

FLYROCK AND OTHER IMPACTS FROM QUARRY BLASTING OPERATIONS

There is no general provision in the Occupational Health and Safety Act (OHSA), or any Ontario Statute other than section 14 of the Environmental Protection Act (EPA), which prohibits the discharge of rock or any other material that may injure any person, cause damage to property, plant or animal life, interfere with normal course of business or enjoyment of property or adversely affect the environment.¹

Setbacks to Avoid Conflicting Land Uses and Adverse Effects

Quarries can conflict with existing land uses, and have adverse physical, social and economic impacts on the surrounding environment and its inhabitants. Land use controls are an effective way of minimizing conflicts between competing land uses and avoiding adverse effects. Setback requirements prohibiting quarry uses, regardless of whether blasting is involved and only permitting quarrying by special permit, are not preempted because setbacks are traditional land use regulations.²

Applications for new quarries ought not to be approved and expansion of existing quarries denied if a quarry operation cannot be adequately setback and guaranteed to:

- avoid conflict and incompatibility with existing sensitive land uses,³
- not compromise the health and safety of the public,
- not harm wildlife and livestock,⁴
- preclude environmental damage,⁴
- preclude damage to personal and real property,⁵ and
- preclude reduction in value of neighbouring properties.⁶

As blasting is the most dangerous aspect in operating a quarry, to protect workers and the general public a generous setback must be imposed. When establishing setbacks from populated areas or human activity, the setbacks should reflect a worst case scenario, and

¹ *Castonguay Blasting Ltd., v. Her Majesty the Queen in Right of the Province of Ontario*. Respondent's Factum on Appeal, para. 41, SCC File No.34816. https://www.scc-csc.ca/WebDocuments-DocumentsWeb/34816/FM020_Respondent_Her-Majesty-the-Queen-in-Right-of-the-Province-of-Ontario-as-Represented-by-the-Minister-of-the-Environment.pdf.

² *Tinicum Tp. V. Delaware Valley Concrete*, 812 A. 2d 758 (Pa.Comm. Ct. 2002, https://scholar.google.com/scholar_case?case=15752167703902735334&q=tinicum+tp+v+delaware+valley+concrete&hl=en&as_sdt=2006).

³ "**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 or built environment. Examples may include, but are not limited: residences, day care centres, and educational and health facilities. [p. 48]" *Provincial Policy Statement*, 2014. <http://www.mah.gov.on.ca/AssetFactory.aspx?did=10463>.

⁴ "**Adverse effects:** as defined in the *Environmental Protection Act*, means one or more of: impairment of the quality of the natural environment for any use that can be made of it;...[p. 38]" *PPS*, 2014.

⁵ *PPS* Section 1.1.1(c) states that "Healthy, liveable and safe communities are sustained by...avoiding development and land use patterns which may cause environmental or public health and safety concerns.

⁶ Emil Malikov, Yiguo Sun and Diane Hite, "(Under)Mining Local Residential Property Values: A Semiparametric Spatial Quantile Autoregression," *Journal of Applied Econometrics* (June 22, 2018): 82-109. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/jae.2655>.

allow for human error (overloading with explosive and mistakes in blast design⁷) and the unpredictability of flyrock. According to expert testimony presented during the Ministry of Environment's (MOE) investigation of two flyrock incidents in July 2009 at Pakenham Quarry, near Arnprior,⁸

Any experienced blaster would have had the same fly rock incident take place.” “There is no technology to identify anomalies in rock such as mud seams or voids.” “90% of all fly rock incidents are unexplainable.” “[The expert] advised ‘that the hazard zone [for Pakenham Quarry] be increased to 500 m when firing any future blasts...’

Concerns expressed over the danger of *Flyrock* are posted on the New England Laborers' Health and Safety Fund's website:⁹

Blasting can be much more dangerous than you think. Even if you are thousands of feet away from the blast, you can still be hit by debris from the blast. This debris is called Flyrock. Flyrock can travel at high speeds and very far from the blast area. It can easily pierce a windshield or even the metal of a truck.

Here is an example of an incident that occurred in West Virginia. A worker thought he was safely seated in the cab of his truck about 2000 feet [610 metres] from the blast, when all of a sudden he saw flying rocks propelling toward him. Luckily, he was able to duck below the dashboard and was not injured. A rock, the size of a football entered the front of the windshield, traveled where his head would have been and exited the back. Other rocks in the cloud dented the truck. If any of the flying rocks would have hit the driver, he could have been killed. The furthest rocks from the blast flew about 6000 feet [1,829 metres].

Laborers can be exposed to the dangers of Flyrock while working in/on or around a blasting operation. Flyrock can affect both construction workers and bystanders. Flyrock is one of the major causes of blasting-related injuries.

Flyrock can result in critical injuries or even fatalities. Flyrock is also a frequent cause of damage to equipment and facilities.

