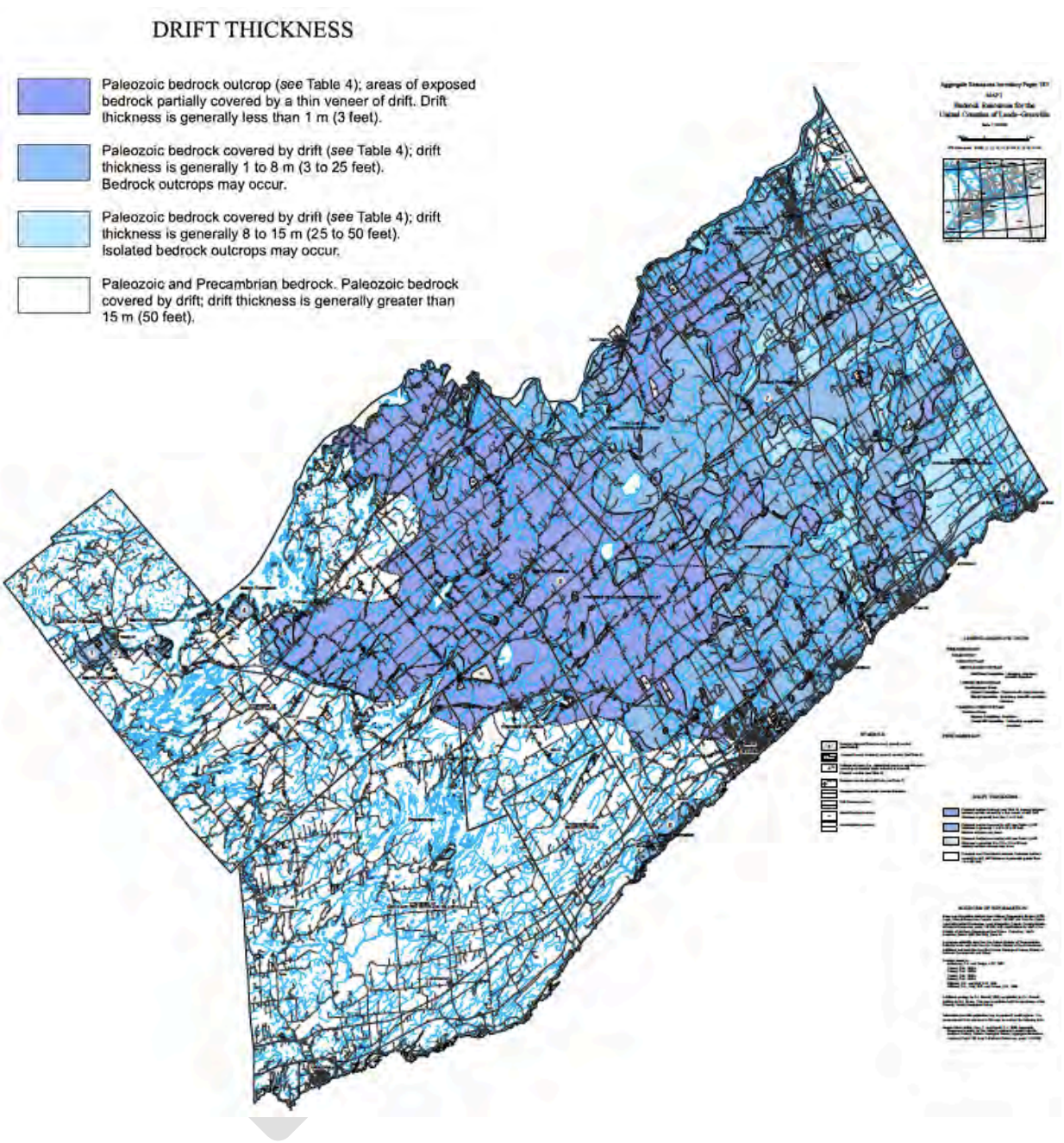
The darkest shade of blue indicates where bedrock crops out or is within 1 m of ground surface. These areas constitute potential resource areas because of their easy access. The medium shade of blue indicates areas where drift cover is up to 8 m thick. Quarrying is possible in this depth of overburden and these zones also represent potential resource areas. The lightest shade of blue indicates bedrock areas overlain by 8 to 15 m of overburden.

Map 2: Bedrock Resources for the United Counties of Leeds-Grenville, from the ARIP 183, is included at the end of this section of the ARMP.

In addition to the above, the ARIP 183 further notes that: *Selected Bedrock Resource Areas shown on Map 2 are not permanent, single land use units. They represent areas in which a major bedrock resource is known to exist and may be reserved wholly or partially for extractive development and/or protection, within an Official Plan.*

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SAND AND GRAVEL RESOURCES
1
Selected Sand and Gravel Resource Area, primary significance; deposit number (see Table 3)
Selected sand and gravel resource area, secondary significance
Sand and gravel deposit, tertiary significance
Other surficial deposits or exposed bedrock


DRIFT THICKNESS
Paleozoic bedrock outcrop (see Table 4); areas of exposed bedrock partially covered by a thin veneer of drift. Drift thickness is generally less than 1 m (3 feet).
Paleozoic bedrock covered by drift (see Table 4); drift thickness is generally 1 to 8 m (3 to 25 feet). Bedrock outcrops may occur.
Paleozoic bedrock covered by drift (see Table 4); drift thickness is generally 8 to 15 m (25 to 50 feet). Isolated bedrock outcrops may occur.
Paleozoic and Precambrian bedrock. Paleozoic bedrock covered by drift; drift thickness is generally greater than 15 m (50 feet).



4. OVERVIEW OF THE COUNTIES OFFICIAL PLAN

The UCLG Official Plan ('Counties OP') provides policy direction on matters of County-wide significance, such as mineral aggregate resources, and it is intended to provide policy direction to the 10 local municipalities that comprise the UCLG. The purpose of this section of the ARMP is to identify and discuss the Counties OP policies that currently apply to mineral aggregate resources.

The Counties OP includes a number of strategic directions to guide planning within the UCLG. With respect to mineral aggregates, Section 1.1.5.4 of the Counties OP includes the following strategic direction:

Protect mineral, mineral aggregates, and petroleum resources for their long-term use in a manner that is socially and environmentally responsible.

Section 2.6 of the Counties OP includes policies that apply to economic development. It is noted within the preamble of this section that that the extraction and management of aggregate resources is an important industry in the UCLG that employs a large percentage of its working population.

In addition to this, Section 2.6 f) reads as follows:

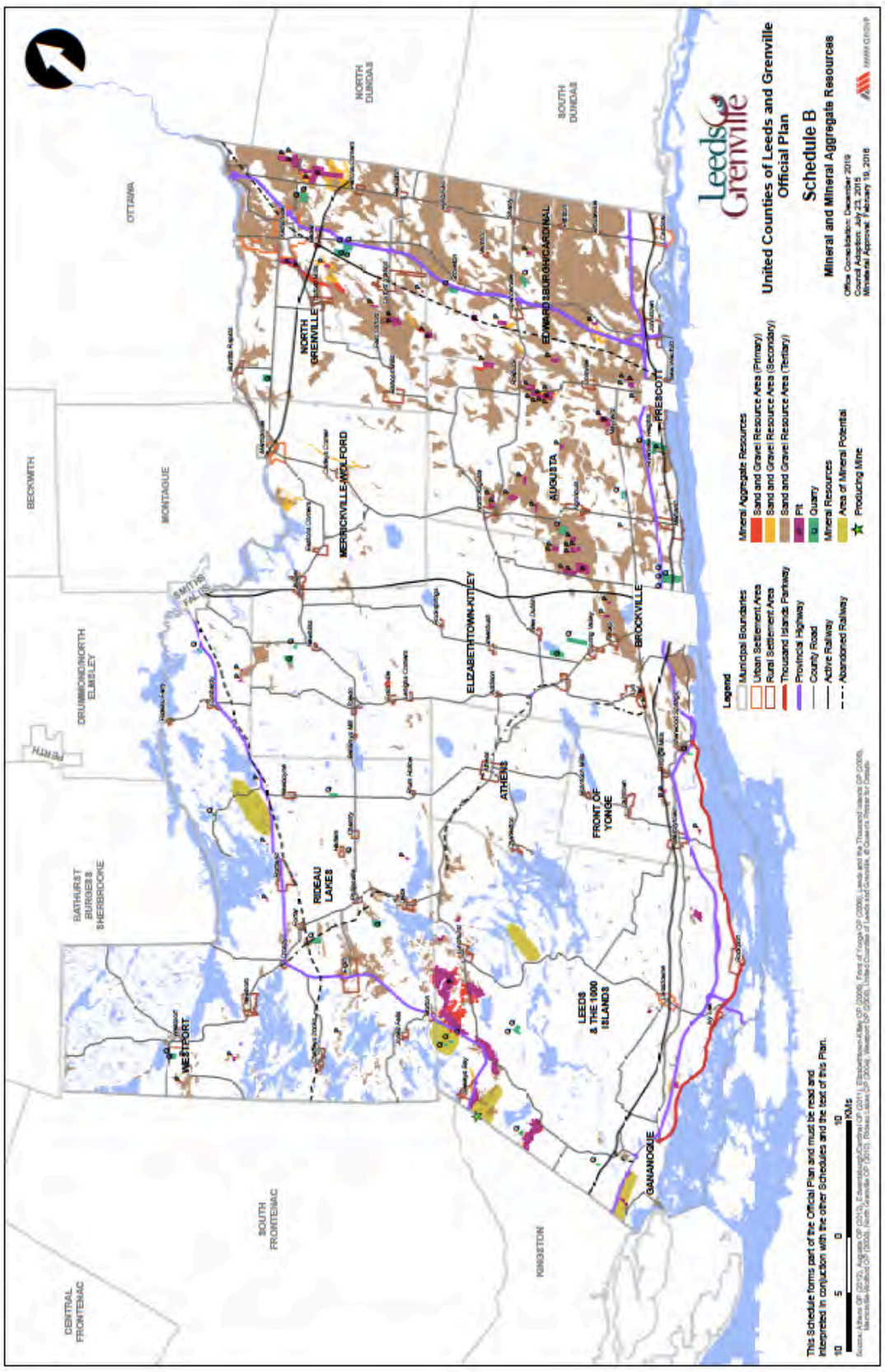
It is a policy of the United Counties of Leeds and Grenville to:

f) Support the long-term protection and appropriate management of minerals, mineral aggregate resources, and petroleum resources in accordance with Section 3.5 of this Plan.

Schedule B to the Counties OP includes a map of mineral aggregate resources within the UCLG. This map identifies primary, secondary and tertiary sand and gravel resources as identified in the ARIP 183. As noted previously in this ARMP, bedrock resources are not currently identified on a map in the Counties OP.

Schedule B from the Counties OP is shown on the next page and it identifies primary resource areas in red, secondary resource areas in yellow and tertiary resources in brown. In addition, the letter 'P' identifies pits and the letter 'Q' identifies quarries.

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Leeds Grenville
United Counties of Leeds and Grenville
Official Plan
Schedule B
Mineral and Mineral Aggregate Resources
Legend
Municipal Boundaries
Urban Settlement Area
Rural Settlement Area
Thousand Islands Parkway
Provincial Highway
County Road
Active Railway
Abandoned Railway
Mineral Aggregate Resources
Sand and Gravel Resource Area (Primary)
Sand and Gravel Resource Area (Secondary)
Sand and Gravel Resource Area (Tertiary)
Pit
Quarry
Mineral Resources
Area of Mineral Potential
Producing Mine
This Schedule forms part of the Official Plan and must be read and interpreted in conjuction with the other Schedules and the text of this Plan.
10 5 0 10 KMs
OTTAWA
BECKWITH
MONTAGUE
NORTH DUNDAS
SOUTH DUNDAS
DRUMMOND/NORTH ELMSLEY
PERTH
SMITHS FALLS
BATHURST BURGESS SHERBROOKE
RIDEAU LAKES
NORTH GRENVILLE
MERRICKVILLE-WOLFORD
ELIZABETHTOWN-KITLEY
ATHENS
FRONT OF YONGE
LEEDS & THE 1000 ISLANDS
WESTPORT
GANANOQUE
AUGUSTA
EDWARDSBURGH/CARDINAL
PRESCOTT
BROCKVILLE
SOUTH FRONTENAC
KINGSTON
CENTRAL FRONTENAC



As shown on the previous page, primary sand and gravel resources appear to be concentrated in the northern portion of the Township of Leeds and the Thousand Islands, between Morton and Lyndhurst, as well as in North Grenville near Oxford Mills. Secondary and tertiary sand and gravel resources are generally located in the eastern portion of the UCLG, which also corresponds to the majority of pits that are currently in operation in the UCLG.

Below is a review of the existing policies within the Counties OP that address mineral aggregate resources. There are a number of policies in the Counties OP that will need to be updated following the completion of the ARMP and these have been identified below as well. **Section 8** to this ARMP includes a set of proposed Official Plan policy recommendations that provide further guidance on how the policies could be amended following the completion of the ARMP.

Section 3.5 of the Counties OP includes policies that apply to mineral, mineral aggregate and petroleum resources. Section 3.5.1 of the Counties OP includes a number of policy objectives that apply to mineral aggregates and it reads as follows:

The Counties objectives related to the management of minerals, mineral aggregate resources and petroleum resources include:

a) Protect deposits of mineral aggregate resources and areas of potential mineral aggregate resources for potential future extraction.
b) Recognize existing pits and quarries, and protect them from activities that would preclude or hinder their continued use or expansion.
c) The development of new pits and quarries, and petroleum exploration.
d) Provide a framework for mineral aggregate operations such that they are carried out in a manner that minimizes potential negative, social, economic and environmental impacts.
e) Provide for the progressive rehabilitation of pits and quarries to an appropriate after use.

On the basis of the above, the objective policies above implement the PPS and no changes to this section would be required to implement the ARMP.

Section 3.5.2 of the Counties OP includes policies that apply to mineral aggregate resources. The Counties OP includes the same definition of mineral aggregate resources as contained in the PPS (which is the same that was previously used in the 2014 PPS) and it is defined as follows:

Mineral Aggregate Resources: means gravel, sand, clay, earth, shale, stone, limestone,

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dolostone, sandstone, marble, granite, rock or other material prescribed under the Aggregate Resources Act suitable for construction, industrial, manufacturing and maintenance purposes but does not include metallic ores, asbestos, graphite, kyanite, mica, nepheline syenite, salt, talc, wollastonite, mine tailings or other materials present under the Mining Act. (Source: PPS, 2020)

As noted above, this definition is the same as the one contained within the PPS and would not require any update following the completion of the ARMP.

The introductory paragraph in Section 3.5.2 of the Counties OP indicates that Schedule B of the Counties OP identifies primary, secondary and tertiary sand and gravel resources to the same extent as the mapping contained in the ARIP 183. However, bedrock resources are not contained on any schedule in the Counties OP. In this regard, the introductory paragraph to Section 3.5.2 of the Counties OP also states that:

…As the extent of the bedrock resource areas identified by the Province is expansive and covers the majority of the counties, Counties Council has directed that bedrock resource areas as depicted in the Schedules of the local municipal Official Plans will represent a detailed interpretation of the boundaries of viable bedrock resources areas until such time that a Counties' Aggregate Resource Master Plan is prepared. A Counties' Aggregate Resources Master Plan will be carried out by the County in consultation with local municipalities, the Province and other agencies, and the public. Such a study shall be undertaken within 3 years of the approval of this Plan, and, subsequently the product of that review shall result in an amendment to this Plan. A Counties' Aggregate Resources Master Plan will consider all available mapping, potential constraints to resource extraction, and the associated policy framework, which may identify the criteria that should be considered when an application is submitted.

On the basis of the above, the preamble for Section 3.5.2 indicates that extraction of viable mineral aggregate resources will be undertaken in a manner that minimizes social, economic and environmental impacts. There is also an explanation of what is considered as a deposit of mineral aggregate resource and reference to the ARIP 183.

Lastly, there is a description of the decision made by the UCLG Council to complete an Aggregate Resource Master Plan and the Counties OP further indicates that the bedrock resources as shown on maps in the local Official Plans represents the boundaries of bedrock resources until the UCLG completes its ARMP. This means that following the completion of an ARMP, the

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Counties OP will need to be amended to include a map of bedrock resource areas and associated policies as well as an update the preamble to remove references to the completion of the ARMP.

Below is an overview of the remaining subsections in Section 3.5.2 of the Counties OP.

Section 3.5.2 a) of the Counties OP states:

It is the policy of the United Counties of Leeds and Grenville that:

a) In accordance with provincial policy and the policies of this Plan, viable mineral aggregate resources will be protected for long-term use. Primary, secondary and tertiary sand and gravel resource areas are identified on Schedule B. Bedrock resource areas will be identified in the local municipal Official Plans. The identification of deposits of mineral aggregate resources on Schedule B and in the local municipal Official Plans does not presume that all lands located within these areas are suitable for the establishment of new or expansions to existing mineral aggregate operations. Furthermore, the deposits of mineral aggregate resources identified on Schedule B and in the local municipal Official Plans are not intended to be reserved in totality for extraction of these resources over other potential land uses in these areas.

As noted in Sub-section a) above, mineral aggregate resources are to be protected for long-term use. The Counties OP identifies primary, secondary and tertiary sand and gravel resource areas on a schedule, while directing local Official Plans to delineate bedrock resource areas in their respective Official Plans. This means that following the completion of the ARMP, Section 3.5.2 a) of the Counties OP will need to be updated.

Sub-section a) above also clarifies that not all areas are suitable for the establishment of extraction of mineral aggregates and are not meant to be reserved in totality for extraction. This means that other uses may be permitted on lands that are within mineral aggregate resource areas.

Section 3.5.2 b) of the Counties OP reads as follows:

b) It is recognized that there is potential for viable deposits of mineral aggregate resources to exist outside of the areas identified on Schedule B and in the local municipal Official Plans. The extraction of viable mineral aggregate resources may be permitted outside of the potential mineral aggregate resource areas identified on Schedule B and in the local municipal Official Plans where there is a sufficient quantity and quality of viable mineral aggregate resources to warrant extraction, as determined on a case-by-case basis.

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Sub-section b) above recognizes that there may be other viable mineral aggregate resources beyond those that are identified in either the Counties OP or a local Official Plan. This means that an application, with comprehensive supporting studies, can be made on lands that are outside of identified resource areas. On the basis of the above, Section 3.5.2 b) should be retained in the Counties OP.

Section 3.5.2 c) of the Counties OP reads as follows:

c) The Counties will undertake the preparation of an Aggregate Resources Master Plan, in consultation with the Province, local municipalities and stakeholders, to more accurately identify and examine the extent and viability of the potential mineral aggregate resources in the Counties prior to the next review of this Plan under Section 26 of the Planning Act. The intent of the Aggregate Resources Master Plan is to identify the location of viable areas of sand and gravel and bedrock deposits that are appropriate for protection and suitable for extraction. The Aggregate Resources Master Plan will assist the Counties in refining the identification of the deposits of mineral aggregate resources as identified by the Province, and will be implemented through an amendment to the Counties Official Plan, in consultation with the local municipalities and various stakeholders.

On the basis of the above, this ARMP is being prepared to support the future Counties OP Amendment. The ARMP and the associated Counties OP Amendment will include policies and updated mapping of Selected Sand and Gravel Resource Areas and Bedrock Resource Areas in the UCLG. This means that following the completion of the ARMP, Section 3.5.2 c) of the Counties OP will need to be updated.