On January 23, 2018, in response to a number of serious injuries suffered by miners as a result of premature blast, the Mine Safety and Health Administration (MSHA) issued a safety alert,¹⁰ which addressing the dangers of flyrock:

MSHA recommends that Blast Area should as a minimum be one and a half times the furthest distance that any previous fly rock has travelled.

Blasting is a serious and potentially dangerous practice on a mine site due to the use of explosives, and it is difficult to determine the specific trajectory of fly rock during a blast.

⁷ “Working to Protect Your Community and Environment,” <http://sg.crcrockwood.org/wp-content/uploads/2019/03/Doug-Tripp-Flyrock-background-CRC-Popular-Science.pdf>.

⁸ Quoting from <http://sg.crcrockwood.org/wp-content/uploads/2019/03/Flyrock-FAQ-True-and-False.pdf>.

⁹ <http://www.nelhsf.com/nelhsf-library/safety/flyrock/>.

¹⁰ Justin Winter and Jackson Lewis, “MSHA Issues Warning On Blast Safety Following Fly Rock Injuries,” January 23, 2018. <https://www.jdsupra.com/legalnews/msha-issues-warning-on-blast-safety-39564/>.

On March 24, 2016, the MSHA expressed the following concerns about flyrock on its website:¹¹

Flyrock – the fragments of rock thrown and scattered during blasting – is responsible for a large proportion of all blasting-related injuries and fatalities. Flyrock is a potential hazard anytime and anywhere there is blasting.

According to Jack Eloranta, who is responsible for revising the International Society of Explosives Engineers (ISEE) Handbook chapter on open pit and quarry operations, it is unethical to disregard public safety and to accept flyrock as inevitable:

[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.¹²

A blaster-training module¹³ funded by the Office of Technology Transfer, Western Regional Office, Office of Surface Mining, U.S. Department of the Interior points out the potential for severe adverse impacts from flyrock:

[Flyrock is] The Single Factor Of Surface Mining That is Most Likely to Cause A Fatality!!!
[p. 57]

Flyrock is the single most dangerous adverse effect that can cause property damage and personal injury or death [p.4]. Flyrock is the number two killer in mining operations [p.60].

As reported in the June 2013 issue of the *NRIAG Journal of Astrophysics and Geophysics*,¹⁴ the damage caused by flyrock is both undesirable and self-evident:

Fly rocks are considered to be the most undesirable movement of rocks during the blasting activities. Damage by a fly rock can not be refuted; the evidence is usually present and visible [p. 103].

In the United Kingdom, over a five-year period, where incidents of flyrock had been reported and documented, cumulatively 100% of the flyrock incidents occurred within 800 metres of the blast site, as summarized on the chart prepared by Hill.¹⁵

¹¹ “Flyrock Dangers & Best Practices,” <https://www.msha.gov/news-media/announcements/2016/03/24/flyrock-dangers-best-practices>.

¹² https://www.mankatofreepress.com/news/local_news/expert-flyrock-from-any-blast-unacceptable/article_8ad31cf8-b5cf-11e7-bf58-c3cdd328cf7f.html.

¹³ <https://www.osmre.gov/resources/blasting/docs/WYBlasterCertModules/8AdverseEffectsBlasting.pdf>.

¹⁴ Adel M.E. Mohamed and Abuol El-Ela A. Mohamed, “Quarry blasts assessment and their environmental impacts on the nearby oil pipelines, southeast of Helwan City, Egypt,” *NRIAG Journal of Astronomy and Geophysics* (Volume 2, Issue 1, June 2013): 102-115. <https://www.sciencedirect.com/science/article/pii/S2090997713000308>.

¹⁵ William Hill, “Dangers Proposed To Highway 7 By Hidden Quarry Flyrock,” p.7, William Hill Mining Consultants Ltd, 2013, <http://sg.crcrockwood.org/wp-content/uploads/2017/01/HQ-Flyrock-Dangers-ref.-Highway-7.pdf>.

Distance from blast (m)	Number of incidents	Percent of total	Cumulative %
100	17	20	20
200	22	26	46
300	25	29	75
400	7	8	84
500	8	9	93
600	2	2	95
700	3	4	99
800	1	1	100
total	85	100%	

As reported in an August 5, 2013 news release issued by the publication “Quarry,”¹⁶ in response to a 2011 flyrock incident at Brayford Quarry, the UK *Health and Safety Executive* (HSE) said that,

With 3,250 injuries, including 27 fatalities, since 2000, quarrying in the UK remained one of the most dangerous industries to work in.

Flyrock is a public safety issue, and setback requirements should not be reduced in favour of economic interests of the aggregate industry over the health and safety of the public. A mandatory setback of 800 metres from any sensitive land use (or activity) or settlement area imposed on a proposed blasting quarry or existing blasting quarry expansion would virtually eliminate the potential adverse impacts of flyrock. Blasting below the water table has numerous known adverse environmental impacts, warranting a greater setback, especially in a karst terrain.

A brochure¹⁷ produced by the mining and quarrying companies of Nova Scotia as an effort to assure the public that blasting would not have an adverse effect on neighbouring properties alludes to the fact that,

[All] regulated blasting buffers in Nova Scotia are 800 metres, [making] the risk to groundwater or anything else...extremely low.

No Amount of Flyrock is Acceptable

According to *Jack Eloranta*,¹⁸ vice-president for technical matters for the International Society of Explosives Engineers (ISEE), there is no practical economic way of preventing flyrock impacts from quarry blasting:

“Really, flyrock is intolerable.” Any amount of flyrock is unacceptable. You lose control of the process at that point,” said Eloranta. “Speaking generally, Eloranta said flyrock

¹⁶ <https://www.quarrymagazine.com/Article/3260/Quarry-blast-goes-drastically-wrong>.

¹⁷ “Not Your Grandfather’s Mining Industry,” <https://notyourgrandfathersmining.ca/faq>.

¹⁸ *Eloranta* has 29 years of blasting experience, has degrees in mining and geology, has a master’s degree in mining, has authored more than 20 papers on mining and blasting, and revised the ISEE Handbook chapter on open pit and quarry operations. In 2004, he was awarded the President’s Award by the society for meritorious service to the explosives industry. In 2005, he was elected to the board of directors for the ISEE. *Eloranta & Associates Inc.* website: <https://elorantaassoc.com/about-us/>.

doesn't automatically suggest an excessive amount of explosives had been used. "Explosives doesn't equal flyrock," he said."

Proper design of the blast is critical, ensuring that there's enough distance between the columns of explosives at the bottom of drill holes and the sheer edge of the shelf of rock. That's known as "burden," and it keeps the force of the blast from launching rocks from the shelf face. The material above where the explosives are placed, called "stemming," is equally important to keep flyrock from being ejected vertically from the blast.

The force of an explosion is going to seek a path of least resistance, Eloranta said. If the design is done correctly, there is no path of least resistance. The power of the blast simply does its job of pulverizing the rock and shifting it slightly away from the face of the shelf.

A fault in the rock, if unknown to the explosives engineer, can provide a path for that explosive energy that can mess up an otherwise well-designed blast, he said. "The same amount of energy in there can just launch those materials."

Caution can be costly. It's not accurate to suggest that the presence of faults and seams in a section of rock is unknowable, though. Enough geologic testing could identify those problem areas. But there's an economic issue with that solution. "The cost of the testing would exceed the value of that product," Eloranta said...

[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.

"To say 'It might happen again, there's nothing we can do about that,' well, nobody buys that," he said.

The options, really, are only two in Eloranta's mind: Don't blast in a location that threatens public safety or adopt the safety measures required, regardless of the price, that meet the challenges Mother Nature has put in place.

https://www.mankatofreepress.com/news/local_news/expert-flyrock-from-any-blast-unacceptable/article_8ad31cf8-b5cf-11e7-bf58-c3cdd328cf7f.html.

Excessive Airblast and Ground Vibrations Can Cause Flyrock

In quarry blasting, only 20 to 30 percent of the energy produced is utilized to fragment and move rock mass. The remaining energy is wasted to create unwanted environmental impacts. Often, the factors that cause excessive airblast and ground vibrations have the potential to cause flyrock as well.

Characteristics of Flyrock

Flyrock involves the uncontrolled propelling of rock fragment produced by blasting. Institute of Makers of Explosives (IME) has defined flyrock to distinguish it from blast area accident. It is defined as the rock propelled beyond the blast area by the force of an explosion.¹⁹ These rocks can travel distances of more than 600 m at speeds of up to 650 km/h.²⁰ [emphasis added]

¹⁹ IME, "Glossary of commercial explosives industry term" (Washington, D.C.: Safety Publication No. 12, p. 16, 2007).

²⁰ H.C. Verakis, Flyrock: a continuing blast safety threat: *Proc. 37th Annual Conf. on Explosives and Blasting Technique*, International Society of Explosives Engineers, San Diego, 2011, 731-739.

Flyrock comes in different sizes and shapes, ranging in mass from few ounces to several tons. Persson et al. [1994] referenced flyrock weighing approximately three tons thrown to a distance of 980 ft. [299 m].