Section 3.5.2 d) of the Counties OP states the following:

d) Viable deposits of mineral aggregate resources, including primary, secondary and tertiary sand and gravel resources and bedrock resources, and mineral aggregate resources and mineral aggregate resource operations will be identified in the local municipal Official Plans, and will represent a detailed interpretation of the boundaries of viable deposits of mineral aggregate resources until such time that a Counties' Aggregate Resources Master Plan is prepared.

Sub-section d) above requires local Official Plans to include a map that identifies sand and gravel and bedrock resources. As noted previously, bedrock resources are not currently identified on any Counties OP schedule, however most of the local Official Plans identify both sand and gravel and bedrock resource areas on a map. This is

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discussed further in **Section 5** of this ARMP. On the basis of the above, this means that following the completion of the ARMP, Section 3.5.2 d) of the Counties OP will need to be updated.

Section 3.5.2 e) of the Counties OP states the following:

e) Until such time that an Aggregate Resources Master Plan has been prepared and implemented through an amendment to the Counties Official Plan, local municipalities in their local municipal Official Plans may adjust or refine the extent of the sand and gravel resource areas identified on Schedule B and the bedrock resource areas identified by the Province, and the extent to which the policies associated with deposits of mineral aggregate resources apply within these areas, without an amendment to the Counties Official Plan. Refinements or adjustments to the extent of the sand and gravel resource areas and the bedrock resource areas may be based on the consideration of the viability of the local resources, the location of settlement areas and existing development, the location of natural heritage features and areas, and setbacks from waterbodies, among other matters, and will be subject to provincial approval.

Sub-section e) above permits local municipalities to adjust or refine the boundaries of sand and gravel and bedrock resources without requiring an amendment to the Counties OP until the ARMP is completed. However, it is noted in the above-mentioned policy that Provincial approval is required. Following the completion of the ARMP, Section 3.5.2 e) of the Counties OP will need to be updated.

Section 3.5.2 f) of the Counties OP reads as follows:

f) Development and activities in known deposits of mineral aggregate resources and on adjacent lands, with the exception of any use in an Urban and Rural Settlement Area and/or Employment Area and agricultural uses, which would preclude or hinder the establishment of new mineral aggregate resource operations or access to the resources will only be permitted if:

resource use would not be feasible; or
the proposed land uses or development serves a greater long-term public interest; and
issues of public health, public safety and environmental impact are addressed.

For the purposes of this policy, 'adjacent to' will generally include lands within 300 m of sand and gravel resource areas or the licensed boundary of an existing pit, and within 500 m of bedrock resource areas or the licensed boundary of an existing quarry.

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Sub-section f) above establishes which types of development and activities are permitted on lands with a known deposit of mineral aggregate resources and on adjacent lands. In this regard, this policy does not apply to lands that are within an Urban or Rural Settlement Area, Employment Area or agricultural uses. Other types of development or uses that are not captured within the previously mentioned exemptions may be permitted if the criteria within the policy are satisfied.

Sub-section f) above also defines 'adjacent to' as being within 300 metres of a sand and gravel resource area or the licensed boundary of an existing pit and being within 500 metres of a bedrock resource area or the licensed boundary of an existing quarry.

The influence areas described above were originally identified in the Ministry of Natural Resources Non-Renewable Training Manual (1997). Most, if not all, Official Plans in Ontario contain a provision that requires a study be completed if an alternative land use is proposed within 300 metres of a gravel pit or resource area or within 500 metres of a quarry or quarry resource area. In addition, these influence areas are the same as those established in many of the local Official Plans as discussed in **Section 5** of this ARMP. On the basis of the above, Section 3.5.2 f) should be retained in the Counties OP.

Section 3.5.2 g) of the Counties OP reads as follows:

g) Further to policy 3.5.2 (f), until the Aggregates Resources Master Plan has been prepared and implemented through an amendment to the Counties Official Plan, local municipalities may require studies to demonstrate that proposed development and activities in the sand and gravel resource areas and bedrock resource areas and on adjacent lands will not preclude or hinder the establishment of new mineral aggregate resource operations or access to the resources. The local municipalities may waive these study requirements in the Agricultural Area, Urban and Rural Settlement Areas, Regionally Significant Employment Area, and Locally Significant Employment Area designations.

Sub-section g) above indicates that until the ARMP is completed the local municipalities are enabled to request studies to demonstrate that proposed development and/or activities will not preclude or hinder the establishment of new mineral aggregate resource operations or access to the resources. In this regard, the local municipalities have the ability to determine if the required studies for development and/or activities within a resource area have satisfied the criteria in Section 3.5.2 f). On the basis of the above, following the

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completion of the ARMP, Section 3.5.2. g) should be updated.

Section 3.5.2 h) of the Counties OP reads as follows:

h) Mineral aggregate resource conservation will be undertaken, including through the use of accessory aggregate recycling facilities within operations, wherever feasible.

The final sub-section h) requires operators to undertake mineral aggregate resource conservation. Section 3.5.2 h) should be retained in the Counties OP.

Section 3.5.2.1 of the Counties OP includes policies that apply to new or expanding mineral resource operations. Section 3.5.2.1 a) of the Counties OP reads as follows:

a) New mineral aggregate resource operations or any expansion to an existing mineral aggregate resource operation that extends beyond the licensed boundary identified in the local municipal Official Plan will require an amendment to the local municipal Official Plan, and will conform to the policies of this Plan and the local municipal Official Plan. An amendment to this Plan will not be required for new or expanding mineral resource operations. The licensed boundaries of existing mineral aggregate resource operations are identified on Schedule B of this Plan, and their boundaries will be identified in the local municipal Official Plans. An amendment to this Plan will not be required to identify a new mineral aggregate resource operation or changes to existing boundaries. New mineral aggregate resource operations and changes to existing boundaries will be updated at the time of the review of the Counties Official Plan under Section 26 of the Planning Act.

Sub-section a) above establishes the requirement for a local Official Plan Amendment when a new or expanding operation extends beyond the limits of a licensed area. The policy also clarifies that an amendment to the Counties OP is not required. In this regard, Section 3.5.2.1 a) should be retained in the Counties OP.

Sub-section b) of the Counties OP reads as follows:

b) In considering new mineral aggregate resource operations or any expansion to an existing mineral aggregate resource operation, the Counties and local municipality will be satisfied that prior to approval of a local municipal Official Plan amendment that the impacts are minimized with respect to the following:

i. surrounding land uses and siting of extraction operations, including demonstrating compatibility with the

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rural character and landscape, including visual impacts;

ii. *surrounding sensitive uses through adequate buffering, screening, and other mitigation measures;*

iii. *transportation infrastructure, particularly as it relates to County Roads and Provincial Highways;*

iv. *social and community considerations;*

v. *demonstration that the final rehabilitation plan is consistent with the policies of this Plan and the local municipal Official Plan; and*

vi. *requirements under the Aggregate Resources Act.*

Sub-section b) above identifies evaluative criteria that must be met when considering new or expanding aggregate operations and a local Official Plan Amendment. In this regard, Section 3.5.2.1 b) should be retained in the Counties OP.

Sub-section 3.5.2.1 c) of the Counties OP reads as follows:

c) The Counties' Aggregate Resources Master Plan may rely on studies prepared in response to policy 3.5.2.1 b) and take into account the potential cumulative impacts that may result from proposed new or expanding mineral aggregate resource operations when added to other past, present and known mineral aggregate resource applications in the vicinity. The cumulative impact assessment will be undertaken in consultation with local municipalities, applicable Conservation Authorities, aggregate operation owners/applicants, and the public.

Sub-section c) above indicates that the Counties' ARMP may rely on studies prepared in response to subsection b) and may consider cumulative impacts resulting from proposed new or expanding operations. Since the ARMP will be implemented through a Counties OP Amendment that includes a policy framework that addresses assessment and application requirements, Section 3.5.2.1 c) should be deleted from the Counties OP.

Section 3.5.2.1 d) of the Counties OP reads as follows:

d) A pre-application consultation meeting with the Province, Counties, local municipality and applicable Conservation Authority will be required to ensure that any specific requirements for each of the agencies are addressed to avoid overlap among the required studies, and such that the studies can satisfy all the requirements of the identified agencies. Following the pre-application consultation meeting, the Counties and/or local municipality to the extent of its jurisdiction, may appropriately scope, waive, or establish a peer review or

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other suitable evaluation process for any required study, at the expense of the applicant.

Sub-section d) above requires a pre-application consultation meeting with the Province, Counties, local municipality and Conservation Authority. The purpose of this meeting is to identify required studies, scope or waive studies and identify any other peer review or evaluation process. In this regard, Section 3.5.2.1 d) should be retained in the Counties OP.

Section 3.5.2.1 e) of the Counties OP reads as follows:

e) Where the licensee has circulated an application under the Aggregate Resources Act, to expand an existing licensed mineral aggregate operation or increase the depth of extraction which does not require the approval of a development application, the Counties and local municipality may review and provide comments on the application to the Province in the context of all policies in this Plan that would apply to an application for a new or expanding mineral aggregate operation.

Sub-section e) above enables the Counties to provide comments on an application made under the Aggregate Resources Act if the application does not require the approval of a development application. In this regard, Section 3.5.2.1 e) should be retained in the Counties OP.

Section 3.5.2.1 f) of the Counties OP reads as follows:

f) The Counties will encourage the Province to ensure that all appropriate requirements resulting from the review of an application for a new or expanding mineral aggregate operation are imposed and enforced as conditions on the license or through the site plan required under the Aggregate Resources Act, particularly as it relates to the matters identified in Section 3.5.2.1 b).

Sub-section f) above indicates that the Counties will encourage the Province to impose conditions on the license or site plan required under the Aggregate Resources Act with respect to implementing Section 3.5.2.1 b) of the Counties OP. In this regard, Section 3.5.2.1 f) of the Counties OP should be retained in the Counties OP.

In addition to the above, Section 3.5.2.2 of the Counties OP includes a number of policies that address rehabilitation of mineral aggregate resource operations. In this regard, the policies require rehabilitation of operations after the extraction has occurred and other related activities have ceased.

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Section 3.5.2.2 a) of the Counties OP reads as follows:

a) Progressive and final rehabilitation will be required to accommodate subsequent land uses, to promote land use compatibility, to recognize the interim nature of extraction, and to minimize impacts, to the extent possible. Final rehabilitation will take into consideration the pre-extraction land use designation and conditions, and compatibility with the character of the surrounding land uses and approved land use designations, in consideration of the Counties Plan and local municipal Official Plan, as well as the opportunity to accommodate parks and open space uses.

Sub-section a) above requires progressive and final rehabilitation for aggregate operations. In this regard, Section 3.5.2.2 a) should be retained in the Counties OP.

Section 3.5.2.2 b) of the Counties OP reads as follows:

b) Comprehensive and coordinated rehabilitation planning is encouraged where there is a concentration of mineral aggregate operations.

Sub-section b) above encourages comprehensive and coordinated rehabilitation where there is a concentration of operations. In this regard, Section 3.5.2.2 b) should be retained in the Counties OP.

Section 3.5.2.2 c) of the Counties OP reads as follows:

c) In prime agricultural areas, on prime agricultural land the extraction of mineral aggregate resources is permitted as an interim use provided the site will be rehabilitated back to an agricultural condition. Complete rehabilitation back to an agricultural condition is not required if:

i. there is a substantial quantity of mineral aggregate resources below the water table warranting extraction, or the depth of planned extraction in a quarry makes restoration of pre-extraction agricultural capability unfeasible;

ii. other mineral aggregate resource extraction alternatives have been considered by the proponent and found unsuitable. The consideration of other mineral aggregate resource extraction alternatives will include mineral aggregate resources in areas of Canada Land Inventory Class 4 through 7 lands, resources on lands identified as settlement areas, and, resources on prime agricultural lands where rehabilitation is feasible. Where no other alternatives are found, prime agricultural lands will

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be protected in this order of priority: Canada Land Inventory Class 1, 2 and 3 lands; and

iii. agricultural rehabilitation in remaining areas is maximized.

Sub-section c) above permits the extraction of mineral aggregate resources (as an interim use) on prime agricultural land in prime agricultural areas, provided that the site is rehabilitated back to an agricultural condition. In this regard, Section 3.5.2.2 c) should be retained in the Counties OP.

Section 3.5.2.2 d) of the Counties OP reads as follows:

d) Local municipal Official Plans may establish policies for the removal of accessory buildings, structures and uses after the mineral aggregate operation ceases.

Sub-section d) above enables local municipalities to include policies in their respective Official Plans that address mineral aggregate operations. In this regard, Section 3.5.2.2 d) should be retained in the Counties OP.

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5. REVIEW OF LOCAL OFFICIAL PLANS

The purpose of this section of the ARMP is to provide an overview of the local Official Plans that include a policy framework that addresses mineral aggregate resources as well as provide initial guidance on the types of policies that may need to be amended in their Official Plans following the completion of the ARMP and Counties OP Amendment process.

There are 10 local municipalities that comprise the UCLG and these are:

- Township of Athens;
- Township of Augusta;
- Township of Edwardsburgh/Cardinal;
- Township of Elizabethtown-Kitley;
- Township of Front of Yonge;
- Township of Leeds and the Thousand Islands;
- Village of Merrickville-Wolford;
- Municipality of North Grenville;
- Township of Rideau Lakes; and,
- Village of Westport.

In addition to the above and as indicated in the Counties OP, the City of Brockville, Town of Gananoque and Town of Prescott are separated municipalities that are geographically part of the UCLG, but not administratively part of the UCLG. The Official Plans for these separated municipalities do not include a map, designation or specific policies that address mineral aggregate resources and for these reasons are not discussed further in this section of the ARMP.

The following subsections include an overview of each of the local Official Plans that address mineral aggregate resources. It is not the intent of the subsections to provide a detailed review of all mineral aggregate policies, however each subsection identifies:

- The mineral aggregate resource designation(s) that applies;
- The map(s) that shows the location of the mineral aggregate resource designation(s);
- The uses permitted on lands within the mineral aggregate resource designation(s); and,
- Other policies that address circumstances that require an Official Plan Amendment, alternative uses in resource areas as well as influence areas.

On the basis of the above, the following sections provide an overview of the local Official Plans.

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5.1 Township of Athens

On June 7, 2010, the Council for the Township of Athens adopted its Official Plan ('Athens OP') and it came into effect on July 17, 2012 following approval by the Ontario Municipal Board (now the Ontario Land Tribunal). The Township is currently undertaking an OP Review and has prepared a first draft for consultation with the Counties, dated June 2020.

The current Athens OP includes a Mineral Resource designation and the intent of this designation is to recognize licensed pits and quarries as well as lands containing deposits of mineral aggregates or minerals. This designation includes two subcategories referred to as '- Aggregate' and '- Mineral', however it is noted in Section 3.2.1 of the Athens OP that at the time of adoption there were no lands designated Mineral Resource – Mineral.

The Athens OP indicates that the *Township is virtually devoid of natural granular material …* and that *at the eastern end of Charleston Lake, deposits are small and of poor quality rendering them most suitable for fill material only.* In this regard, the only surficial mineral aggregate deposits designated as Mineral Resource – Aggregate are found in the northwest portion of the Township. Schedule A to the Athens OP is included at the end of this subsection and it shows the Mineral Resource – Aggregate designation (with black dots).

In addition to the above, Schedule B: Constraints and Opportunities to the Athens OP identifies potential bedrock sources of mineral aggregate. Schedule B also identifies significant woodlands, significant wildlife habitat, significant valleylands, natural corridors and organic soils. There are six areas identified as potential bedrock sources of mineral aggregate (in red outline) on Schedule B that overlap with the aforementioned constraints. Schedule B from the Athens OP is shown at the end of this subsection.

Section 3.2.1 of the Athens OP includes policies that apply to mineral resources and indicates the following with respect to bedrock resources:

Mapped bedrock information has been provided to the Township through the Ministry of Natural Resources. The March Formation that is found in the north and east portions of the Township is considered to be the only probable bedrock source of aggregate that has potential to be quarried to serve local aggregate needs. From the mapping supplied, the Township has identified the areas of the municipality where there are potential sources of mineral aggregate that could be exploited, after having given regard to environmental

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constraints imposed by the presence of locally- and Provincially-significant wetlands as well as the presence of land use constraints imposed by existing development.

On the basis of the above, the mapped bedrock resources within the Athens OP were subject to an exercise that considered environmental and other land use constraints. In this regard, the mapped bedrock resources in the Athens OP are considerably less than what is contained within the ARIP 183.

Section 3.2.2 of the Athens OP permits a range of aggregate-related uses as follows:

The aggregate-related uses permitted include pits and quarries, as well as all associated facilities used in extraction, transport, beneficiation, processing or recycling of mineral aggregate, or the production of secondary related products. These uses include extractive operations, crushing facilities, stockpiles, washing and screening operations, asphalt plants, concrete plants and aggregate transfer stations, as well as accessory uses to extractive operations including asphalt plants, concrete batch plants, recycle stockpile areas for glass, asphalt and concrete and aggregate transfer stations.

In addition to the above, mineral-related uses such as open pit and underground mining operations and associated facilities are also permitted. Land uses such as agriculture, forestry, conservation and outdoor recreation uses are also permitted provided such land uses do not generally include buildings or activities that would preclude or hinder the establishment of new mining or mineral aggregate operations or access to mineral resources.

Section 3.2.3 of the Athens OP includes policies that apply to mineral resources. In this regard, Section 3.2.3.1 requires an Official Plan Amendment for a new resource operation if located outside of the Mineral Resource – Aggregate designation or if there is a significant expansion proposal that involves lands beyond the limits of the designated area.

Section 3.8.5 of the Athens OP also permits extraction in the Prime Agricultural Area as an interim use, provided that rehabilitation of the site is carried out so that substantially the same areas and same average soil quality for agriculture are restored.