Fly rock can be cast thousands of feet from a blast. The most dangerous source is ejection from a crack or weak zone in the highwall face where gases violently vent. This action is akin to a rifle where the expanding gases eject a projectile. Frequently the ejection of stemming out of the top of a blast hole is called rifling.²¹

Flyrock is unpredictable and dangerous. Flyrock can travel in any direction or multiple directions from a blast.²²

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.²³

In areas of steep slopes, a rock set in motion by the explosive energy may roll hundreds of feet. In this instance the rock rolled through a trailer down slope from the mine. Children were playing in the front yard at the time. Fortunately no one was injured.²⁴

Any size material is capable of damaging property or injuring people.²⁵

...Where blasting causes the discharge of a contaminant, such as fly-rock, into the natural environment, blasting may harm people, animals or property. This is what happened in this case. [emphasis added] A blasting activity gone wrong (as the appellant concedes) may not have caused more than trivial or minimal harm to the air, land or water. However, the fly-rock generated by the blasting did cause significant harm to property, a different adverse effect under the Act [EPA]. Importantly, the direct conduit resulting in this harm was the appellant's use of the environment (the air) to disperse a contaminant (fly-rock) [para. 76].²⁶

The EPA seeks to achieve its goal of protecting the natural environment and those who use it through a series of regulations, prohibitions and reporting requirements. It also provides for a wide range of inspection, enforcement, preventative and remedial powers, such as the authority to issue control orders (s. 7), stop orders (s. 8), orders requiring the repair of damage (s. 17), preventative measure orders requiring steps to ensure that a

²¹ "Controlling the Adverse Effects of Blasting." <https://www.osmre.gov/resources/blasting/docs/WYBlasterCertModules/8AdverseEffectsBlasting.pdf>.

(This blaster-training module was put together, under contract, with Federal funds provided by the Office of Technology Transfer, Western Regional Office, Office of Surface Mining, U.S. Department of the Interior, located in Denver, Colorado.) Much of the information in the module is derived from the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The performance standards apply to all surface coal mines. Similar standards have been adopted on some State and local levels and applied to non-coal blasting operations such as quarrying and construction.

²² http://www.killthealbionquarry.org/flyrock_danger.pdf.

²³ "Controlling the Adverse Effects of Blasting."

²⁴ "Controlling the Adverse Effects of Blasting."

²⁵ "Controlling the Adverse Effects of Blasting."

²⁶ *Ontario (Environment) v. Castonguay Blasting Ltd.*, 2012 ONCA 165 (CanLII), <<http://canlii.ca/t/fqlt7>>, retrieved on 2019-09-27. Castonguay Blasting Ltd. did not report the incident to the Ministry of the Environment, and was subsequently charged with failing to report the discharge of a contaminant ("flyrock") into the environment contrary to s. 15(1) of the [Environmental Protection Act](#) (the "EPA"). The appellant was acquitted, but the acquittal was reversed by the Superior Court of Justice and a conviction was entered. The conviction was upheld by the Ontario Court of Appeal. Leave to appeal to the Supreme Court of Ontario was denied. *Castonguay Blasting Ltd. v. Ontario (Environment)*, [2013] 3 SCR 323, 2013 SCC 52 (CanLII), <<http://canlii.ca/t/g1038>>, retrieved on 2019-09-27.

discharge does not occur or recur (s. 18), or contravention orders requiring a discharger to take compliance steps (s. 157). [para. 11]

One of the means by which the EPA promotes its protective and preventative purposes is through the prohibition in s. 14(1) against discharging a contaminant into the natural environment where it is likely to have an adverse effect, and the related requirement in s. 15(1) that any such discharge which is out of the normal course of events be reported to the Ministry of the Environment. [para. 12]

As the interveners Canadian Environmental Law Association and Lake Ontario Waterkeeper pointed out in their joint factum, s. 15(1) is also consistent with the precautionary principle. This emerging international law principle recognizes that since there are inherent limits in being able to determine and predict environmental impacts with scientific certainty, environmental policies must anticipate and prevent environmental degradation [emphasis added] (O. McIntyre and T. Mosedale, "The Precautionary Principle as a Norm of Customary International Law" (1997), 9 J. Env'tl. L. 221, at pp. 221-22; 114957 Canada Ltée (Spraytech, Société d'arrosage) v. Hudson (Town), 2001 SCC 40 (CanLII), [2001] 2 S.C.R. 241, at paras. 30-32). Section 15(1) gives effect to the concerns underlying the precautionary principle by ensuring that the Ministry of the Environment is notified and has the ability to respond once there has been a discharge of a contaminant out of the normal course of events, without waiting for proof that the natural environment has, in fact, been impaired.²⁷ [para. 20]

Often, the factors that cause excessive airblast (concussion) and ground vibrations have the potential to cause flyrock as well. For this reason, it is crucial that blasters understand and control the factors that can create flyrock. Some of the common causes of flyrock are:²⁸