In addition to the above, Section 3.2.3.10 of the Athens OP establishes influence areas in relation to pits and quarries near sensitive uses and it reads as follows:

It is a policy of this Plan that existing sensitive land uses such as residences, day care centres and educational and health facilities

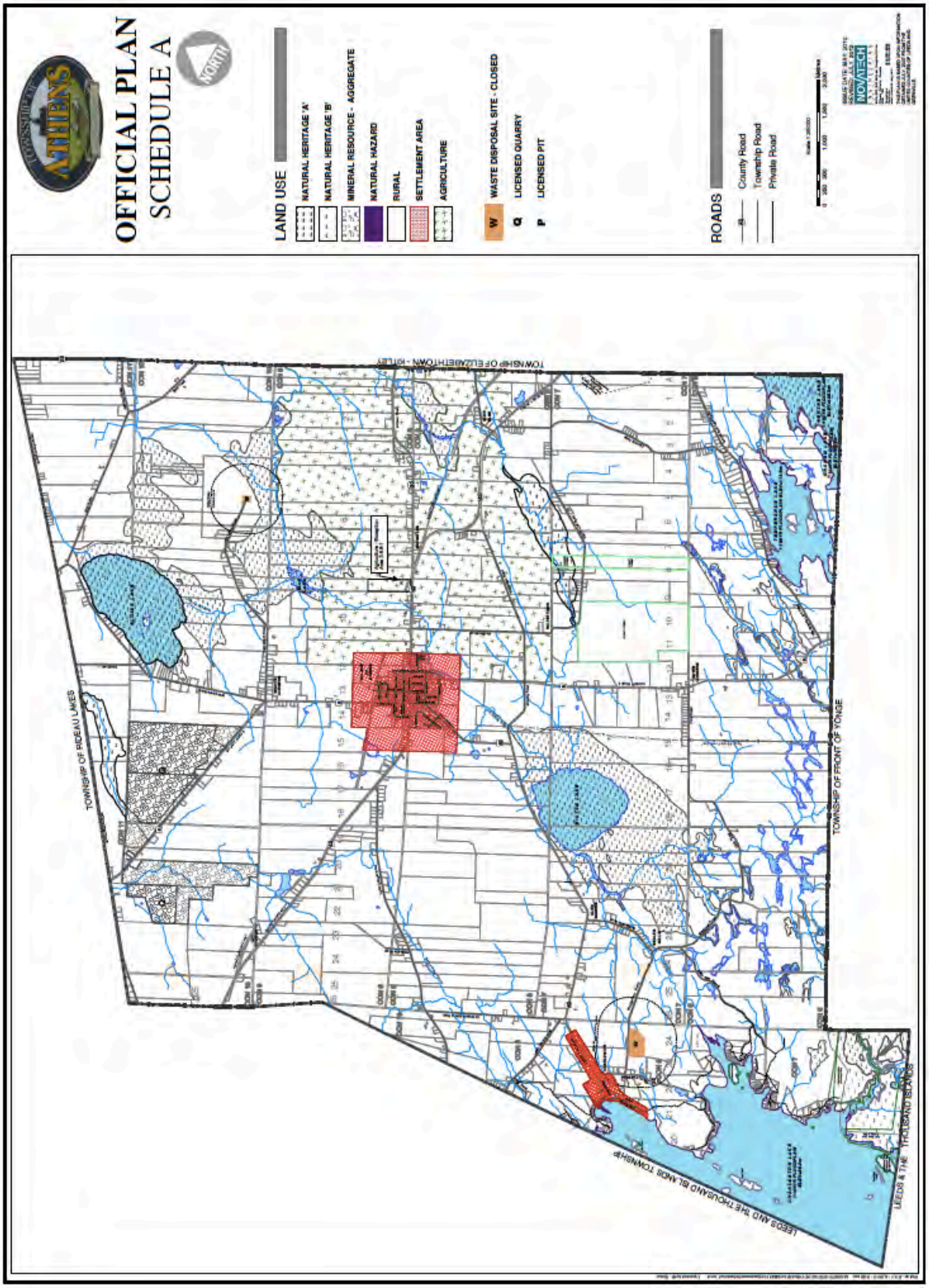
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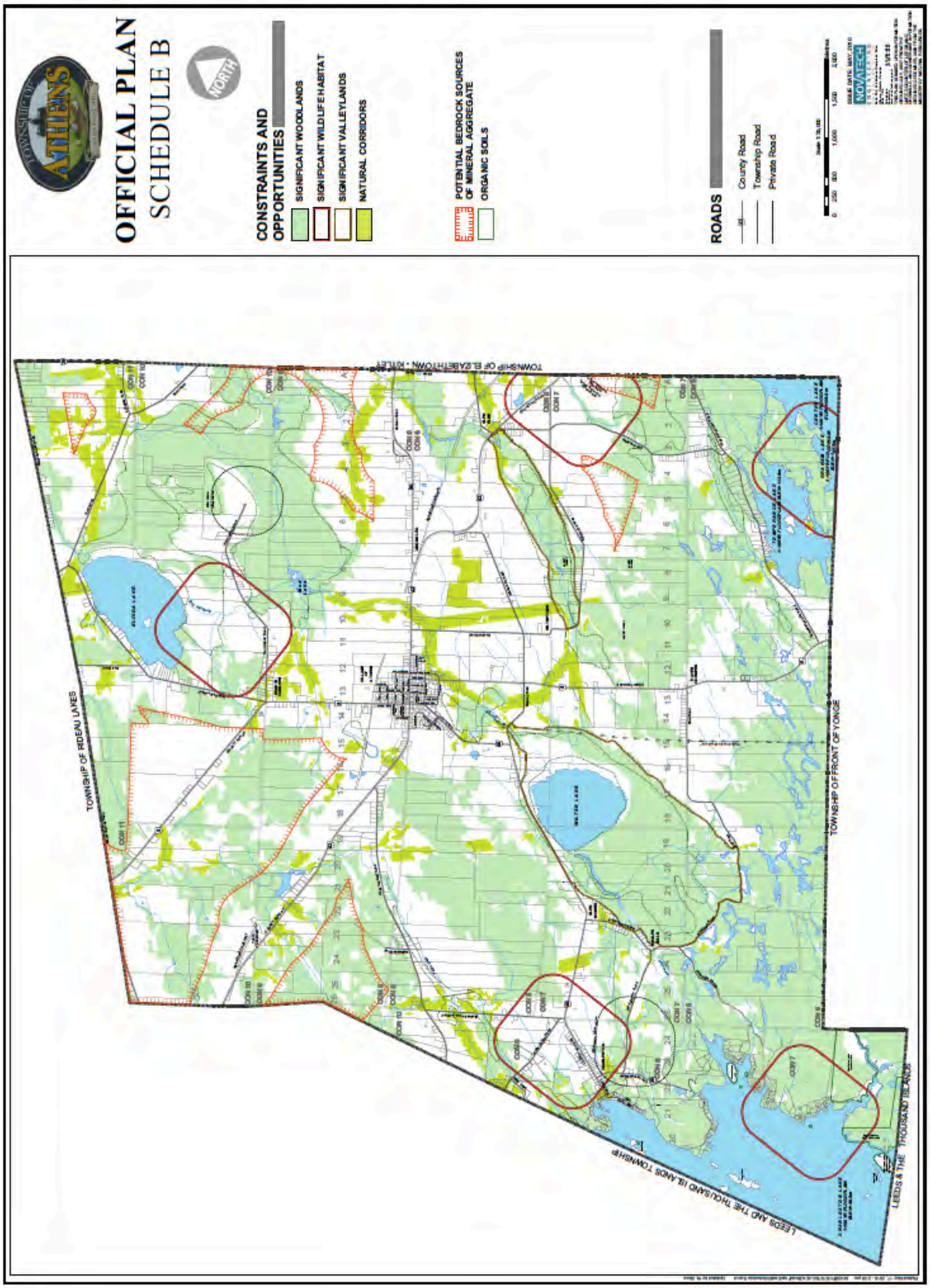


shall be protected from the establishment of new mineral aggregate and mining operations or expansions where such establishment or expansion would be incompatible for reasons of public health, public safety or environmental impact. Similarly, established pits and quarries and resource areas are the beneficiaries of reciprocal policies contained in the Land Use Compatibility section of this Plan intended to protect them from encroachment by sensitive land uses. Influence areas in relation to pits are 300 metres, except in the case of Class B pits where excavation is above the water table, in which case the influence area is 150 metres. The influence area in relation to quarries is 500 metres.

On the basis of the above, an influence area for a pit is 300 metres, unless the pit is a Class B pit with excavation above the water table then the influence area is 150 metres. The influence area for a quarry is 500 metres.

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OFFICIAL PLAN
SCHEDULE A
NORTH
LAND USE
NATURAL HERITAGE 'A'
NATURAL HERITAGE 'B'
MINERAL RESOURCE - AGGREGATE
NATURAL HAZARD
RURAL
SETTLEMENT AREA
AGRICULTURE
W WASTE DISPOSAL SITE - CLOSED
Q LICENSED QUARRY
P LICENSED PIT
ROADS
County Road
Township Road
Private Road
MOVATECH
TOWNSHIP OF RIDEAU LAKES
TOWNSHIP OF FRONT OF YONGE
LEEDS AND THE THOUSAND ISLANDS TOWNSHIP


OFFICIAL PLAN
SCHEDULE B
NORTH
CONSTRAINTS AND OPPORTUNITIES
SIGNIFICANT WOODLANDS
SIGNIFICANT WILDLIFE HABITAT
SIGNIFICANT VALLEYLANDS
NATURAL CORRIDORS
POTENTIAL BEDROCK SOURCES OF MINERAL AGGREGATE
ORGANIC SOILS
ROADS
County Road
Township Road
Private Road
TOWNSHIP OF RIDEAU LAKES
TOWNSHIP OF FRONT OF YONGE
LEEDS AND THE THOUSAND ISLANDS TOWNSHIP
LEEDS & THE THOUSAND ISLANDS



5.2 Township of Augusta

The Township of Augusta Official Plan ('Augusta OP') came into effect on May 25, 2012. The Augusta OP includes a Mineral Aggregate Resource Policy Area designation that is identified on Schedule A – Land Use, Infrastructure and Natural Heritage Features. Lands within this designation represent those that are licensed as a pit or quarry or both under the Aggregate Resources Act.

In addition to the above, the Augusta OP identifies Bedrock Resource areas on Schedule B – Development Constraints Map. It is noted that sand and gravel resources are not identified on any schedule in the Augusta OP, despite being identified in the more recent Counties OP and the ARIP 183 mapping. Schedule B also identifies significant woodland, floodplain limit, significant wildlife habitat, Areas of Natural or Scientific Interest (ANSI), organic soil and publicly owned land. Schedule B from the Augusta OP is shown on the next page and it identifies Bedrock Resource with black, hatched lines.

On the basis of the above, it appears that the mapped Bedrock Resource areas on Schedule B have been subjected to a scoping exercise as there is considerably less area identified as bedrock resource in the Augusta OP compared to the ARIP 183.

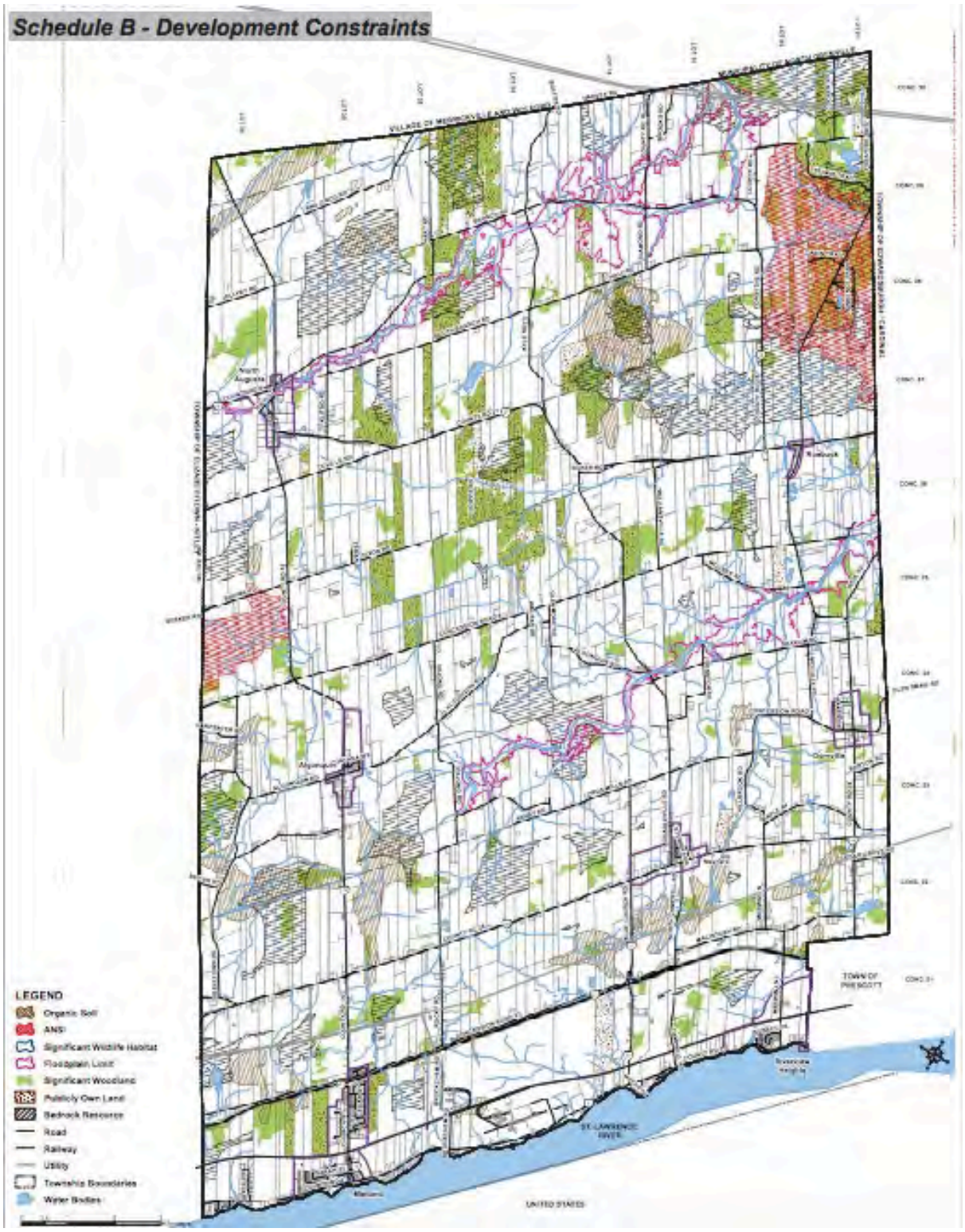
Section 5.2.1 of the Augusta OP establishes the permitted uses for the Mineral Aggregate Resource Policy Area designation. In this regard, the following uses are permitted: pits and quarries, wayside pits and quarries, portable asphalt plants and concrete plants, agricultural uses excluding accessory buildings or structures, conservation and natural resource management uses excluding any accessory buildings or structures, other aggregate accessory uses and permanent asphalt and concrete plants.

Section 5.2.2 of the Augusta OP sets out prohibited uses within the Mineral Aggregate Resource Policy Area designation and it reads as follows:

Development, including changes in land use and the creation of new lots for residential, commercial, institutional, recreational or industrial development which has the potential to preclude or hinder future aggregate extraction or the expansion of existing extraction operations or resource use shall be prohibited within the Mineral Aggregate Resource Policy Area.

Section 5.2.3 of the Augusta OP permits the establishment of a new or enlarged existing operation to occur if the operation is entirely within an area that is designated as Mineral Aggregate Resource Policy Area.

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Schedule B - Development Constraints
LEGEND
Organic Soil
ANSI
Significant Wildlife Habitat
Floodplain Limit
Significant Woodland
Publicly Owned Land
Bedrock Resource
Road
Railway
Utility
Township Boundaries
Water Bodies
TOWN OF PRESCOTT
ST. LAWRENCE RIVER
UNITED STATES



A new operation on any lands that are not designated Mineral Aggregate Resource Policy Area requires an amendment to the Official Plan.

Section 5.2.4 of the Augusta OP includes policies that apply to areas identified as Bedrock Resource. Section 5.2.4.1 states that areas of potential bedrock resources are identified as Bedrock Resource on Schedule B as a constraint overlay. Section 5.2.4.2 requires an amendment to the Official Plan to establish a mineral aggregate operation on lands within these areas.

In addition to the above, Section 5.2.5 of the Augusta OP establishes other policies that apply to lands within areas identified as Bedrock Resource as well as those that are considered to be adjacent lands. In this regard, Section 5.2.5.1 reads as follows:

In areas located within 300 metres of a Mineral Aggregate Resource Policy Area intended or utilized for a licensed pit operation and 500 metres from a Mineral Aggregate Resource Policy Area intended or utilized for a licensed quarry operation, incompatible development, including the creation of new lots shall only be permitted subject to the following criteria:

The criteria referenced in Section 5.2.5.1 is identified in Sections 5.2.5.2 and 5.2.5.3 below:

Hydrogeological investigations conducted by a qualified professional conclusively demonstrate that the proposed non extraction development can be adequately serviced by water and sewer services in a manner which will not impede continued existing and proposed extraction operations.

Any other investigation as required by the development approval authority such as traffic studies, noise studies, vibration studies, slope stability studies, air quality impact studies and land use compatibility studies, etc. are carried out and demonstrate that the proposed development can proceed without impeding the continued operation of the licensed extraction operation existing licensed operations and future operations on reserves. Such studies are to be carried out by qualified professionals.

On the basis of the above, the influence area for a pit is 300 metres and the influence area for a quarry is 500 metres. AS noted above, Section 5.2.5.2 and 5.2.5.3 of the Augusta OP set out the required studies to support development within the established influence areas.

Section 5.2.6 of the Augusta OP permits mineral aggregate resource extraction within the Prime Agricultural Area as an interim use provided that rehabilitation of the site is carried out substantially in the

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same area and the same average soil quality for agriculture is restored.

Section 5.2.7 of the Augusta OP restricts mineral aggregate resource extraction from occurring within significant woodlands, unless it can be demonstrated through an Environmental Impact Statement and Land Use Compatibility Study that an aggregate extraction operation is justified. In this regard, the cutting of woodlands to facilitate extraction is permitted provided that there is minimal woodland loss and that the extraction area is progressively rehabilitated to woodland use during and following aggregate removal.

5.3 Township of Edwardsburgh Cardinal

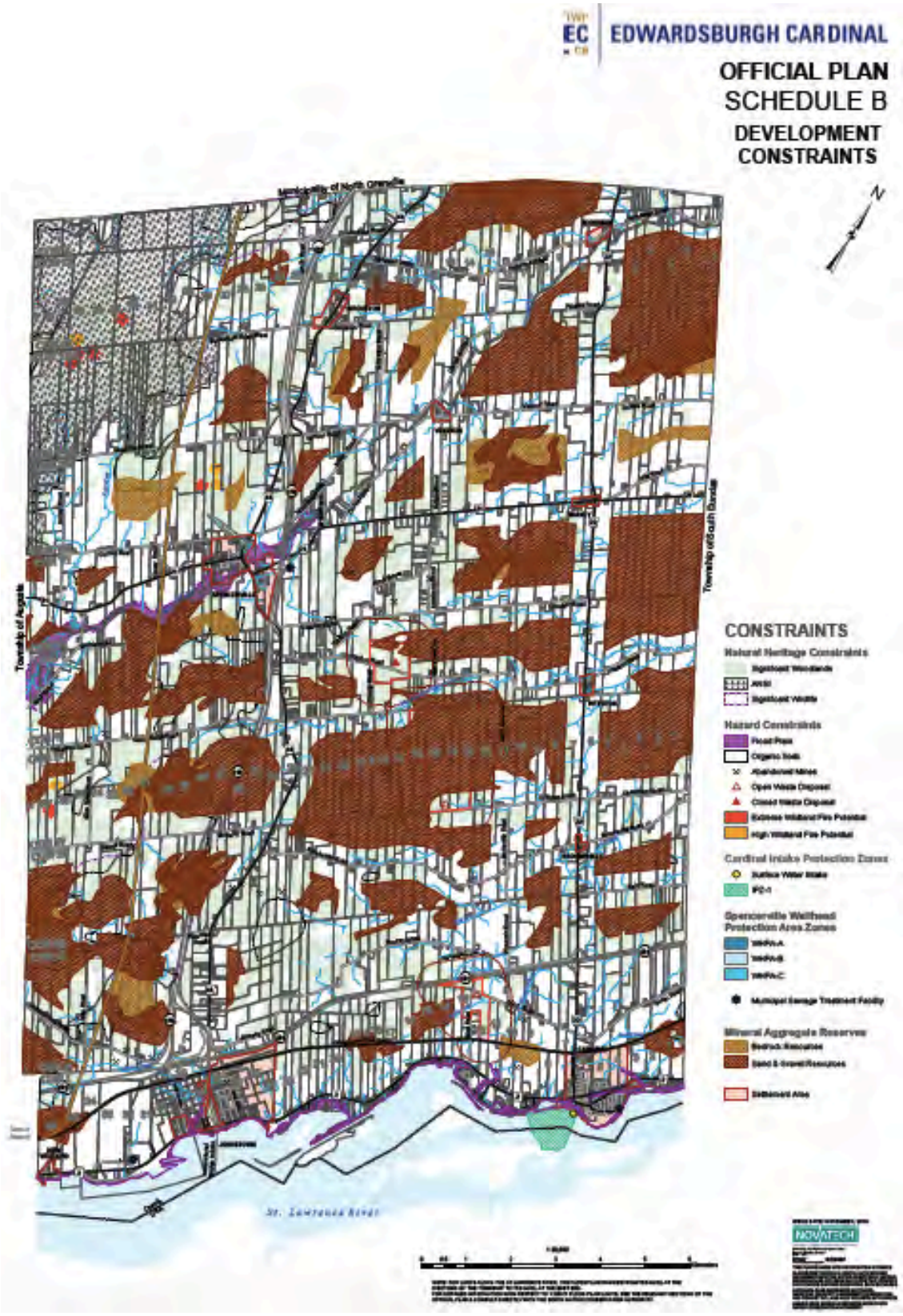
The Township of Edwardsburgh Cardinal Official Plan ('Edwardsburgh Cardinal OP') came into effect in November 2019. The Edwardsburgh Cardinal OP includes a Mineral Aggregate Resource Policy Area designation on Schedule A: Land Use and Transportation Map. This designation applies to pits and quarries that have been licensed under the Aggregate Resources Act as well as known areas of mineral aggregate resources.

In addition to the above, the Edwardsburgh-Cardinal OP identifies Bedrock Resource and Sand and Gravel Resource on Schedule B – Development Constraints Map. Schedule B also identifies significant woodlands, significant wildlife, ANSI, flood plain, organic soil, abandoned mines, waste disposals (open and closed), extreme wildland fire potential, high wildland fire potential, intake protection zones and wellhead protection zones. Schedule B from the Edwardsburgh Cardinal OP is shown on the next page, where areas of Sand and Gravel Resource are shown as orange, hatched lines and areas of Bedrock Resource are shown as red, hatched lines.

Section 3.6 of the Edwardsburgh Cardinal OP includes policies that apply to the Mineral Aggregate Resource Policy Area designation. In the introductory paragraphs of Section 3.6, it is indicated that:

The Township contains considerable areas of surficial sand and gravel resource, as well as areas of bedrock resource. On the basis of the Aggregate Resources Inventory of the United Counties of Leeds & Grenville, Southern Ontario, Paper 183 (2009), surficial deposits that are categorized as being of tertiary significance predominate throughout the Township, while surficial

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EDWARDSBURGH CARDINAL
OFFICIAL PLAN
SCHEDULE B
DEVELOPMENT
CONSTRAINTS
CONSTRAINTS
Natural Heritage Constraints
Hazard Constraints
Cardinal Intake Protection Zones
Spencerville Wellhead
Protection Area Zones
Mineral Aggregate Reserves
Township of Augusta
Township of South Dundas
St. Lawrence River



deposits of secondary significance are exceedingly limited in extent. Bedrock resources are expansive throughout the Township and could play an important role in the supply of bedrock-derived aggregates where suitable resources exist and access to the resource is feasible.

Many of the areas of tertiary deposits are small and fragmented, and others are significantly larger and/or represent areas where deposits are concentrated. Given that the sand and gravel resources are primarily of tertiary significance and many are small and fragmented, it is recognized that not all deposits are suitable to support commercial activity for aggregate extraction. Similarly, not all bedrock resources may be suitable to support commercial activity.

In addition to the above, it is also stated within this section that:

Areas of potential surficial and gravel resources and areas of potential bedrock resources are identified as mineral aggregate reserves on Schedule B. In certain cases, these resources have been excluded from Schedule B due to contextual considerations such as proximity to provincially significant wetlands and/or incompatible land uses such as settlement areas and other built up areas.

The policy above indicates that a scoping exercise was undertaken to delineate both the sand and gravel and bedrock resources within the Township, however it is not clear what buffers were applied in the refinement process.

In addition to the above, the final introductory paragraph recognizes that an amendment may be required to implement the UCLG ARMP once it is completed and that this may include designating additional lands on Schedule A as Mineral Aggregate Resource Area, refining the extent of mineral aggregate reserves identified on Schedule B and the inclusion of additional mineral aggregate policies.

Section 3.6.2.1 of the Edwardsburgh Cardinal OP establishes the permitted uses for the Mineral Aggregate Resource Policy Area designation and these include:

- Pits and quarries;
- Wayside pits and quarries;
- Portable asphalt plants and concrete plants;
- Agricultural uses, excluding any accessory building or structure;
- Conservation and natural resource management uses, excluding any accessory building or structure;
- Uses accessory to an aggregate extraction operation, such as crushing and screening operations,

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machinery storage facilities and office space; and,

- Permanent asphalt and concrete plants, subject to a zoning by-law amendment.

In addition to the above, Section 3.5.3.3 permits extraction within the Agricultural Resource Policy Area designation as an interim use provided that the site will be rehabilitated back to an agricultural condition.

Section 3.6.3 of the Edwardsburgh Cardinal OP includes policies that apply to lands within the Mineral Resource Policy Area designation. The establishment of new licensed operations or the enlargement of an existing licensed operation is permitted by the Official Plan provided that the new area or enlargement area is located entirely within the designated area. This section of the Official Plan also includes a list of the types of studies that are required to support new or expanded operations beyond the Mineral Resource Policy Area designation. It is noted, however, that Section 3.6.3.8 requires an Official Plan Amendment for the establishment of a mineral aggregate operation within lands identified as Mineral Aggregate Reserve on Schedule B. Lands within the Mineral Aggregate Reserve include Bedrock Resource and Sand and Gravel Resource areas.

In addition to the above, Section 3.6.3.9 of the Edwardsburgh Cardinal OP establishes the influence area for pits and quarries and it reads as follows:

It is a policy of this Plan that existing sensitive land uses such as residences, day care centres and educational and health facilities shall be protected from the establishment of new mineral aggregate operations or expansions where such establishment or expansion would be incompatible for reasons of public health, public safety or environmental impact. Similarly, established pits and quarries and resource areas are the beneficiaries of reciprocal policies contained in the Land Use Compatibility section of this Plan intended to protect them from encroachment by sensitive land uses. Influence areas in relation to pits are 300 metres, except in the case of Class B pits where excavation is above the water table, in which case the influence area is 150 metres. The influence area in relation to quarries is 500 metres.

On the basis of the above, the influence area for a pit is 300 metres, unless the pit is a Class B pit with excavation above the water table then the influence area is 150 metres. The influence area for a quarry is 500 metres.

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5.4 Township of Elizabethtown-Kitley

On July 16, 2018, the Council for the Township of Elizabethtown-Kitley adopted its Official Plan ('Elizabethtown-Kitley OP') and it was approved by the UCLG on October 25, 2018. The Elizabethtown-Kitley OP includes a Mineral Resource designation and it is identified on Schedule A1 – Land Use and Roads, Schedule A2 – Land Use and Roads North and Schedule A3 – Land Use and Roads South. The intent of the Mineral Resource designation is to recognize existing resources as well as pits and quarries. The Mineral Resource designation includes two subcategories ' – Mineral' and '– Mineral Aggregate'.

Section 3.3.1 of the Elizabethtown-Kitley OP indicates that the surficial sand and gravel deposits in the Township are of tertiary significance. There are no deposits of primary or secondary significance within the Township. It is noted in the introductory paragraphs that:

In certain cases, areas of surficial tertiary deposits have been excluded from the Mineral Resource designation due to contextual considerations such as proximity to natural heritage features such as wetlands, ANSIs, existing incompatible land uses or the shorelines or water bodies.

It is anticipated that an Official Plan amendment will be necessary to identify both surficial and bedrock sources of aggregate in the Township upon completion of the Counties' Aggregate Resource Master Plan.

On the basis of the above, the policy above indicates that a scoping exercise was undertaken to delineate the sand and gravel resources within the Township, however it is not clear what buffers were applied in the refinement process.

The Elizabethtown-Kitley OP recognizes that bedrock resources are not shown on any schedule in the Official Plan. It is further noted within the introductory paragraphs of Section 3.3.1 that as surficial aggregate resources are exhausted, bedrock resources may become of interest and that amendment to the Official Plan will be required to establish an operation within a bedrock resource area. It is further recognized that the Elizabethtown-Kitley OP will need to be amended to identify both surficial and bedrock sources of aggregate upon completion of the UCLG ARMP.

On lands within the current Mineral Resource designation, Section 3.3.2 of the Elizabethtown-Kitley OP permits aggregate-related and mineral-related uses as well as agriculture forestry, conservation and outdoor recreation uses provided that such

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uses do not include buildings and would not preclude or hinder the establishment of a new mineral mining or mineral aggregate operation or access to mineral resources.

Section 3.3.3 of the Elizabethtown-Kitley OP includes policies that apply to the Mineral Resource designation. In this regard, Section 3.3.3.1 requires an amendment to the Official Plan for any expansion proposal that extends onto lands that are beyond the limits of the designated area. Additional subsections within Section 3.3.3 include policies that outline required studies and tests for alternative land uses as well as rehabilitation requirements.

In addition to the above, Section 3.3.3.12 of the Elizabethtown-Kitley OP establishes influence areas and it reads as follows:

It is a policy of this Plan that existing sensitive land uses such as residences, day care centres and educational and health facilities shall be protected from the establishment of new mineral aggregate and mining operations or expansions where such establishment or expansion would be incompatible for reasons of public health, public safety or environmental impact. Similarly, established pits and quarries and resource areas are the beneficiaries of reciprocal policies contained in the Land Use Compatibility section of this Plan intended to protect them from encroachment by sensitive land uses. Influence areas in relation to pits are 300 metres, except in the case of Class B pits where excavation is above the water table, in which case the influence area is 150 metres. The influence area in relation to quarries is 500 metres.

On the basis of the above, the influence area for a pit is 300 metres, unless the pit is a Class B pit with excavation above the water table then the influence area is 150 metres. The influence area for a quarry is 500 metres.

5.5 Township of Front of Yonge

On January 15, 2018, the Council for the Township of Front of Yonge adopted its Official Plan ('Front of Yonge OP') and it was later approved by the UCLG on March 22, 2018. The Front of Yonge OP includes a Mineral Resource designation on Schedule A: Land Use and Roads. This designation applies to licensed pits and quarries (also shown on Schedule A) as well as lands containing deposits of mineral aggregates or minerals. Section 3.2.1 of the Front of Yonge OP indicates that lands within this designation are based on information from the Ministry of Northern Development and Mines and the Ministry of Natural Resources and Forestry.

With respect to the mapping of aggregate resources, the introductory paragraphs in Section 3.2.1 of the Front of Yonge OP indicates the following:

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In general, the Township's natural granular material is virtually depleted. Portions of the remaining surficial reserves are limited in quality and quantity, and are inaccessible due to contextual considerations such as existing incompatible land uses that would make extraction problematic. As a consequence, surficial mineral aggregate deposits, designated as Mineral Resource – Aggregate, are in limited supply throughout the Township. It is recognized, however, that due to a lack of adequate mapping, the Township's relatively significant bedrock resources of aggregate are not shown on Schedule A. Accordingly, as surficial aggregate resources within and adjacent to the Township are exhausted, bedrock sources may become of interest. In the meantime, Official Plan Amendment applications to develop these bedrock aggregate resources may, therefore, be expected. This Plan may also be amended to identify additional mineral aggregate areas upon completion of the Counties' Aggregate Resources Master Plan.

On the basis of the above, the Front of Yonge OP recognizes that there are significant bedrock resources within the Township that are not identified on a map and indicates that the Official Plan may be amended to identify bedrock resources on an Official Plan schedule following the completion of the UCLG's ARMP.

On lands designated Mineral Resource, Section 3.2.2 of the Front of Yonge OP permits aggregate-related uses such as pits and quarries and associated uses as well as agriculture, forestry, conservation and outdoor recreation provided that such uses do not include buildings and would not preclude or hinder the establishment of a new mineral mining or mineral aggregate operation or access to mineral resources.

Section 3.2.3 of the Front of Yonge OP includes policies that apply to the Mineral Resource designation. Section 3.2.3.8 requires an Official Plan Amendment for any new aggregate resource operations or any expansions to an existing mineral aggregate resource operation that extends beyond the licensed boundary that is identified within the Official Plan.

In addition to the above, Section 3.2.3.13 of the Front of Yonge OP establishes influence areas for pits and quarries and it reads as follows:

It is a policy of this Plan that existing sensitive land uses such as residences, day care centres and educational and health facilities shall be protected from the establishment of new mineral aggregate and mining operations or expansions where such establishment or expansion would be incompatible for reasons of public health,

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public safety or environmental impact. Similarly, established pits and quarries and resource areas are the beneficiaries of reciprocal policies contained in the Land Use Compatibility section of this Plan intended to protect them from encroachment by sensitive land uses. Influence areas in relation to pits are 300 metres, except in the case of Class B pits where excavation is above the water table, in which case the influence area is 150 metres. The influence area in relation to quarries is 500 metres.

On the basis of the above, the influence area for a pit is 300 metres, unless the pit is a Class B pit with excavation above the water table then the influence area is 150 metres. The influence area for a quarry is 500 metres.

5.6 Township of Leeds and the Thousand Islands

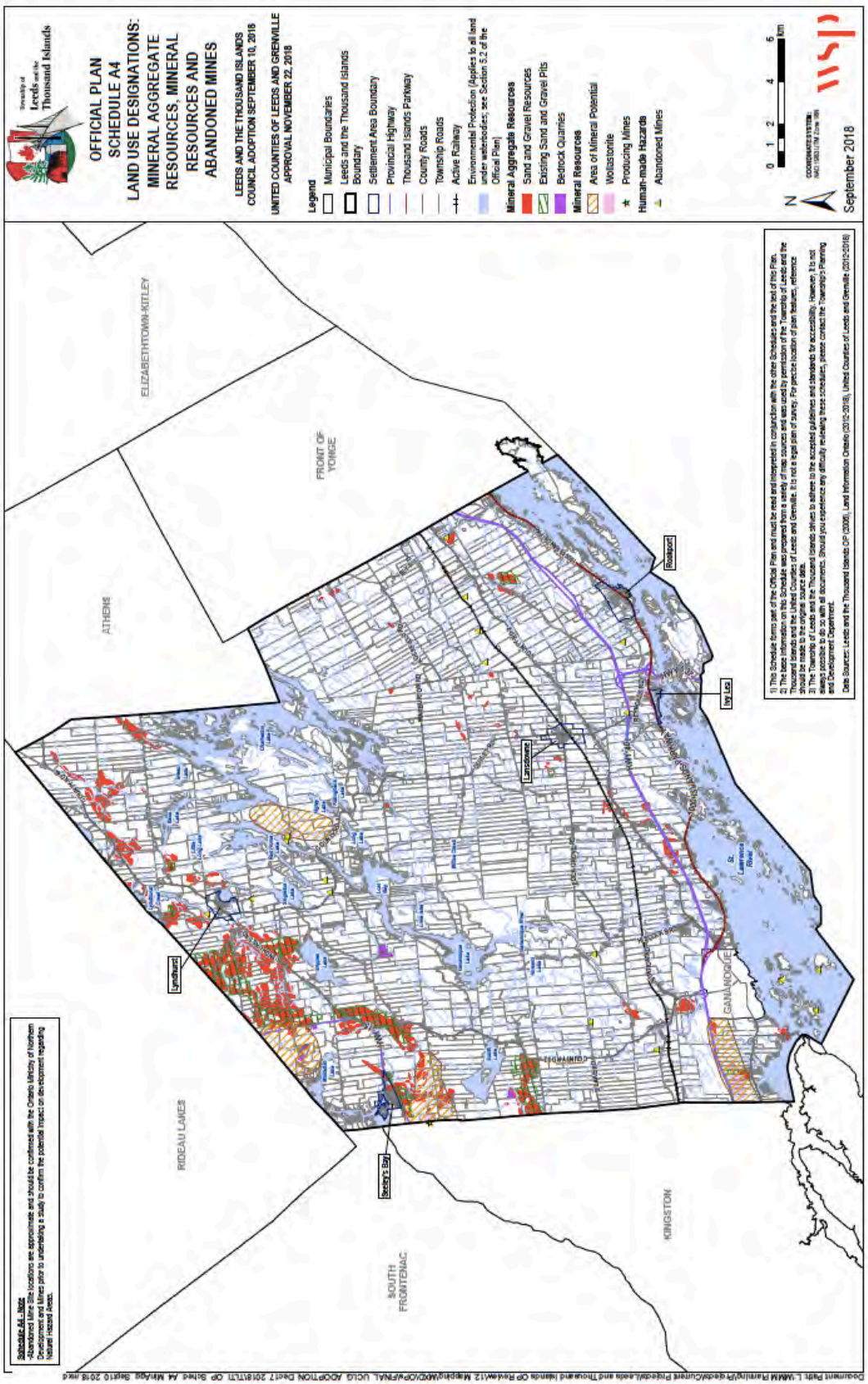
On September 10, 2018, the Council for the Township of Leeds and the Thousand Islands adopted its Official Plan ('Leeds and the Thousand Islands OP') and it was later approved by the UCLG on November 22, 2018. The Leeds and the Thousand Islands OP includes a Mineral Aggregate Resources designation on Schedule A4: Land Use Designations: Mineral Aggregate Resources, Mineral Resources and Abandoned Mines. Schedule A4 of the Leeds and the Thousand Islands OP is included on the next page and it shows sand and gravel resources in red, existing sand and gravel pits in green hatching and bedrock quarries in purple.

Section 5.4.1 of the Leeds and the Thousand Islands OP includes policies that apply to mineral aggregate resources. The introductory paragraphs in this section indicate that:

The Township is characterized by a predominant pattern of Precambrian rock knobs made up of granite and other rock types interspersed with clay flats left primarily by the Glacial Lake Iroquois. The southern exposure of the Canadian Shield is present in most of the Township underlying the more recent deposits as a potential source of building and monument (dimension stone) stone. A limited amount of sand and gravel is also present, left by glacial activity.

The northeast corner of the Township lies outside of the Canadian Shield in the physiographic region known as the Smiths Falls Limestone Plain. This area has potential for quarrying of mineral aggregate but no detailed study of the resource has been completed, therefore no lands are designated. Proposed mineral aggregate quarries will require amendments to the Official Plan and Zoning By-law.

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OFFICIAL PLAN
SCHEDULE A4
LAND USE DESIGNATIONS:
MINERAL AGGREGATE RESOURCES, MINERAL RESOURCES AND ABANDONED MINES
LEEDS AND THE THOUSAND ISLANDS
COUNCIL ADOPTION SEPTEMBER 10, 2018
UNITED COUNTIES OF LEEDS AND GRENVILLE
APPROVAL NOVEMBER 22, 2018
Legend
Municipal Boundaries
Leeds and the Thousand Islands Boundary
Settlement Area Boundary
Provincial Highway
Thousand Islands Parkway
County Roads
Township Roads
Active Railway
Environmental Protection (Applies to all land under wetlands; see Section 5.2 of the Official Plan)
Mineral Aggregate Resources
Sand and Gravel Resources
Existing Sand and Gravel Pits
Bedrock Quarries
Mineral Resources
Area of Mineral Potential
Wollastonite
Producing Mines
Human-made Hazards
Abandoned Mines
September 2018
ELIZABETHTOWN-KITLEY
FRONT OF YONGE
ATHENS
RIDEAU LAKES
SOUTH FRONTENAC
KINGSTON
GANANOQUE
Lyndhurst
Delta
Rockport
Lansdowne
Ivy Lea
Bentley's Bay



On the basis of the above, it is clear in the above-mentioned policy that there may be potential for quarrying of mineral aggregate in the northeast corner of the Township, however no detailed study of the resource has been completed and there are no lands designated as mineral aggregate in this area on Schedule A4 of the Thousand Islands OP. In this regard, any proposed quarry in this area will require an Official Plan Amendment and Zoning By-law Amendment.