- 1) Overloaded blastholes with excessive amounts of explosives
- 2) Heavily confined charges or the lack of relief (e.g. Lift blasts)
- 3) Explosives loaded into incompetent materials (egg. mud seams, fractures, and/or voids)
- 4) Insufficient front-row burden, causing front-face blowouts
- 5) Burdens and spacings too close together (resulting in high powder factors)
- 6) Inadequate/insufficient stemming material
- 7) Inadequate delay between holes in the same row or between rows; detonators firing out of sequence
- 8) Deviation of blast hole detonation from the intended sequence
- 9) Changing geology or rock type
- 10) Spacing and burden exceeds borehole depth
- 11) Angled boreholes
- 12) Secondary blasting
- 13) Human error, improperly loaded blasts

The excessive throw of rock fragments beyond the blast safety area is an environmental issue. The U.S. Code of Federal Regulations (CRF), Title 30 defines 'Blast Area' as the area in which concussion (shock wave), flying material, or gases from an explosion may cause

²⁷ *Castonguay Blasting Ltd. v. Ontario (Environment)*, [2013] 3 SCR 323, 2013 SCC 52 (CanLII), <<http://canlii.ca/t/g1038>>, retrieved on 2019-09-27.

²⁸ "Controlling the Adverse Effects of Blasting," <https://www.osmre.gov/resources/blasting/docs/WYBlasterCertModules/8AdverseEffectsBlasting.pdf>.

(This blaster-training module was put together, under contract, with Federal funds provided by the Office of Technology Transfer, Western Regional Office, Office of Surface Mining, U.S. Department of the Interior, located in Denver, Colorado.)

injury to persons. The CRF also states that the blast area shall be determined by considering the following:

- 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 personnel,
- 5) Delay systems, powder factor, and pounds per delay,
- 6) Type and amount of explosive material, and
- 7) Type and amount of stemming.²⁹

“The U.S. Code of Federal Regulations definition of blast area is purely qualitative and it is difficult to rely on the definition for enforcing blast area safety regulations.”³⁰

Flyrock Meets EPA’s Definition of Contaminant

According to the Supreme Court of Canada,³¹ in its interpretation of the *EPA*, the *adverse effects* of “flyrock,” occasioned by blasting, are not trivial.

[Castonguay] “discharged” fly-rock into the “natural environment”, and there is no doubt that fly-rock meets the definition of “contaminant”. The discharge was “out of the normal course of events”, and it caused an “adverse effect” under the definition of that term in s.1(1), namely, it caused injury or damage to property and loss of enjoyment of the normal use of property. 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.

According to the Ministry of the Environment, Conservation and Parks (MOECC), a blasting quarry is a Class III³² use. Guideline D-6 recommends a Potential Area of Impact of 1,000 metres and Minimum Separation Distance of 300 metres from the property line of a sensitive land use. A blasting quarry is the most disruptive, destructive, and polluting Class III use, and the *adverse impacts* of blasting can extend beyond 1,000 metres, above and below ground, especially in a karst environment.

At the Miller Braeside Quarry, as acknowledged during an OMB hearing, blasting caused flyrock to travel 400 metres.³³ The OMB rejected *Miller Paving’s* argument that the setback

²⁹ <https://www.cdc.gov/niosh/mining/UserFiles/works/pdfs/fadtf.pdf>.

³⁰ 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,” *Int. Journal of Engineering Research and Applications* (December 2014): 1-6. https://www.researchgate.net/profile/Eze_Chibuogwu/publication/274008421_Hard_Rock_Quarry_Seismicity_and_Face_Bursting_Flyrock_Range_Prediction_in_the_Granite_and_Migmatites_Rocks_of_North_Central_Nigeria/links/5525b22f0cf295bf160eae0e/Hard-Rock-Quarry-Seismicity-and-Face-Bursting-Flyrock-Range-Prediction-in-the-Granite-and-Migmatites-Rocks-of-North-Central-Nigeria.pdf?origin=publication_detail.

³¹ *Castonguay Blasting Ltd. v. Ontario (Environment)*, [2013] 3 SCR 323, 2013 SCC 52 (CanLII), <<http://canlii.ca/t/g1038>>, retrieved on 2019-09-29

³² MOECC D-6-3 Separation Distances <https://www.ontario.ca/page/d-6-3-separation-distances>.

³³ *Miller Paving Ltd.*, PL130785, OMB, October 27, 2015 <http://www.omb.gov.on.ca/e-decisions/pl130785-Oct-27-2015.pdf>.

for the expanded quarry should be measured from the *dwelling* rather than the *property line* of the adjacent residences in a designated Settlement Area.

[T]he general rule in key Ministry guidelines is that 300 m is the recommended minimum distance from the property line. That 300 m figure is a "minimum"; indeed, even when operations were farther from neighbours than 300 m,³⁴ adverse impacts still precipitated two Court Orders [para. 158]. [OMB Decision October 27, 2015, as amended on December 18, 2015.]