Section 5.4.1 of the Leeds and the Thousand Islands OP sets out the permitted uses within the Mineral Aggregate Resources designation and these include extractive operations, associated aggregate uses, agriculture, forestry, conservation or passive recreation which do not preclude or hinder current or future extraction of the resource. Existing dwellings and accessory uses may also be permitted as legal non-conforming uses and may be expanded or new accessory uses permitted where Council determines that such an expansion or accessory use does not hinder access to the resource or the continued operation of pits and quarries.

Section 5.4.1.1.1 of the Leeds and the Thousand Islands OP includes policies that apply to mineral aggregate resources as well as sand and gravel resources. It is noted within this section that Schedule A4 identifies those sand and gravel resources that are not yet sterilized as well as other licensed areas. Interim land uses such as agriculture, forestry and outdoor recreation uses may be permitted provided that these do not include buildings or activities that would preclude the establishment of a pit. However, in areas of existing agricultural operations, buildings and structures accessory to an agricultural operation may be permitted.

In addition to the above, Section 5.4.1.1.3 of the Leeds and the Thousand Islands OP includes a policy that establishes influence areas and it reads as follows:

The concept of an influence area is recognized as a means of protecting against incompatible land uses in the vicinity of existing and proposed pits and quarries. This influence area can be considered a study area in which studies may be completed by the proponent to demonstrate that the proposed pit or quarry is compatible with land uses within the influence area. This influence area is applied reciprocally to sensitive land uses encroaching upon existing pits and quarries.

The Ministry of the Environment, Conservation and Parks recommends an influence area of 500 metres for quarries, 150 metres for sand and gravel pits or reserves above the groundwater table, and 300 metres for sand and gravel pits or reserves below the groundwater table.

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Development within this influence area may be permitted if impacts such as noise, dust, and vibration can be mitigated.

On the basis of the above, the influence area for a pit is 300 metres, unless the pit is a Class B pit with excavation above the water table then the influence area is 150 metres. The influence area for a quarry is 500 metres.

Section 5.4.1.2 of the Leeds and the Thousand Islands OP includes policies that apply to bedrock resources. In this regard, the only policy within this section reads as follows:

The majority of the Township has bedrock resource areas. The location and extent of the bedrock resource areas shall be determined through the Counties' preparation of an Aggregate Resources Master Plan, in consultation with the Province, local municipalities including the Township, and stakeholders.

On the basis of the above, the Leeds and the Thousand Islands OP does not recognize bedrock resources and indicates that the location and extent of bedrock resources will be identified in the UCLG ARMP.

5.7 Village of Merrickville-Wolford

On February 10, 2020, the Council for the Village of Merrickville-Wolford adopted the Official Plan ('Merrickville-Wolford OP'). The Merrickville-Wolford OP includes an Aggregate Resource designation on Schedule A: Land Use Plan. This designation is intended to recognize existing pits and quarries within the Village. It also identifies areas where primary, secondary and tertiary surficial deposits of sand and gravel resources are located. These deposits are found throughout the Village in a number of areas.

Section 6.3.4.1 of the Merrickville-Wolford OP also indicates that there are no bedrock resources identified on a schedule in the Official Plan. In this regard, the Official Plan recognizes that an amendment will be required to implement the UCLG ARMP once it is completed.

Section 6.3.4 of the Merrickville-Wolford OP includes policies that apply to aggregate resources and requires an amendment to the Official Plan to permit a new pit or quarry. Section 6.3.4.2 addresses permitted uses within the Aggregate Resource designation and it reads as follows:

The permitted uses include aggregate extraction by means of pits and quarries as defined in the Aggregate Resources Act, as well as associated uses such as aggregate storage, stone crushing plants, concrete batching plants, asphalt batching plants and



accessory uses. Forestry, open air recreation and agriculture are also permitted uses.

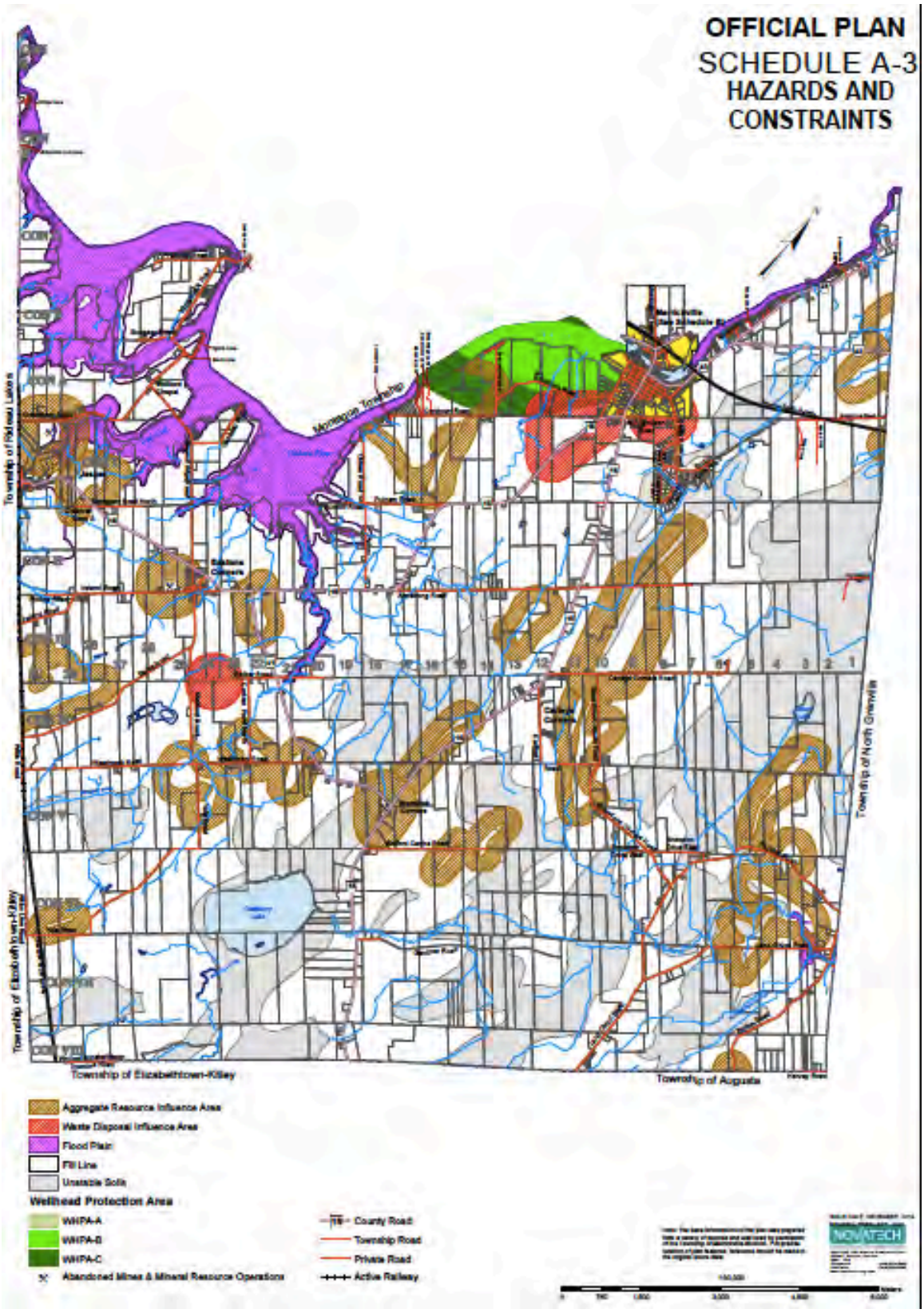
In addition to the above, Schedule A-3: Hazards and Constraints of the Merrickville-Wolford OP identifies the Aggregate Resource designation and the associated influence area. Schedule A-3 of the Village of Merrickville-Wolford OP is shown on the following page and it identifies the influence area in orange, hatched lines. It is noted that the white area within each influence area are the lands that are designated Aggregate Resource in the Merrickville-Wolford OP.

Section 5.6 of the Merrickville-Wolford OP includes policies that apply to influence areas. Section 5.6.1 indicates that Schedule A-3 and Schedule B-3 identify influence areas adjacent to certain land uses where development, particularly residential development, may be restricted or prohibited because of potential incompatibility with the adjacent designated land uses. In this regard, the influence area is 300 metres for a pit and 500 metres for a quarry.

In addition to the above, Section 5.6.2 of the Merrickville-Wolford OP establishes the type of development that is permitted within influence areas and it reads as follows:

a) *Development may be permitted within the Influence Areas in accordance with the policies of the underlying land use designation and in accordance with any applicable policies of the adjacent land use designation to which the Influence Area applies, subject to the following additional policies.*
b) *Residential and other sensitive land uses are generally prohibited, but may be permitted in consultation with the public agency having an interest in the Influence Area.*
c) *Prior to approving any development within the Influence Areas, Council shall require the applicant to undertake a study in order to identify the impact of the proposed development on the adjacent designated land use, and vice versa. The study shall also identify what measures can be undertaken to mitigate the impact. Any such study shall be undertaken to the satisfaction of the Village and in accordance with the requirements of the public agency having an interest in the Influence Area.*
d) *Where the designated land use ceases operation, either by the closing of a waste disposal site or salvage yard, or*

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OFFICIAL PLAN
SCHEDULE A-3
HAZARDS AND
CONSTRAINTS
Township of Elizabethtown-Kitley
Township of Augusta
Township of North Grenville
Aggregate Resource Influence Area
Waste Disposal Influence Area
Flood Plain
Fill Line
Unstable Soils
Wellhead Protection Area
WHPA-A
WHPA-B
WHPA-C
Abandoned Mines & Mineral Resource Operations
County Road
Township Road
Private Road
Active Railway



e) the surrendering of a license to operate a pit or quarry, the policies of this Section will continue to apply to the extent that the study referred to above shall be required, with necessary modifications, prior to the approval of any development.

5.8 Municipality of North Grenville

On May 14, 2018, the Council for the Municipality of North Grenville adopted its Official Plan ('North Grenville OP') and it was approved by the UCLG on November 22, 2018. The North Grenville OP indicates that the North Grenville area contains extensive sand and gravel deposits that provide a valuable source of road and building construction material. The North Grenville OP includes a Mineral Aggregate designation that applies to licensed operations as well as reserves of sand, gravel and limestone. It is noted in the introductory paragraphs in Section 7 of the North Grenville OP that the lands currently designated as Mineral Aggregate are the result of a scoping exercise that was undertaken with the Ministry of Natural Resources and Forestry, which reads as follows:

The Municipality, in consultation with the Ministry of Natural Resources and Forestry, has undertaken a scoping exercise regarding mineral aggregate resources as part of this Official Plan. However, the Municipality acknowledges that a Counties' Aggregate Resources Master Plan will be carried out by the Counties in consultation with local municipalities within 3 years of approval of the Counties' Official Plan. Furthermore, this exercise will consider available mapping, potential constraints to resource extraction, and the associated policy framework, which may identify the criteria that should be considered as part of any Aggregate Resources Master Plan.

On the basis of the above, the policy above indicates that a scoping exercise was undertaken to delineate the sand and gravel and bedrock resources within the Township, however it is not clear what buffers were applied in the refinement process.

Schedule A to the North Grenville OP identifies the lands that are within the Mineral Aggregate designation. Section 7.1 of the North Grenville OP sets out the permitted uses for this designation which include aggregate-related uses as well as interim land uses such as agriculture, forestry and outdoor recreation provided that these uses do not include buildings or activities which would preclude the establishment of a pit or quarry.

Section 7.2 of the North Grenville OP includes policies that apply to the Mineral Aggregate designation. Subsection a)

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indicates that any proposal to expand beyond the limits of the designation requires an amendment to the Official Plan. Subsections b) and c) apply to influence areas and they read as follows:

b) The concept of an influence area is recognized as a means of protecting against incompatible land uses in the vicinity of Mineral Aggregate areas and to protect existing pits and quarries from encroachment from other incompatible land uses. In accordance with this concept, it will be the policy of the Municipality to discourage incompatible land uses in areas surrounding Mineral Aggregate areas by careful review of any severance application, rezoning application or other development proposal in consultation with the appropriate government agency. This area of influence is generally 150 metres for a pit above the water table, 300 metres for a pit below the water table and 500 metres for a quarry from the boundary of an area licensed through the Aggregate Resources Act. In these areas, development which would preclude or hinder the establishment of new operations or access to the resources will only be permitted if:

i. resource use would not be feasible; or

ii. the proposed land uses or development serves a greater long term public interest; and

iii. issues of public health, public safety and environmental impact are addressed.

c) For proposed development within influence areas, studies may be required by the Municipality to determine whether development would preclude or hinder the establishment of new operations or access to the resources. These studies may include noise assessments, hydrogeology reports and other similar studies.

On the basis of the above, the influence area for a pit above the water table is 150 metres and a pit below the water table is 300 metres. The influence area for a quarry is 500 metres.

In addition to the above, Section 7.2 n) also states that bedrock resources are identified on Schedule A of the North Grenville OP. The establishment of a mineral aggregate operation on lands identified as bedrock resource requires an Official Plan Amendment and the influence area of 500 metres applies. This subsection also recognizes that the UCLG will complete an ARMP that may require amendments to the North Grenville OP to implement new and/or updated mineral aggregate resource mapping and policies.

5.9 Township of Rideau Lakes

On October 20, 2003, the Council for the Township of Rideau Lakes adopted its

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Official Plan ('Rideau Lakes OP') and it was approved by the MMAH, with modifications, on April 2, 2004. The Township is currently undertaking an Official Plan update according to its website. A draft Official Plan, dated February 10, 2021, is currently available for review. It is noted that the policies in the February 2021 draft Official Plan for mineral aggregate resources have been enhanced to include policies that apply to minerals and other policy language that implements the current PPS.

The Rideau Lakes OP includes a map of each Township ward and each includes the Mineral Resource designation. Section 3.3 of the Rideau Lakes OP indicates that the designation reflects the extent of resources and existing operations and is based on information provided by the MNRF and the MNDM. It is further noted that:

In certain cases, areas having mineral aggregate or mineral potential have been excluded from the Mineral Resource designation due to contextual considerations such as proximity to natural heritage features such as wetlands and ANSIs, existing incompatible land uses or the shorelines of water bodies.

On the basis of the above, the policy above indicates that a scoping exercise was undertaken to delineate the sand and gravel and bedrock resources within the Township, however it is not clear what buffers were applied in the refinement process.

Section 3.3.2 of the Rideau Lakes OP permits a number of uses in the Mineral Resource designation such as aggregate-related uses, mineral-related uses, agriculture, forestry, conservation and outdoor recreation as long as such uses do not generally include buildings or activities that would preclude or hinder the establishment of new aggregate operations.

In addition to the above, Section 3.3.3 of the Rideau Lakes OP includes policies that apply to lands within the Mineral Resource designation. In this regard, Section 3.3.3.2 indicates that new operations, as well as expansions to existing operations will be established through an amendment to the Zoning By-law and also may require other studies to support the proposal.

Section 3.3.3.3 of the Rideau Lakes OP establishes influence areas and it reads as follows:

Lands within the Mineral Resource designation that are not zoned for mineral aggregate or mineral mining operations shall be placed in an appropriate zone category in the Zoning By-law which will allow rurally-oriented uses, but which will not allow sensitive land uses such as residences, day care centres and educational and health

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facilities within the influence area of existing mineral aggregate and mining operations. Influence areas in relation to pits are 150 or 300 metres, depending upon the licence classification of the pit, as well as whether the pit excavation extends above or below the water table. The influence area in relation to quarries is 500 metres.

On the basis of the above, the influence area for a pit depends on the license classification but it is either 150 metres or 300 metres. The influence area for a quarry is 500 metres.

5.10 Village of Westport

The Council for the Village of Westport adopted its Official Plan ('Westport OP') in March 2006 and it was approved, with modifications, by the MMAH on October 31, 2006. While there are no mineral aggregates within the boundaries of the Village, there is a quarry on lands adjacent to the Village. In this regard, the Westport OP includes a policy in Section 3.15 that applies to lands that are adjacent to the western boundary of the Village and reads as follows:

Although not within the boundaries of the Village, the Ministry of Natural Resources has indicated that currently there are two separate licensed quarries in the Township of Rideau Lakes. Therefore any development proposed within 50 metres of the western edge of the Village boundary, which is within 500 metres of a licensed quarry, will only be considered if it is supported by a compatibility study, undertaken by a qualified expert, which demonstrates that continued use of the mineral aggregate operation will not be precluded or hindered as a result of the proposed development. Implementation of this policy will require contact with the Township of Rideau Lakes. Current information with respect to the status and location of licensed mineral aggregate operations and technical advice in the preparation of the terms of reference for a compatibility study can be obtained from the Ministry of Natural Resources.

On the basis of the above, lands along the western edge of the Village boundary are within the 500 metre influence area of a licensed quarry and are required to submit a compatibility study to demonstrate that the continued use of the existing mineral aggregate operation will not be impacted.

5.11 Summary of Mapping in the Local Official Plans

Section 3.5.2 e) of the Counties OP enables local municipalities to refine the mapped boundaries of sand and gravel and bedrock resource areas in their respective Official Plans without an amendment to the Counties OP, until such time that the UCLG completes the ARMP. For ease of reference, Section 3.5.2 e) has been reproduced below.

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3.5.2 e) Until such time that an Aggregate Resources Master Plan has been prepared and implemented through an amendment to the Counties Official Plan, local municipalities in their local municipal Official Plans may adjust or refine the extent of the sand and gravel resource areas identified on Schedule B and the bedrock resource areas identified by the Province, and the extent to which the policies associated with deposits of mineral aggregate resources apply within these areas, without an amendment to the Counties Official Plan. Refinements or adjustments to the extent of the sand and gravel resource areas and the bedrock resource areas may be based on the consideration of the viability of the local resources, the location of settlement areas and existing development, the location of natural heritage features and areas, and setbacks from waterbodies, among other matters, and will be subject to provincial approval.

As noted above, while local refinements are permitted in the Counties OP, Provincial approval is still required, however, it is noted that the Province is not the approval authority for local Official Plans. In addition, the wording in this policy makes it clear that this applies until the UCLG completes the ARMP and implements the ARMP in the Counties OP through an Official Plan Amendment.

On the basis of the above, the UCLG could continue to permit the local municipalities to complete minor refinements to sand and gravel and bedrock resource boundaries in the same manner that it permits refinements to certain natural heritage features, as established in Section 4.2 a) of the Counties OP. However, if local refinements to sand and gravel and bedrock resources are permitted in the Counties OP, it should be clear in the policy framework that such refinements are subject to a review by the UCLG.

Sections 5.1-5.11 of this ARMP provided an overview of the policies in the 10 local Official Plans with respect to mineral aggregate designations and mapping. In this regard, 8 of the local municipalities include a map that identifies sand and gravel resources while only 5 of the local municipalities include a map that identifies bedrock resources.

In addition to the above, there are 6 local municipalities that have completed a scoping exercise for sand and gravel and/or bedrock resources. Based on a review of the local Official Plans, it is not clear exactly which factors (e.g. extent of buffers) were included in the scoping exercises, however there is reference to certain types of features being excluded (e.g. Provincially significant wetlands).

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Below is a summary table of the mapped aggregate resources in the local Official Plans. The green highlighted rows indicate that a scoping exercise to delineate aggregate resources has been completed, as referenced in the respective Official Plan policies.

Local Municipality	Sand and Gravel Resource Mapping	Bedrock Resource Mapping
Athens	Yes	Yes
Augusta	No	Yes
Edwardsburgh Cardinal	Yes	Yes
Elizabethtown-Kitley	Yes	No
Front of Yonge	Yes	No
Leeds and the Thousand Islands	Yes	No
Merrickville-Wolford	Yes	No
North Grenville	Yes	Yes
Rideau Lakes	Yes	Yes
Westport	No	No

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6. WHAT WE'VE HEARD

The purpose of this section of the ARMP is to provide a summary of the comments that have been received by the UCLG during the study process. The ARMP study process included a number of meetings with the Technical Steering Committee ('TSC') as well as open house meetings with industry stakeholders and the public. A statutory Public Meeting was also held to present the proposed Official Plan Amendment. Below is a summary of the meetings and comments that have been received by the UCLG.

6.1 Technical Steering Committee Meetings

The ARMP study process was overseen by the TSC. The TSC includes Counties staff, local municipal staff, as well as individuals from the MMAH, MNDM and the MNRF. On March 5, 2021, the TSC held its first meeting and it provided an opportunity to introduce the consulting team, describe ARMP study process and obtain initial feedback from the members on the TSC on the considerations that should be included in the ARMP study process.

Following the preparation of the first draft ARMP, a second TSC meeting was held on October 4, 2021. The purpose of this meeting was to seek input from the TSC on the draft ARMP and proposed policies for the Counties OP.

A number of questions were raised about how the clusters of development would be identified and requests were made to the UCLG to prepare an informal guidance document on what should be considered in determining whether a cluster exists.

There were also comments on the assessment requirements in the proposed policy framework and who constitutes a qualified professional that would be able to review and comment on a mineral aggregate resources study. In this regard, it was indicated that local judgement would be required depending on the type of information that is being requested and that would need to be reviewed.

In addition to the above, there was also a discussion on the approach to bedrock mapping and a suggestion that bedrock overburden of 5 metres or more is not economically feasible. In this regard, staff from the MNDMNRF indicated that the ARIP 183 (and Provincial direction) has been that 8 metres of overburden is the generally accepted cut-off for overburden before extraction becomes unfeasible. However, there could be scenarios where a greater overburden is economically feasible when determining other factors such as distance to market or other operations.

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6.2 Industry Stakeholder Meetings

On April 9, 2021, the Counties hosted an industry stakeholder meeting that was attended by 15 aggregate license holders within the Counties. The intent of this meeting was to introduce the ARMP study process and obtain initial input from license holders on study considerations.

A number of questions were raised about the proposed bedrock mapping and how the bedrock boundaries are determined. In this regard, it was noted that the Province has mapped mineral aggregate resources (as shown in the ARIP 183), which identifies Selected Sand and Gravel Resource Areas and Selected Bedrock Resource Areas. With respect to bedrock resources, the ARIP 183 recommends that areas with a drift thickness between 0 metres and 8 metres be identified in an Official Plan. The proposed bedrock mapping will implement the extent of resources within the ARIP 183 and in addition will also apply pre-emptive constraints, which may exclude certain lands.

There were also comments and questions raised about residential clusters and how these are determined. In addition to this, it was indicated that it would be helpful for aggregate producers to know where these clusters were located since aggregate producers own many properties and purchase properties with the intent of using them for aggregate purposes in the future. In this regard, it was noted that the identification of residential clusters would be directed to the local municipalities and that the Counties OP would provide direction to the local municipalities on considerations for identifying such areas.

Comments were also raised about rehabilitation and aggregate assessments. In this regard, it was noted that the Counties OP currently addresses rehabilitation and that future policy framework would address the requirements for aggregate assessments.

Following the preparation of the first draft ARMP, a second industry stakeholder meeting was held on October 21, 2021. The purpose of this meeting was to seek input from the industry stakeholders on the draft ARMP and proposed policies for the Counties OP.

On the basis of the above, there was discussion on the intent of buffers applied to the proposed mapping. In this regard, it was noted that buffered areas are intended to exclude lands from being required to complete an assessment when development is being proposed within those areas.

There were also questions on clusters of development and how they would be identified and what happens in the interim

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between the time that the UCLG implements the ARMP in the Counties OP and the time that the local municipalities are updating their respective Official Plans. In this regard, it noted that the UCLG is focused on providing for a balance between rural development and protection of aggregate resources. It was further indicated that the determination of clusters of development would be a responsibility of the local municipalities and that the UCLG was considering the preparation of an informal guidance document to assist the local municipalities with making the determination.

6.3 Open House Meeting

On May 31, 2021, the Counties hosted its first Open House to discuss the ARMP. The Counties invited 50 license holders to the open house, along with local municipalities, adjacent municipalities, agencies and bodies such as cultural and conservation representatives, utility providers and First Nations representatives. Public notice was also included in newspapers, on the Counties website and posted on social media. The Open House was held online using the Microsoft Teams meeting platform and there were about 20 people in attendance.

The purpose of the Open House was to introduce the consulting team, provide a brief overview of the current policy framework, describe the project objectives, discuss the next steps in the work plan and to obtain preliminary feedback from participants.

A number of comments were made at the Open House on the extent of bedrock resources and the types of features that would be considered as pre-emptive constraints in the proposed mapping. Those in attendance suggested a number of features that should be considered in the mapping exercise such as the natural heritage system, local and/or regionally significant wetlands, forests, lands used for maple syrup production, lands that are classified as priority agriculture and the Rideau Canal, which is classified as a UNESCO World Heritage Site. It was noted that pre-emptive constraints are used to net out areas where aggregate extraction is unlikely and that the intent of the mapping exercise was to minimize the amount of areas being removed from the mapped resources in the ARIP 183. It was also mentioned that despite the final mapped resources, an application could still be made to establish a pit or quarry.

With respect to sand and gravel resources, a question was raised about the tertiary sand and gravel resources. During the Counties OP Review, the MNRF (through a comment letter dated December 2014) strongly recommended that primary, secondary **and** tertiary sand and gravel resources be

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identified on a schedule in the Counties OP. The MNRF recommended this because of the limited amount of sand and gravel resources within the UCLG.

Another question was raised about how bedrock resources will be classified within the Counties OP. In this regard, it was noted that a Bedrock Resource Overlay would likely be included within the Counties OP, rather than a land use designation. This means that a parcel of land may have a land use designation **and** be subject to the Bedrock Resource Overlay. In this regard, any development and/or activities in this circumstance would be subject to the policies of the Bedrock Resource Overlay as well as the land use designation to determine if development and/or activities are permitted.

In addition to the above, there were a number of comments made about the mineral aggregate policy framework. In this regard, it was suggested that the policy framework be clear and simplistic and reflective of the Provincial requirements to protect aggregate resources for long-term use. Comments were also made about there being consideration within the policy framework for better enabling license expansion opportunities and when studies and/or an assessment should or should not be required. A comment was also raised about specifically considering setbacks from roadways as a pre-emptive constraint, which would enable development along roadways. It was also suggested that the policy framework be tailored to address sand and gravel resources and aggregate resources separately.

6.4 Summary of Other Comments

Below is a summary of the other comments that the UCLG has received as part of the ARMP study process.

On February 23, 2021 staff at the MNDMNRF provided links to a bedrock geology layer and Paleozoic geology layers that are accessible through the OGS. In addition, staff noted that there may be some potential for aggregate sources in Precambrian rocks and further mentioned that granites and gabbro are becoming more common sources of road aggregate and are also being quarried for decorative aggregate. It was also noted that there is potential for developing sandstones, as shown on the Paleozoic map, as both crushed aggregate and as dimension stone. While this information provides additional layers to consider, only the data from the ARIP 183 was used in delineating bedrock and sand and gravel resources as the PPS requires the use of this dataset.

On April 9, 2021, the MNDMNRF also provided some initial comments to inform



the ARMP and noted their desire to see a certain level of rigor around applying Section 2.5.2.5 of the PPS to planning applications, including applications for severances. For ease of reference, Section 2.5.2.5 of the PPS has been reproduced below.

In known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if: a) resource use would not be feasible; or b) the proposed land use or development serves a greater long-term public interest; and c) issues of public health, public safety and environmental impact are addressed.

The MNDMNRF has noted that in assessing such applications, the quality of resource needs to be considered in conjunction with other constraints. The MNDMNRF also noted that severances in resource areas could have a significant constraining impact on the ability to extract a mineral resource and that the resources are non-renewable and fixed in place.

On April 14, 2021, Tomlinson Group ('Tomlinson') provided UCLG staff with their initial comments related to the protection of aggregate resources. Tomlinson provided an overview of PPS policies that require the protection of aggregate resources for long-term use as well as the requirement of municipalities to restrict development or activities on lands adjacent to aggregate resources that would preclude or hinder extraction.

Tomlinson questioned the pre-emptive constraints and, in particular, how residential clusters are defined. In their opinion, site-specific applications should be the appropriate method to determine setbacks from adjacent residential uses rather than using constraints to remove areas from aggregate mapping.

Tomlinson also expressed concern with the statement that the Counties may pre-identify uses and types of applications that would not be subject to the preclude and hinder policies in the PPS.

In addition to the above, Tomlinson noted that a Counties OP Amendment should not be required if the local municipalities require an Official Plan Amendment and Zoning By-law Amendment (as is the current practice). In their opinion, requiring a planning process at the UCLG level would add unnecessary red tape and delay for aggregate applications.

Lastly, Tomlinson indicated that the mapping should not just be treated as a screening tool when other land uses are proposed. In this regard, Tomlinson noted that the function of the mapping is also to protect and identify

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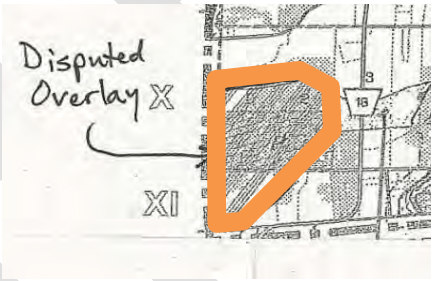
significant aggregate resources that should work in conjunction with the Counties OP policies.

On May 14, 2021, Tom Graham from Songwood Farm provided background on an OMB Decision to remove an area behind the Songwood Farm property from the Bedrock Resource Overlay that was established in the North Grenville OP. Below is a summary of the appeal and the OMB Decision.

On May 11, 2009, the Municipality of North Grenville adopted the North Grenville OP and it was forwarded to the MMAH for approval May 29, 2009. Following the adoption and approval of the North Grenville OP, the MNDM released ARIP 183 on June 3, 2009. In response, based on communications between North Grenville, the MMAH and the MNRF, North Grenville modified Appendix A1 of the North Grenville OP to include a Bedrock Resource Overlay and the inclusion of policies related to bedrock resources. On August 20, 2009, the MMAH approved, with modifications, the North Grenville OP and a Notice of the Decision was issued on August 21, 2009.

Following the MMAH approval, the North Grenville OP was appealed to the OLT on August 31, 2009. One of the appeals was made by Tom Graham, the owner of Songwood Farm, on the basis that it was inappropriate to include the lands in the Bedrock Resource Overlay because of the location of houses surrounding the property, topography and the existence of an unrated wetland.

The graphic below shows the area subject to the appeal, otherwise referred to as the 'Disputed Overlay' in orange outline.



At the time, staff from the MNRF and the Municipality of North Grenville were involved in surveying the site and agreed that the lands should not be identified as being within the Bedrock Resource Overlay.

On February 2, 2010, the OMB issued a Decision to allow the appeal, in part, to the North Grenville OP. On this basis, the Decision modified Schedule A1 of the North Grenville OP to remove the Disputed Overlay from a portion of the Bedrock Resource Overlay.

Below is a graphic that shows the area that remains as Bedrock Resource Overlay in yellow.



On May 31, 2021, Mr. James Bertram provided the UCLG with a study prepared by Lansink Appraisals and Consulting ('Lansink Report') titled '*Case Study Analyses: Diminution in Price (if any) to Residential Real Estate, Located in the Vicinity of an Existing or Proposed Ontario Pit or Quarry*', dated July 2013. The purpose of the Lansink Report was to evaluate properties in southern and eastern Ontario that are located within the influence area of an active or proposed pit or quarry or haul route and to determine whether or not the presence of an aggregate operation impacted property value.

The study analyzed specific examples that occurred within the open real estate market in order to isolate the impact on property values caused by a pit or quarry. In this regard, the Lansink Report findings identified 19 examples from across Ontario (none in Leeds and Grenville) that suggested a very high probability that there would be price diminution if a residential property is located within the influence of a pit, quarry or along a haul route.

On June 18, 2021, the UCLG received a letter from MHBC ('Tomlinson letter'), on behalf of Tomlinson, on the proposed aggregate mapping. In this regard, the letter provides a background on Tomlinson's aggregate production history, reviews the applicable PPS policy with respect to mineral aggregates and indicates that the proposed aggregate mapping should not only be viewed as a screening tool but that its function should also be to protect and identify significant aggregate resource areas and be supported by Official Plan policies.

In addition to the above, the Tomlinson letter recommends that the UCLG identify as much of the primary, secondary and tertiary sand and gravel resources as possible due to the relatively limited extent of sand and gravel resources within the UCLG. In addition, the proposed approach of using a cut-off of 8 metres or less is appropriate for bedrock resources, but cautioned situations where viable sand and gravel overlays high quality bedrock. In these circumstances, it is noted that the ARIP could show a greater depth of overburden for bedrock even though there are two viable deposits on a site.

The Tomlinson letter suggests that further discussion and/or evaluation is needed on the pre-emptive constraints (e.g. defining



residential clusters) and the 500 metre setback area from settlement areas. The Tomlinson letter also expressed concern with pre-identifying uses and types of applications that do not require consideration of the preclude and hinder policies in the PPS.

Lastly, the Tomlinson letter recommends that a Counties OP Amendment should not be required for aggregate applications and that only applications to the local municipalities for a local Official Plan Amendment and/or Zoning By-law Amendment should be required to avoid unnecessary duplication and red tape.

On June 23, 2021, the UCLG received a letter from MHBC ('Tackaberry letter'), on behalf of G. Tackaberry & Sons Construction Co. Ltd. ('Tackaberry'), on the proposed aggregate mapping and severance activity in rural areas. The Tackaberry letter provides a background on Tackaberry's aggregate production history, recognizes the requirement of the PPS to identify aggregate resources on a map and also includes a number of concerns about the pre-emptive constraints and severance approvals in the area. In this regard, the Tackaberry letter questions how residential clusters are defined and notes that depending on how residential clusters are defined it may arbitrarily exclude high quality resource areas where extraction could still be feasible. Concerns were also raised about the 500-metre setback from settlement areas and whether this setback considers different types of operations.

In addition to the above, the Tackaberry letter recognizes that being identified on the proposed aggregate mapping does not mean that aggregate extraction is the only permitted use or activity. In this regard, the Tackaberry letter requests that the proposed policy framework specifically include policies that acknowledge that aggregate applications outside of mapped areas are not precluded or restricted. The Tackaberry letter also recommends that a Counties OP Amendment not be required for an application for an aggregate operation.

Lastly, the Tackaberry letter noted that there was discussion at the Open House about the ability to continue to accommodate severances in rural areas. Further, the Tackaberry letter notes that they have observed a higher level of severance activity recently near their licensed pits and quarries in the UCLG. The Tackaberry letter indicates that if municipalities are determining that such severances are appropriate and would not preclude or hinder existing aggregate operations then it is recommended that at a minimum the approval be conditional on placing a warning clause on title to ensure that the future purchaser or landowner is aware of the presence of a licensed

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aggregate operation and mapped deposit areas. The Tackaberry letter further requests that the UCLG consider including this requirement in the policy framework for the ARMP.

The Counties also received a number of requests to consider prioritizing bedrock into primary and secondary classifications (based on overburden depth and/or deposit depth) or limiting bedrock classifications to specified (e.g. 1 or 5 metre) overburden depths. These options were discussed with the Ministries who indicated that they are supportive of mapping that includes overburden depths of 0 to 8 metres as mapped in the ARIP 183. It was also noted that any deviation from this approach would not be consistent with the PPS, which required municipalities to identify deposits of mineral aggregate resources as delineated in the ARIP.

The UCLG also received two requests that pits and quarries be noted separately on the mapping. Pits and quarries are already identified by type on Schedule B to the Counties OP and this was not being proposed to change.

In addition to the above, on November 9, 2021, the UCLG also circulated a draft Official Plan Amendment ('OPA') to local municipalities and agencies for their review and comment. In response to the comments received from this circulation, the proposed OPA was updated to clarify:

- The definition of a cluster of development (4 or more lots near an intersection, 3 or more lots close together on the same side of a road or across from each other). Sketches have also been prepared in a separate guideline document to visually show what a cluster of development could look like;
- The opportunity for local municipal staff to undertake a desktop review to waive/scope professional assessment requirements;
- Which government body requests/accepts professional assessments (local municipality, with the Counties reserving the right to request/accept where it is the approval authority;
- The transportation network considerations (ability of the road to handle traffic associated with extraction activities, and the distance from a provincial highway);
- That a Counties Official Plan application is not required and local official plans will determine which planning applications (local official plan amendment and/or zoning by-law amendment) are required for new or expanding aggregate operations; and,

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- The natural and cultural heritage considerations when considering new aggregate operations or an expansion to an existing operation.

6.5 Statutory Public Meeting

On December 14, 2021, a statutory Public Meeting was held to consider the proposed Official Plan Amendment ('OPA') to implement the Aggregate Resources Master Plan. In accordance with the requirements of the Planning Act, a notice of statutory Public Meeting for the Counties proposed Official Plan Amendment was advertised in various newspapers across the Counties. The notice was also mailed to applicable agencies as set out in the Planning Act and interested members of the public, including aggregate producers and licence holders. The notice was also available on the Counties website and by request from Planning staff prior to the Public Meeting.

For the Public Meeting, staff prepared a report to the Planning Advisory Committee ('PAC') that provided an overview of the study process and consultation, followed by a discussion of comments and considerations that informed the preparation of OPA. Meridian Planning Consultants delivered a presentation to the PAC. Following the presentation, members of the PAC made comments on the proposed OPA. There were no members of the public present who wished to speak on the amendment.

Following the question and comment period, the Clerk advised the PAC of three written correspondence documents that were received by the UCLG following the posting of the agenda for the Public Meeting. As a result of this, the PAC directed staff to review, consider and prepare a response to the three written correspondence documents. In addition, the UCLG also received a written comment after the public meeting that has also been reviewed and considered. Below is a summary of the comments and response to each.

On December 13, 2021, the UCLG received correspondence from the Municipality of North Grenville in the form of a Council resolution from their Council meeting on December 8, 2021. Staff provided Council with Report PD-063-2021, titled *'Aggregate Resources Master Plan – Support for Edwardsburgh Cardinal Resolution'*, and Council adopted the following resolution:

"That Council support the resolution from Edwardsburgh Cardinal to reduce the overburden for bedrock resources as identified in the Aggregate Resources Master Plan from 8 metres to 5 metres."

As noted above, the Municipality of North Grenville's resolution supports a resolution

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that was adopted by the Council for the Township of Edwardsburgh-Cardinal at their Council meeting on September 27, 2021. The resolution indicated that bedrock resources with an overburden of 8 metres was uneconomical and that an overburden of 5 metres would be more economical.

The UCLG received the Township of Edwardsburgh-Cardinal resolution in November 2021. Through the process of preparing the Aggregate Resources Master Plan, the UCLG also received a number of requests to consider limiting bedrock classifications to specified overburden depths. These options were discussed with the provincial Ministries and they confirmed that bedrock mapping at 5-metre intervals for overburden were not available.

The Ministries further indicated that they were not supportive of proposed mapping that implements an alternative overburden cutoff other than what is recommended in the Aggregate Resource Inventory Paper #183 (ARIP), which identified significant bedrock resource area as those areas that have an overburden depth of 0 to 8 metres. The Ministries also indicated that bedrock operations at 0 to 8 metres are feasible particularly when planning for the long-term and that any different classifications of bedrock overburden mapping is not consistent with the Provincial Policy Statement (2020), which requires municipalities to identify deposits of mineral aggregate resources as delineated in the ARIP as established by the province. In this regard, no changes were recommended to the proposed OPA.