The adjacent properties are rural residential and each has a typical lot depth of 220 metres (722 feet). *Miller*, the quarry owner, wanted the rear 150 metres (492 feet) of each residential lot included in the 300 metre setback as part of its plan to expand the existing quarry. By demanding that the rear 150 metres of each lot be part of the 300 metre setback from the quarry, *Miller's* contribution to the 300 metre setback would only be 150 metres, roughly half the setback requirement. The rear 150 metres of each resident's lot, in which *Miller* has no possessory interest, would effectively be sterilized, precluding any development of the rear yard, vastly reducing the use and enjoyment of the rear yard as amenity space, and causing a significant reduction in the value of each property. (Conversely, *Miller* would benefit by being permitted to increase the extraction zone of the quarry by 9.7 hectares or 24.0 acres. This is akin to the taking of property rights without compensation.) Moreover, in the event quarry blasting causes further Flyrock incidents, the health and safety of the residents will again be endangered. A 300-metre setback or buffer zone is inadequate to avoid an adverse effect on the neighbouring residential properties, considering that past quarry blasting had caused flyrock to be hurled a distance of 400 meters into the neighbouring cluster of residential properties.

The OMB alluded to an earlier detailed 38-page decision of the Ontario Superior Court of Justice (Small Claims Court) issued on November 3, 2011. The neighbours had claimed that "noise and odour from the portable asphalt plant interfered with the reasonable and ordinary use of their properties." As to the severity of the harm endured by the neighbours, the trial judge had this to say:

Overnight the enjoyment of their land and residences was substantially interfered with. The noise during the day was described as noisy especially when wind was blowing in their direction, "like a "freight train," "a fan running beside the bed," "like being next to an airport," "a plane idling on the runway," "bad," "horrible to live beside," "louder than a diesel freightliner idling," "place became a loud industrialized neighbourhood," "like a big steam generator," "slamming of tail gates," "like sitting behind a jet engine," "was really quiet [sic] load," "very annoying," "really really bad," "a constant noise," "unbearable," "louder than television or dishwasher running in the house [para. 64]."

The odour and noise occurred on and off from September 28, 2009 to November 16, 2009...while the plant was located in the quarry. It was more frequent for some...than others depending on their times at home as opposed to times at work and sometimes depending on the wind direction. Nevertheless the noise and odour was there in the mornings, afternoons and during the night. To escape it they would close all doors and windows and stay in the house. This did not always totally alleviate the problem. The

³⁴ In 2005, one neighbour described flyrock from a "mega" blast that landed on his roof, over 400 metres from the quarry site.

problem the plaintiffs had was that they never knew when to expect the noise or odour and they therefore could not plan any outdoor activities as they had done prior to the fall of 2009. The interference was enough to meet the severity of the harm test [para. 67].

The trial judge also relied on a November 24, 2009 Air Facility Inspection Report, prepared by MOE, which stated:

the operation of “this plant at this location” may be causing an adverse effect as defined under Section 14 of the Environmental Protection Act. It also stated the odour was noted as a distinct odour at 4 residences and noise levels were clearly audible at 16 observations [para. 77].

Miller’s “air quality” experts’ evidence was characterized as less than credible:

I find it impossible to accept the findings of Mr. Trought and Dr. Wiseman that plaintiffs['] symptoms are caused by vehicle exhaust, wood burning, cigarette smoke or food as opposed to the fumes from the plant [para. 81].

Residential land uses, including associated amenity space, are considered sensitive 24 hours per day (D-6, p.3). Finding in favour of the neighbours on the torts of trespass (in the form of contaminants), negligence (duty of care), and nuisance, the court alluded to “the character of the neighbourhood,” and found that it had significant “residential” traits:

[The area] is zoned rural and if anything it would be much more residential than commercial, as there is only a roof truss business, a quarry and farming property in the area as opposed to approximately 150 residential houses....

The plaintiffs were aware that there was a quarry when they purchased their properties but they did not know that this asphalt plant was going to operate in it....The noise and odour that they experienced when the plant started was severe. Overnight, the enjoyment of their land and residences was substantially interfered with....

On appeal,³⁵ the “trespass” and “negligence” convictions were overturned. The “nuisance” claim as well as the damages were sustained, with the appeals court, again, recognizing the “character of the neighbourhood” as being more residential:

The trial judge determined that the quarry was in a rural area that had a mix of uses but which was primarily residential in character....In the present appeal, there is adequate evidence to support the trial judge's finding that the area was, in his words, "much more residential than commercial."

Miller Paving Ltd.³⁶ was denied leave to appeal the OMB’s October 27, 2015 decision, as no “question of law” was raised. In upholding the OMB decision imposing a 300 metre setback from the *property line* of nearby residences, the Superior Court of Justice (Divisional Court), stated, in pertinent part,

³⁵ Moore v. Smith Construction Company, a division of the Miller Group Inc., [2013] O.J. No. 3768, <<http://canlii.ca/t/g04d5>>, retrieved on 2019-10-01.

³⁶ Miller Paving Limited v. The Corporation of the Township of McNab/Braeside et al, 2016 ONSC 6570.

Section 4.1.1 [PPS] is for potential influence areas within which adverse effects may be experienced for industrial uses setting the distance for Class III at 1000 m. Section 4.3 recommended minimum separation distances for Class III at 300 m [para. 24].

Miller has put forth the position based on the facts of the case and the decision of the OMB. In reviewing the decision, I do not agree that there is a question of law. The OMB was cognizant of the provincial interest as well as the expert opinions and the arguments of the property owners. The Province provided no evidence at the hearing. The Provincial Guidelines were just that guidelines. The OMB considered the evidence and concluded as set out in the Official Plan, namely section 11(2) (3) concerning limiting the disturbance to the subject site. Miller has not provided any authority to support its argument that there is a question of law. The decision of the OMB was one based on the evidence provided at the hearing and at best, is a question of mixed law and fact [para. 32].*[emphasis added]*

There is nothing that has been presented by Miller that puts into substantial doubt the decision of the OMB on this issue. On reviewing the decision, there is ample evidence that the OMB used to support its decision. The OMB did not solely rely on the Guideline D-6. There is nothing directed to this Court that the using of Guideline D-6 would bring the correctness of the OMB decision into serious doubt [para. 39]. *[emphasis added]*

Again, in 2017, *Miller*³⁷ was found liable for damages in nuisance for interference caused to the enjoyment and use of each plaintiff's property, located nearby in a designated Settlement Area. The court heard from 21 witnesses over the course of twelve days of trial before issuing its ruling in favour of the residents. The interference caused by the operation of the asphalt plant arose from "odour, noise and dust" that significantly impacted all fourteen residents' ability to enjoy the "full" use of their properties. The court found that the interference was "substantial," meaning it was "non-trivial." Each resident testified that they would not have chosen to reside proximate to the quarry had they known how the operations of the temporary asphalt plant would affect them.

I base my conclusion that the interference was "substantial" based upon how the effects of the plant's operation impacted the plaintiffs. While the defendant produced records to support the fact that the noise / odour issues were not constant and that their complaints as chronicled in a diary would suggest occasions when odours or noise were not experienced daily, the bottom line is that it impacted the plaintiffs' ability to regularly enjoy their properties. They were no longer willing to continue with their gardens and outdoor activities due to concern of possible negative health effects and the unpleasantness of being outside when the odours and /or noise were present. The plaintiffs spoke of no longer planning social events (barbecues) because it was impossible to predict whether the plant would be operating. This hindered or ended planned activities. In every instance, the plaintiffs testified, had they known the negative impact the operation of the temporary asphalt plant would have on them, that they would not have chosen to purchase their home [para. 19]. *[emphasis added]*

As to whether the interference was reasonable, the court rejected *Miller's* defense of compliance with noise and odour emissions limits, finding that compliance with statutory limits does not make the interference complained of reasonable, commenting, in pertinent part, as follows:

³⁷ *Battiston v Smiths Construction Company*, 2017 CanLII 77336 (ON SCSM), <<http://canlii.ca/t/hnsh8>>, retrieved on 2019-10-07.

Various factors such as the severity of the interference, the character of the neighbourhood, the sensitivity of the plaintiffs, the frequency and duration of the interference, and the utility of the conduct may be considered in making this determination, depending on the particular circumstances of the case. There is no finite list. The focus, generally but not absolutely, is on whether the interference suffered by the plaintiffs is unreasonable, and not on whether the nature of defendant's conduct is unreasonable [para. 22]

[T]he defendant relied upon the third party investigations by both the Ministry of Natural Resources and the Ministry of Environment, which, for the most part, confirmed that there were emissions but which found that the noise and odour emissions from the plant were within acceptable statutorily mandated limits [para. 31]. [emphasis added]

All fourteen residential neighbours were awarded damages. While recognizing that providing asphalt under a government contract has public utility, *Miller* is a “for profit” operation. No evidence was presented to suggest that alternative locations for the portable asphalt plant were not feasible, even if less convenient. (para. 28) As observed by the court in the prior 2009 decision.

A private, for-profit company should be required to pay the full cost of its operations without forcing the plaintiffs to effectively subsidize its business through the free use of their properties [para. 28]. [emphasis added]

Although the OMB approved expansion of the Miller Braeside quarry to within 300 metres of the neighbouring residential properties, there is some doubt as to the reliability of the “air quality” study prepared on behalf of Miller that supported the expansion.³⁸ An independent air quality assessment for the proposed Miller Braeside quarry expansion, unrelated to the parties involved in the dispute over the quarry expansion, appeared in the 2015 issue of *Air Qual Atmos Health*,³⁹ and recommended against the quarry expansion. The study sampled potential impacts of total suspended particulates (TSP) or particulate matter (PM). Typical emission sources include dust generated from excavations, quarry, drilling, grinding, gathering, conveyance, and truck loading.