On December 14, 2021, the UCLG received correspondence from the Township of Augusta in the form of a Council report prepared by Planning staff (Report 2021-120). The recommendation contained within the report reads as follows:

"THAT the Planner's report of December 13, 2021, be received for information and this report be forwarded to the United Counties of Leeds and Grenville for consideration of the two recommendations respecting the proposed Aggregate Resources Amendment, as highlighted on page 3."

The two recommendations contained within the report are reproduced below.

1. It is recommended that in lieu of listing "exempted" types of development or planning applications from having to undertake an aggregates assessment study, for clarity, ease of implementation, and transparency, that the policies instead, or in addition to, list the types of applications that would warrant a consultant's assessment study of the impact on aggregate resources to support certain planning applications, e.g. new residential lot creation applications,

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institutional uses, Official Plan Amendments, other.

2. It is recommended that these adjacent land/buffers of 300 m from sand and gravel resource areas and 500 m from Bedrock Resource Areas be added as a "note" to the screening map, for ease of policy reference/implementation, so these potential influence areas are flagged more immediately on the screening map itself.

In response to the first recommendation above, the proposed OPA includes a list of planning applications that are exempt from an aggregate assessment. This means that if a development application is not on the list, then it requires an aggregate assessment. It is our opinion that this approach provides more clarity, rather than identifying the types of planning applications or scenarios where an aggregate assessment would be required. It is noted that there are two other baskets of exemptions as well that relate to agricultural uses and development as well as clusters of residential development. In this regard, no changes were recommended to the proposed OPA.

In response to the second recommendation above, the current Schedule A to the proposed OPA 3 includes the Selected Sand and Gravel and Bedrock Resource Areas as well as constraints and buffers that have been applied. However, it is noted that the policy framework also includes reference to influence areas for sand and gravel (300 metres) and bedrock resources (500 metres) and this is not currently identified on the proposed Schedule A. In this regard, it was recommended that Schedule A to the proposed OPA be updated to include a note that references the policies that address influence areas.

On December 13, 2021, the UCLG received emailed comments from Mr. Graham of Songwood Farm on the proposed OPA. Mr. Graham's first comment concerns significant groundwater recharge areas. It is indicated that many of the areas identified as 'Selected Sand and Gravel Resource Area (Tertiary)' on Schedule A coincide with RVCA's Significant Groundwater Recharge Areas. Mr. Graham feels that the deposits of sand and gravel should not be identified as gravel resources and should otherwise be protected as areas for natural features such as wildlife and drinking water.

Mr. Graham's second comment indicates that the draft Aggregate Resources Master Plan and the proposed OPA do not include reference to Source Water Protection, Significant Groundwater Recharge Area and Highly Vulnerable Aquifers. It is noted that Mr. Graham provided a similar comment to the UCLG on October 18, 2021 in response to his review of the initial draft Aggregate Resources Master Plan.



In response to Mr. Graham's comments, the Source Water Protection Act continues to apply to all lands identified in Appendix 3 to the UCLG Official Plan and this includes lands that may also be identified as Selected Bedrock Resource Area or a Selected Sand and Gravel Resource Area in Schedule A to the proposed OPA. Section 4.4 of the UCLG Official Plan currently contains a number of policies on water resources and source water protection. It is noted that a number of updates were made to policies contained in the proposed OPA to include locally significant wetlands, other wetlands, watercourses and drinking water sources. In this regard, no changes were recommended to the proposed OPA.

On December 31, 2021, the UCLG received comments from Mr. Tony Sevelka of International Forensic & Litigation Appraisal Services Inc. on the draft Aggregate Resources Master Plan (October 4, 2021). Mr. Sevelka's comments are focused on the issue of fly-rock that is associated with blasting at aggregate operations. Mr. Sevelka considers fly-rock as an adverse effect and suggests that aggregate policies should require blasting quarries to locate further than 1,000 metres from sensitive receptors to provide protection from fly-rock.

It is noted that a number of constraints and buffers have been applied to the area identified as Selected Sand and Gravel and Bedrock Resource Areas. These are based on known features and on fixed boundaries such as settlement area boundaries. Aggregate operations that use blasting may generate fly-rock and the extent of the impact of fly-rock can vary from site-to-site, the extent of blasting and other components of the operation itself. In addition, the need for setbacks is determined through the Aggregate Resources Act process that is administered by the province. As a result of the associated variability of fly-rock, it is our opinion that establishing a minimum setback for fly-rock in the Official Plan is not appropriate.

In addition to the above, as of January 1, 2022, new operating requirements for the Aggregate Resources Regulation (Ontario Regulation 244/97) came into force that require aggregate operations with a blasting component to implement measures to prevent fly-rock from leaving the site during blasting if a sensitive receptor is located within 500 metres of the boundary of the site.

On the basis of the above, it is noted that the proposed OPA requires any application for a new or expanding operation to demonstrate that certain factors will be minimized and this includes noise, dust and vibration to name a few. In this regard, it was recommended that the proposed OPA be



updated to add fly-rock to the list of factors to be considered when a planning application is submitted for a new or expanding aggregate operation.

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7. PROPOSED MAPPING

The purpose of this section of the ARMP is to provide an overview of the factors that were considered in developing the proposed mapping. **Appendix A** to this ARMP includes a map of the proposed Selected Bedrock Resource Areas and **Appendix B** includes a map of the proposed Selected Sand and Gravel Resource Areas.

Section 2.5.1 of the PPS requires that all Official Plans contain mapping showing the location of deposits of mineral aggregate resources.

It is important to note that mapping of deposits of mineral aggregate resources are intended to serve as a screening tool when applications to develop other land uses are proposed. A screening tool is a resource used by a municipality and/or applicant to determine which land use designations and other land use considerations apply when a new land use is being proposed.

In addition to the above, the mapping of deposits of aggregate resources is also intended to ensure that the mineral aggregate resources are protected for long-term use. While the area that is the site of Selected Bedrock Resource Areas is significant, it is important to note that it does not establish the principle of establishing a resource use on the lands and the same approval process applies for new resource uses regardless of location. It also does not mean that the use of lands for a mineral aggregate operation is a preferred land use over other land uses provided the other land uses do not preclude or hinder extraction.

In the case of the Counties OP (as approved by the MMAH on February 19, 2016), Schedule B: Mineral and Mineral Aggregate Resources already identifies the location of Selected Sand and Gravel Resource Areas of primary, secondary and tertiary significance. However, Schedule B does not include mapping showing the location of Selected Bedrock Resource Areas because of concerns about the accuracy of the mapping and the extent of the area to be included at the time that the Counties OP was prepared.

Below is an overview of the proposed mapping of Selected Sand and Gravel and Bedrock Resource Areas.

7.1 Proposed Selected Bedrock Resource Area Map

The ARIP 183 includes information on the location of Selected Bedrock Resource Areas in the UCLG. It is noted that Aggregate Resources of Ontario ('ARO') updates aggregate mapping on an annual basis when new information is acquired by the MNDMNRF, such as new boreholes, pits/quarries or other fieldwork collected and verified by OGS staff. In this regard, the

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ARO data relied upon as a base for the UCLG ARMP identifies additional lands as Selected Bedrock Resource Areas than the ARIP 183.

The ARIP 183 recommends that areas with a drift thickness between 0 metres and 8 metres be identified in an Official Plan. In this regard, any identified bedrock resources that contain a drift thickness of greater than 8 metres, as per the ARIP 183, was not included in the proposed Selected Bedrock Resource Area map for the ARMP.

As noted earlier in this ARMP, the UCLG is underlain by Precambrian rocks, the Cambro-Ordovician Potsdam Group and the Ordovician March, Oxford and Gull River Formations. Areas of the Cambro-Ordovician Potsdam Group include the Covey Hill and Nepean Formations, which consists of fine- to coarse-grained quartz sandstone with interbeds of quartz-pebble conglomerate (as noted in the ARIP 183). With respect to these formations in certain areas, the ARIP 183 notes the following:

Areas of the Potsdam Group have not been identified on the map nor have drift thickness or depth of overburden been calculated because this group has no potential for use in aggregate production.

On the basis of the above, these formations are within the ARIP 183 dataset but are not identified as being within a Selected Bedrock Resource Area.

On the basis of the above, only the 7 areas identified as Selected Bedrock Resource Area, as identified in the ARIP 183, were identified on the proposed Selected Bedrock Resource Area map.

In addition to the above, there are a number of physical constraints that were considered in preparing the proposed mapping and these include:

- Provincially significant wetlands;
- Provincially significant Areas of Natural and Scientific Interest ('ANSI');
- Lakes; and,
- Rivers.

The proposed mapping also took into account buffer areas from a number of features. In this regard, the following lands were excluded from the proposed mapping:

- Lands within 500 metres of the boundary of a settlement area;
- Lands within 120 metres of the boundary of a Provincially significant wetland;
- Lands within 120 metres of the boundary of a Provincially significant ANSI; and,

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- Lands within 500 metres of the boundary of lakes and rivers.

The buffer areas above are intended to be an exclusion area, meaning that the lands within a buffer area are not captured within a resource area. The buffer areas are consistent with those implemented in other municipalities in Ontario.

Concerns have been raised about the impacts of the Selected Bedrock Resource Area map on future land use in rural areas, particularly as it relates to rural lot creation. At the Open House, lands within and adjacent to rural residential clusters were identified as a potential pre-emptive constraint. Given the size of the UCLG, pre-identifying all of the potential rural residential clusters for exclusion in the Counties OP would be very challenging and is best left to the local municipalities, where local context can be considered. In this regard, clusters of development in agricultural and rural lands designations are addressed in the proposed policy recommendations.

7.2 Proposed Selected Sand and Gravel Resource Area Map

Schedule B to the Counties OP currently identifies primary, secondary and tertiary Selected Sand and Gravel Resource Areas. However, the resources on this map do not exclude all of the physical constraints and other buffer areas identified above in **Section 7.1** of this ARMP.

On the basis of the above, the proposed Selected Sand and Gravel Resource Areas map modifies the existing Selected Sand and Gravel Resource Areas as shown on Schedule B to the Counties OP as they relate to Provincially significant wetlands, ANSI's, lakes, rivers and settlement areas in the same manner as described in **Section 7.1** as it relates to Selected Bedrock Resource Areas.

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8. OFFICIAL PLAN RECOMMENDATIONS

The purpose of this section of the ARMP is to provide a number of proposed policy recommendations and the rationale behind the proposed policies.

According to the proposed **Appendix A** to this ARMP, significant amounts of land are identified as being the site of Selected Bedrock Resource Areas in particular and concerns have been expressed about the implications of including so much land in this category on the potential for future development.

When Selected Bedrock Resource Areas are identified in an Official Plan, Section 2.5.2.5 of the PPS is triggered and this section reads as follows:

In known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if:

a) resource use would not be feasible; or

b) the proposed land use or development serves a greater long-term public interest; and

c) issues of public health, public safety and environmental impact are addressed.

As set out in Section 2.5.2.5 of the PPS, an assessment of the impacts of proposed development on the feasibility of resource extraction is required to be carried out whenever development is proposed, with development being defined as development requiring a Planning Act approval. It is noted that items a) and b) in Section 2.5.2.5 are separated by the word "or".

This means that a case can be made that a proposed land use or development serves a greater long-term public interest than a proposed resource use even if it is determined that resource use would be feasible. This means that the potential exists as part of the review of any application to make a determination on what use is in the greater long-term public interest to consider. In addition to the above, it is noted that one of the tests is: *"The resource use would not be feasible."* In this regard, the presence of a resource is not in of itself a determinant of whether it is feasible to extract. There are a number of factors that need to be considered to determine feasibility and these are identified in the proposed policies.

This section includes a set of proposed policies for the UCLG to consider. These proposed policies were prepared as a consequence of the discussions held with



the local municipalities, stakeholders and the public, our experience and our research into the approaches taken in other municipalities. Below is a brief overview of approaches taken in other municipalities.

In 2017, the Ministry approved an Official Plan Amendment for the County of Lennox & Addington ('L&A OP') that addressed selected bedrock resources and implemented the PPS 2014. In this regard, the L&A OP identified selected sand and gravel and bedrock resource areas on a map and includes policies that aim to protect mineral aggregate resource supply while also minimizing the impacts to planning approvals in the agricultural and rural areas. The policies implement the preclude and hinder tests as required by the PPS and also include a number of exemptions from the preclude and hinder tests. An influence area of 300 metres from a pit or 500 metres from a quarry is also established within the policy framework.

In addition to the above, in 2019 the District Municipality of Muskoka (District') adopted a new Official Plan ('Muskoka OP') that also contains policies that address sand and gravel and bedrock resources. The Muskoka OP identifies primary and secondary sand and gravel resource areas however it does not identify selected bedrock resource as the District is underlain by Precambrian gneissic rock that exhibits wide variations in lithology and aggregate quality. In this regard, the Muskoka OP recognizes that there may be local knowledge and locations of existing quarries that may be considered by the Area Municipalities if there is a desire to protect local significance.

The Muskoka OP requires a land use compatibility assessment for development that is within 300 metres of a pit or 500 metres of a quarry.

In addition to the above, the Muskoka OP identifies development that is exempted from an aggregate assessment such as development in urban centres and community areas, rezoning applications for development or expansions of a commercial, industrial or recreational use in the Rural Area or Waterfront Area designations, adjustments of a lot line for legal or technical reasons and any application for a minor variance, regardless of location.

The Region of Halton Official Plan ('Halton OP') is another example of an Official Plan that identifies and includes policies that apply to bedrock resources. The Halton OP requires a proponent of any land use changes through the Regional or Local official plan amendments, zoning amendments or consents to complete an assessment if the proposed development is within 300 metres of a pit or 500 metres of a quarry. In this regard, there are no

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exemptions to the requirement to complete an assessment if a proposed development is located within the influence areas identified above. However, it is noted that the Provincially significant wetlands and an area around them were excluded from the mapping in the Official Plan showing where the resource is located. For shale resource areas, the resource mapping also excludes lands within 500 metres of settlement areas. This approach was supported by the Province.

On the basis of the above, the policies contained in the Official Plans for Lennox and Addington, Muskoka and Halton serve as relevant examples for the types of policies that could be considered by the UCLG for the Counties OP.

On the basis of the above, the proposed policies for the UCLG aim to create a balance between protecting mineral aggregate resource areas and at the same time minimizing the impact of Section 2.5.2.5 of the PPS on future Planning Act approvals in the Agricultural Area and Rural Lands designations in the Counties OP.

As mentioned previously in this ARMP, Section 3.5.2 of the current Counties OP applies to Mineral Aggregate Resources. The proposed policies are intended to replace or modify the policies contained in Section 3.5.2 of the Counties OP.

The Official Plan recommendations have been divided into the following sub-sections:

1. Assessment Requirements;
2. Assessment Exemptions;
3. New or Expanding Mineral Aggregate Operations; and,
4. Mapping.

Below is an overview of the recommendations for updates to the Counties OP. Each subsection (except for the mapping sub-section) includes recommended policy changes and clarifies which section(s) of the Counties OP should be retained, modified or replaced.

8.1 Assessment Requirements

The purpose of this section of the ARMP is to provide a set of policies that address assessment requirements for lands that are within or adjacent to an aggregate resource area. When development is proposed within or adjacent to a resource area, an assessment may be required to determine whether the proposed development will preclude or hinder the extraction of a known aggregate resource.

This section includes a number of policies that deal with '*Assessment Requirements for Development in a Mineral Aggregate Resource Area*'. These policies are intended to replace those that are currently contained in **Sections 3.5.2 c), d) and g)** of the Counties

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OP. It is proposed that **Sections 3.5.2 a) and e)** be updated and **Sections 3.5.2 b), f) and h)** be retained. Below is a brief description of each of the above-mentioned policies.

Section **3.5.2 a)** of the Counties OP recognizes that mineral aggregate resources need to be protected for long term use, references the Counties OP schedule where these resources are identified and clarifies that the identification of resources does not mean that all lands will be used for aggregate extraction.

On the basis of the above, it is recommended that **Section 3.5.2 a)** be retained and updated to indicate that bedrock resources, in addition to sand and gravel resources, are also shown on a Schedule to the Counties OP. In addition, the sentence that notes that bedrock resources will be identified in local Official Plans should also be removed.

Section 3.5.2 b) of the Counties OP recognizes that there is the potential for viable deposits of mineral aggregates beyond those that are identified in the Counties OP. This means that an application can be made on lands beyond those that are identified, subject to there being sufficient quantity and quality of the resource and supporting studies. It is recommended that **Section 3.5.2 b)** be retained.

Section 3.5.2 c) of the Counties OP indicates that the Counties will complete an Aggregate Resources Master Plan that will identify resources and be implemented through an amendment to the Counties OP. In this regard, it is recommended that **Section 3.5.2 c)** be deleted in its entirety.

Section 3.5.2 d) of the Counties OP indicates that sand and gravel and bedrock resources will be identified in the local OPs until the Counties complete its Aggregate Resources Master Plan. In this regard, it is recommended that **Section 3.5.2 d)** be deleted in its entirety.

Section 3.5.2 e) of the Counties OP directs local municipalities to identify sand and gravel and bedrock resources in their local OPs and permits the adjustment or refinement of boundaries without a County Official Plan Amendment until the time that the Counties completes its Aggregate Resources Master Plan. This policy also sets out the considerations for making such an adjustment and is subject to Provincial approval. It is recommended that **Section 3.5.2 e)** be updated to allow for minor adjustments or refinements to the boundaries of sand and gravel and bedrock resources without an amendment to the County OP, subject to the review of the County, instead of the Province, who are not the approval authority for local Official Plan Amendments.

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Section 3.5.2 f) of the Counties OP requires the completion of an assessment for development proposals on lands within or adjacent to a known deposit of mineral aggregate resources. The policy clarifies that 'adjacent to' includes lands within 300 metres of a sand and gravel resources and 500 metres of a bedrock resource area. In this regard, it is recommended that **Section 3.5.2 f)** be retained.

Section 3.5.2 g) of the Counties OP indicates that until the Counties complete its Aggregate Resources Master Plan, the local municipalities may require that studies be completed to demonstrate that proposed development will not preclude or hinder the establishment of a new aggregate operation. The policy also provides for the waiving of studies in certain land use designations. It is recommended that **Section 3.5.2 g)** be deleted in its entirety.

Section 3.5.2 h) of the Counties OP requires that mineral aggregate resource conservation be undertaken, including accessory aggregate recycling facilities within operations, where feasible. It is recommended that **Section 3.5.2 h)** be retained.

In addition to the above, below are the proposed policies that address the assessment requirements for development in a mineral aggregate resource area and adjacent lands.

3.5.2.3 Assessment Requirements for Development in a Mineral Aggregate Resource Area and Adjacent Lands

a) ***Schedule B*** *identifies deposits of mineral aggregate resources, including Selected Sand and Gravel Resource Areas and Selected Bedrock Resource Areas, throughout the Counties. However, the identification of these deposits on* ***Schedule B*** *does not necessarily mean that all areas identified are appropriate for the development of mineral aggregate operations, because of reasons such as natural heritage, land use compatibility, transportation, accessibility, quantity and/or hydrogeological constraints nor does it imply that the quality of the mineral aggregate resource at any given location is also suitable. The effect of the mapping is such that it acts as a screening tool for the purposes of this section of the Plan.*

b) *For the purposes of the policies in Section 3.5.2 d) of this Plan, adjacent lands means:*

   i. *Lands within 300 metres of Selected Sand and Gravel Resource Areas and 500 metres of Selected Bedrock Resource Areas within the boundary of the Potential Development Constraint*

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*Overlay (Screening Map) as identified on **Schedule B** of this Plan;*

ii. *Lands within 300 metres of the licensed boundary of an existing pit and lands within 500 metres of the licensed boundary of an existing quarry and,*

iii. *Notwithstanding i. above, adjacent lands do not apply to:*

i. *Lands within 500 metres of the boundary of a settlement area;*

ii. *Lands within a Provincially significant wetland or within 120 metres of the boundary of a Provincially significant wetland;*

iii. *Lands within a Provincially significant Area of Natural and Scientific Interest or within 120 metres of the boundary of a Provincially significant Area of Natural and Scientific Interest; and,*

iv. *Lands within 500 metres of the boundary of lakes or rivers.*

c) *In cases where a proposed development is not exempt under Section 3.5.2.3 b) of this Plan or in accordance with Sections 3.5.2.4, 3.5.2.5 and 3.5.2.6, the local municipality may require studies to demonstrate that the proposed development will not preclude or hinder current or future extraction operations and/or access to the resources or in the alternative that resource use would not be feasible or alternatively that the proposed land use or development serves a greater long-term public interest and that issues of public health, public safety and environmental impact are addressed.*

d) *In addition to the above and in cases where a proposed development is not exempt under Section 3.5.2.3 b) of this Plan or in accordance with Sections 3.5.2.4, 3.5.2.5 and 3.5.2.6, the local municipality, may scope or waive any of the assessment requirements in Section 3.5.2.3 e) as a result of undertaking a desktop analysis of the available information against the criteria in Section 2.5.2.5 of the Provincial Policy Statement to justify that no further information is required to assess the proposed development, if the local municipality is satisfied that the information is not required or not relevant to assess an application for a proposed development on lands that have been identified as deposits of mineral aggregate resources or adjacent lands.*

e) *The following factors shall be considered by the local municipality, where relevant and appropriate, in determining whether an assessment is required in support of an application for development on lands that have been identified as deposits of mineral aggregate resources in accordance with the applicable Aggregate Resource*

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Inventory Paper for the Counties, and adjacent lands on Schedule B and the criteria to be considered in an assessment if it is determined to be required:

i. *The nature and location of other aggregate and non-aggregate resource uses in the area and their potential impact on the feasibility of establishing a mineral aggregate operation on the subject lands and adjacent lands;*
ii. *The nature and location of the potential land uses in the area based on the land use policies in the local Official Plan and zoning bylaw particularly if the land uses have yet to be established;*
iii. *The nature of the current road network in the area, consideration of future roads being added to the road network in the area and the ability to potentially accommodate mineral aggregate operations in the future. It is recognized the provincial highway network is the main transportation route to markets;*
iv. *The configuration of the parcels of land in the area and whether the parcels are individually or collectively large enough and of a shape that would support mineral aggregate operations;*
v. *The depth of the overburden on the subject lands and on adjacent lands and whether the depth precludes the economical extraction of the mineral aggregate resource;*
vi. *The quality of the mineral aggregate resource on the subject lands and in the immediate area;*
vii. *The nature and potential impact of natural heritage features and areas in the immediate area on the potential for mineral aggregate operations in the area in the future;*
viii. *The nature and location of any sensitive surface water and ground water features in the area and its impact on mineral aggregate operations; and,*
ix. *The presence of significant built heritage resources, protected heritage properties, significant cultural heritage landscapes and significant archaeological resources on the subject lands or in the immediate area.*

f) *Where an assessment is determined to be required, proponents shall submit a mineral aggregate resources study completed by a qualified professional to demonstrate that the criteria of Section 3.5.2.3 e) have been met to the satisfaction of the local municipality. The Counties and/or the local municipality may look to the Province to provide information with respect to proposals*

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affecting deposits of mineral aggregate resources. Aggregate resource testing and statements from local industry representatives may be recommended to better assess the viability of the resource.

g) *In cases where the Counties is the approval authority, the Counties has the ability to request an assessment, the methodology and conclusions of which shall be to the satisfaction of the Counties. The Counties also has the ability to have the mineral aggregate resources study peer reviewed at the applicant's cost.*

8.2 Assessment Exemptions

The purpose of this section of the ARMP is to clarify the types of scenarios or development that may be exempt from an assessment described in the proposed policies in **Section 8.1**.

Below are a number of proposed policies that deal with exemptions as they relate to clusters of development, agricultural related development and other types of Planning Act applications that could be exempt from requiring an assessment as per Section 2.5.2.5 of the PPS.

3.5.2.4 Exemption #1 to Section 3.5.2.3 – Clusters of Development in the Agricultural Area and Rural Lands Designations

a) *Any form of development within clusters of non-agricultural development outside of settlement areas is exempted from Section 3.5.2.3 of this Plan, with the determination of where such clusters are located to be made by the local municipalities on a site-specific basis based on policies contained in the municipal Official Plan.*

b) *Local municipal Official Plans shall contain policies that address clusters of development. Until such time, the policies contained in the Counties Official Plan shall provide guidance on the determination of a cluster of development, to be made on a site-specific basis.*

c) *Examples of clusters include 4 or more lots near the intersection of two roads (on one or more corners), 3 or more lots that are close together on the same side of the road or across from each other.*

d) *Factors to consider in making a determination on whether a cluster exists are below:*

   i. *For such a cluster to be a cluster, the residential and other non-agricultural uses in the cluster should be predominately located on smaller lots that do not exceed 2.5 hectares in size.*

   ii. *If one or more uses inside the cluster were located on lots that have a considerable depth, only the portion*

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of the lots in the cluster would be considered.

iii. *Vacant and potentially developable land within the cluster would be included in the cluster provided the residential and other non-agricultural uses are located close enough together.*

iv. *Lands between the edge of a cluster and a nearby physical feature such as a watercourse can be included in the cluster as well.*

3.5.2.5 Exemption #2 to Section 3.5.2.3 – Agricultural Development

The development and/or expansion of an agricultural use, an agriculture-related use and/or an on-farm diversified use, whether it involves the development of buildings or structures or not, is exempted from Section 3.5.2.3 of this Plan, regardless of whether a Planning Act approval is required.

3.5.2.6 Exemption #3 to Section 3.5.2.3 – Types of Planning Act Applications

The following applications are exempted from Section 3.5.2.3 of this Plan:

a) *The creation of a new lot for an agricultural use or an agriculture-related use;*
b) *The creation of a lot to accommodate an existing habitable farm dwelling that has become surplus to a farming operation;*
c) *The adjustment of a lot line for legal or technical reasons;*
d) *The re-zoning of land for the development or expansion of a commercial, industrial or recreational use in the Agricultural Area and Rural Lands designations provided an amendment to the local Official Plan is not required and provided the use does not include the establishment of dwelling units or accommodation units;*
e) *The expansion of a legal non-conforming use, provided such an expansion meets all of the other tests in the local Official Plan; and,*
f) *Any application for site plan or minor variance, regardless of location.*

8.3 New or Expanding Mineral Aggregate Operations

The purpose of this section of the ARMP is to propose other policies that apply to mineral aggregate operations. **Section 3.5.2.1** of the current Counties OP addresses '*New or Expanding Mineral Resource* Operations' and is proposed to be retitled 'New or Expanding Mineral Aggregate Operations'. It is recommended that **Section 3.5.2.1 a)** and **b)** of the Counties OP be modified, and **Section 3.5.2.1 c)** be replaced with the proposed policies below under '*New or Expanding Mineral Aggregate Operations*'. In addition, it is recommended that **Sections**

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3.5.2.1 d), e) and f) of the Counties OP be retained. Below is a brief description of each of the above-mentioned policies.

Section 3.5.2.1 a) requires a local Official Plan Amendment for any new or expanding mineral aggregate operations, but not a Counties OP Amendment. In this regard, it is recommended that **Section 3.5.2.1 a)** be modified to remove references to local Official Plan Amendments, but retain the policy language that confirms that a Counties OP Amendment is not required to identify new or expanding aggregate resource operations.

Section 3.5.2.1 b) identifies evaluative criteria that must be met when considering new or expanding aggregate operations and a local Official Plan Amendment. It is recommended that **Section 3.5.2.1 b)** in the Counties OP be modified to include additional evaluative criteria such as:

- *Significant natural heritage features, including locally significant wetlands, and other wetlands;*
- *Watercourses and fish habitat;*
- *Species at risk habitat;*
- *Drinking water sources including municipal and private drinking water sources;*
- *The impact of noise, dust, fly rock and vibration; and,*
- *The impact of a mineral aggregate operation on agricultural resources cultural-heritage resources and water resources.*

Section 3.5.2.1 c) enables the Counties ARMP to consider studies that consider potential cumulative impacts of proposed aggregate operations on past, present and other known mineral aggregate resource applications in the vicinity. In this regard, there are other proposed policies in this section of the ARMP that deal with assessing cumulative impacts and for this reason it is recommended that **Section 3.5.2.1 c)** be deleted in its entirety.

Section 3.5.2.1 d) requires a pre-application consultation with the Province, Counties, local municipality and Conservation Authority. It is recommended that **Section 3.5.2.1 d)** be retained in the Counties OP.

Section 3.5.2.1 e) enables the Counties to provide comments on an application made under the Aggregate Resources Act if the proposed operation does not require a Counties or local planning approval. In this regard, it is recommended that **Section 3.5.2.1 e)** be retained in the Counties OP.

Section 3.5.2.1 f) encourages the Province to ensure that all appropriate requirements are imposed as conditions

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In addition to the above, below are the proposed policies that address mineral aggregate operations.

New or Expanding Mineral Aggregate Operations

f) Mineral aggregate operations shall be protected from development and activities that would preclude or hinder their expansion or continued use or which would be incompatible for reasons of public health, public safety or environmental impact.

g) Existing mineral aggregate operations that are licensed pursuant to the Aggregate Resources Act shall be permitted to continue without the need for official plan, zoning by-law or community planning permit amendment under the Planning Act. Where the Aggregate Resources Act applies, only processes under the Aggregate Resources Act shall address the depth of extraction of new or existing mineral aggregate operations. When a license for extraction or operation ceases to exist, Section 3.5.2 d) of this Plan continues to apply.

h) When considering a new mineral aggregate operation, the co-location or grouping of such facilities and recycling of materials and progressive rehabilitation should be encouraged by the Counties and/or local municipality to be addressed by the Provincial approval authority.

i) Extraction shall be undertaken in a manner which minimizes social, economic and environmental impacts.

Lastly, the Counties OP also includes **Section 3.5.2.2** that includes policies that apply to rehabilitation. In this regard, it is recommended that this section be retained as is in the current Counties OP.

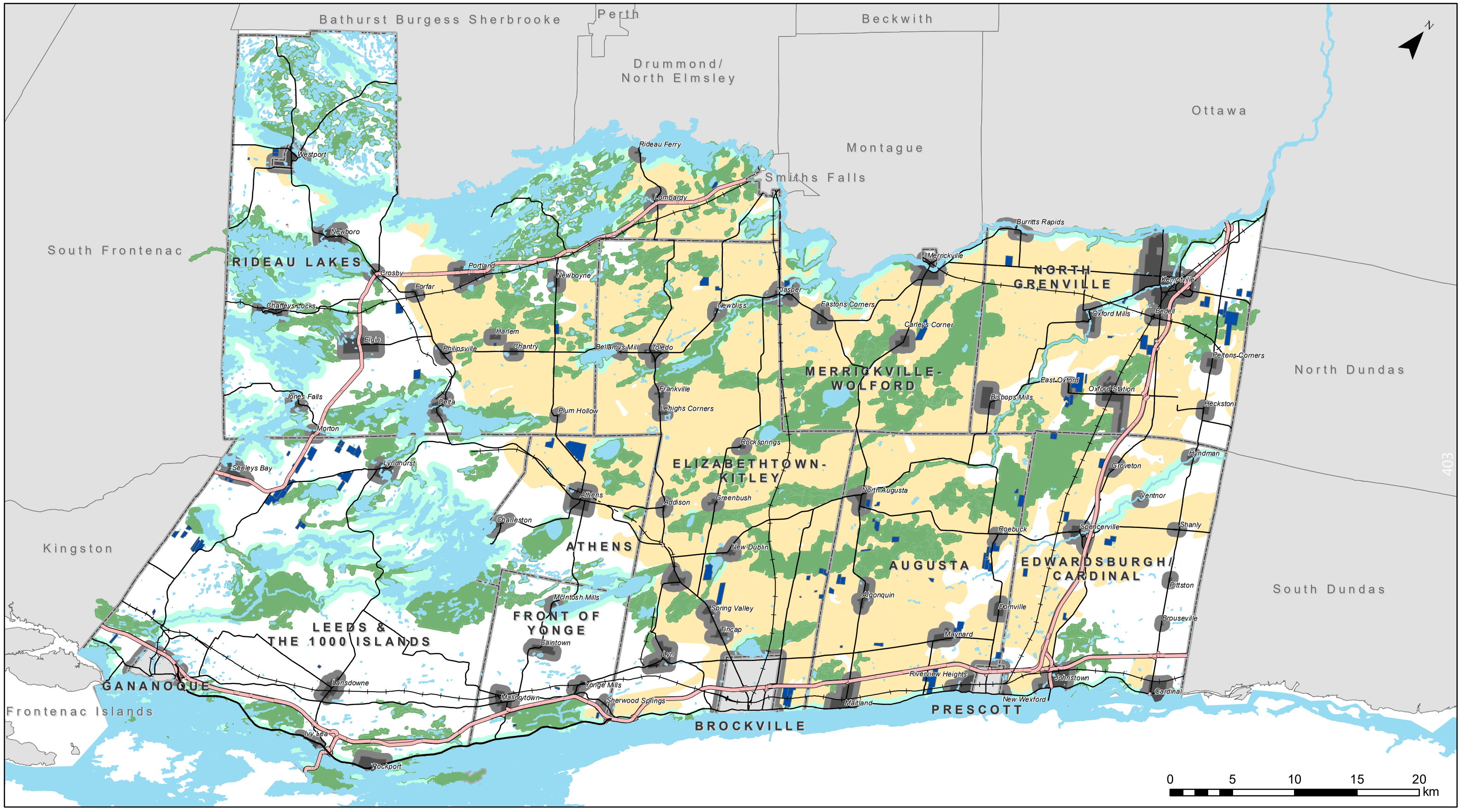
8.4 Mapping (Screening Tool)

The purpose of this section of the ARMP is to provide direction on mapping updates required to identify Selected Sand and Gravel and Bedrock Resource Areas in the Counties OP.

Section 5 of this ARMP reviewed the local Official Plans and their policy approach that applies to mineral aggregate resources as well as their approach to mapping mineral aggregate resources.

On the basis of the above, several of the local Official Plans identified resource areas as a layer on a constraints schedule in their Official Plan. In this regard, is recommended that Selected Sand and Gravel and Bedrock Resource Areas be identified on a map in the Counties OP as a Potential Development Constraint Overlay.

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United Counties of Leeds and Grenville
Mineral Aggregate Resource Study
Bedrock Constraints

Bedrock Resource
(With 8m or less drift thickness)

Pit/Quarry

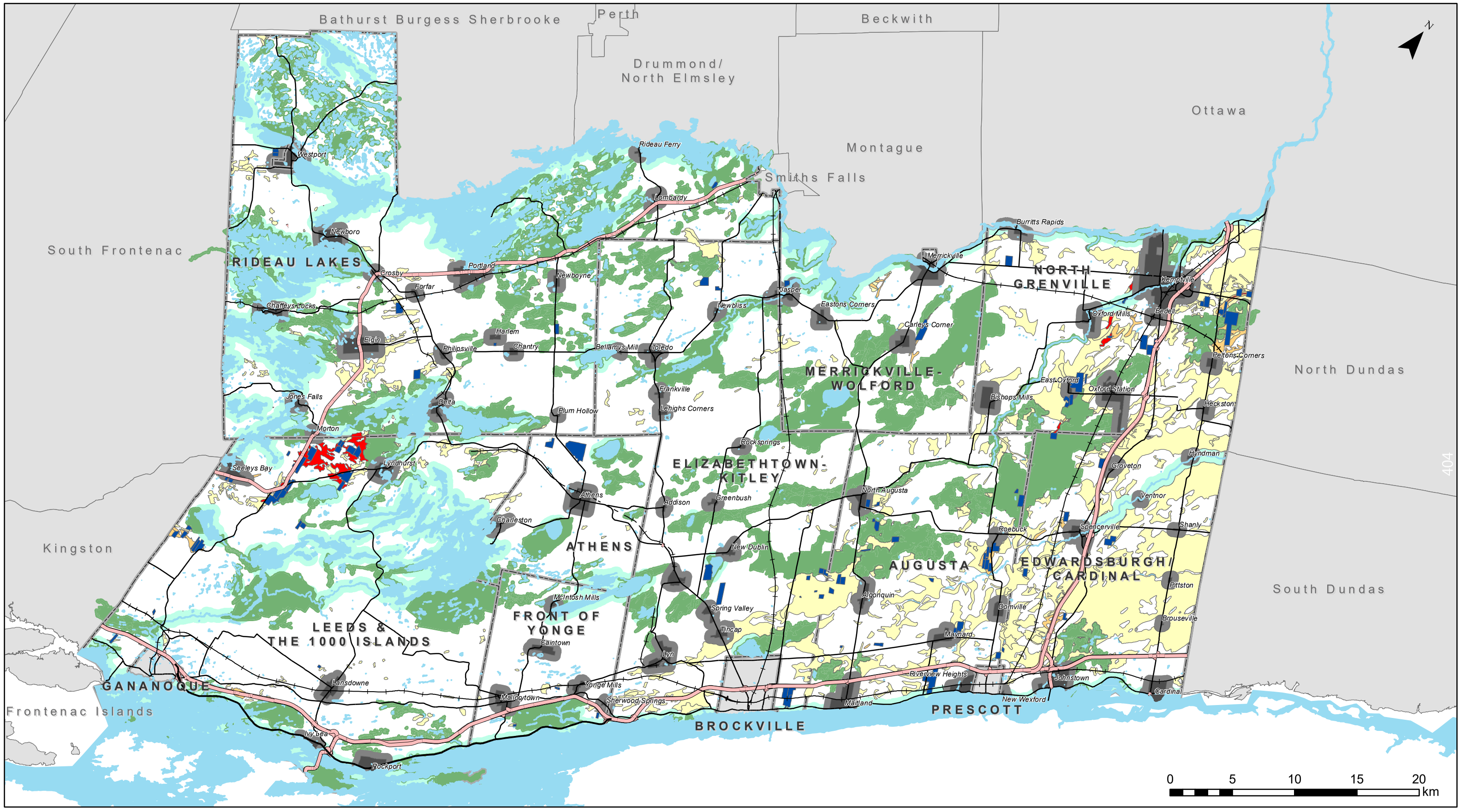
Constraints

- PSW/ANSI including 120 metre buffer
- Settlement Area
- Settlement Area 500m Buffer
- Lake/River
- Lake/River 500m Buffer

Bedrock Resource Constraints		
Resource	**Total (ha)**	**Remaining (ha)**
Bedrock	**176103**	**112039**

Leeds Grenville

July 13, 2021



United Counties of Leeds and Grenville
Mineral Aggregate Resource Study
Sand and Gravel Constraints

Mineral Aggregate Resource

- Primary
- Secondary
- Tertiary
- Pit/Quarry

Constraints

- PSW/ANSI including 120 metre buffer
- Settlement Area
- Settlement Area 500m Buffer
- Lake/River
- Lake/River 500m Buffer

Mineral Aggregate Resource Constraints

Resource	Total (ha)	Remaining (ha)
Primary	1266	1034
Secondary	1664	1295
Tertiary	48497	34178

May 10, 2021