The corporation most highly affected by emissions from the proposed expansion or even the present quarry site is the Arnprior Golf Club, which is located only 2.3 km to the east of the quarry, and the Arnprior Golf Club at Sand Point, which is located within 2 km north of the quarry. The closest residential area to the Miller Braeside quarry is the village of Braeside, which is located within 3 km southeast of the quarry site. Braeside is a dissolved municipality with 191 residents living in an area of 1.86 km² (Statistics Canada 2013b). Located further southeast, within 8 km of the quarry site, is the town of Arnprior, which contains the closest hospital to the township of McNab/Braeside, the Arnprior and District Memorial Hospital which is situated 7.3 km away. With only a total land area of 13.04 km², the town of Arnprior was recorded to contain a population of 8114 residents in 2011, which is greater than the entire population recorded for the township (Statistics

³⁸ The 2008 *Operations Manual for Air Quality Monitoring in Ontario* remained in effect until June 30, 2018, with the revised manual taking effect July 1, 2018. The Manual is based on the procedures used by national agencies such as Environment and Climate Change Canada (ECCC) and the United States Environmental Protection Agency (US EPA). <https://www.ontario.ca/document/operations-manual-air-quality-monitoring-ontario-0>.

³⁹ Sabah A. Abdul-Wahab, Hedia Fgaier, Ali Elkamel and Keziah Chan, “Air quality assessment for the proposed Miller Braeside expansion in Canada: TSP,” *Air Qual Atmos Health* (2015) 8: 573-589.

Canada 2013a). In addition, nearby the quarry site in the southwest direction lies the city hall of the township of McNab/Braeside, situated 5.5 km away, and the McNab Public School, situated 6.8 km away. Across the Ottawa River, within 6 km north of the quarry site also lies the settlement of Norway Bay, which is part of the municipality of Bristol in Quebec, Canada [p. 575].

TSP concentrations were simulated on various days throughout the year to address seasonal variations in 2003 and 2013. The TSP samplings generated the following findings:

[T]he spring day of April 15, 2003 was determined to have the highest 1-h average TSP concentration, while the summer day of July 11, 2003 was determined to have the highest 24-h average TSP concentration out of all 4 days analyzed. In the year 2003, the highest 30-min average TSP concentrations on January 12, April 15, July 11, and November 17 were determined to, respectively, be 1135.15, 1782.32, 1017.74, and 1393.65 µg/m³. These TSP concentrations all significantly exceed Ontario's MOE 30-min criterion of 100 µg/m³. Likewise, in the year 2013, the highest 24-h average TSP concentrations on January 12, April 15, July 11, and November 17 were determined to, respectively, be 132.86, 82.01, 146.07, and 104.9 µg/m³. The TSP concentrations on January 12, July 11, and November 17 are all well above Ontario's MOE 24-h criterion of 120 µg/m³, while the concentration on April 15 is well under this limit [p. 587-588].

Taking these 4 days as a representation of each season, it can be concluded that overall the predicted maximum TSP levels are not within the limits of the applicable standards. In addition, it should be noted that with the changing seasonal weather, TSP concentrations may even exceed the concentrations determined in this study and disperse further from the quarry [p. 588].

During the hours or days where TSP concentrations are high, citizens residing, working, or touring nearby the [Miller Braeside] quarry would experience serious adverse TSP effects. In particular, children, the elderly, and citizens allergic to TSP experience the most hazardous effects of TSP. Unfortunately, many residential areas, in addition to both a hospital and school, are found to be located within close proximity to the quarry [p. 588]. [emphasis added]

Short of a number of suggestions, the study nevertheless concluded that,

[I]n its current proposed state, it is not recommended that the proposal for the expansion of the Miller Braeside Quarry be approved as a result of health and safety issues [p. 588].

Cascading Effects of Quarrying Stone in Karst

The consequences of quarrying for stone in a karst terrain are generally environmentally catastrophic and irreversible, with the series of adverse effects felt well beyond the limits of the quarrying operation:

In karst environments, aggregate mining may alter sensitive parts of the natural system at or near the site thus creating cascading environmental impacts (Langer and Kolm, 2001). Cascading impacts are initiated by an engineering activity, such as the removal of rock, which alters the natural system. The natural system responds, which causes another impact, which causes yet another response by the system, and on and on. For example, aggregate mining in some karst might lower the water table, which will remove the buoyant support of rock that overlies water-filled caverns or other solution features, which might result in land collapse, which will create a sinkhole. Cascading impacts may be severe and affect areas well beyond the limits of the aggregate operation. Cascading impacts may manifest themselves some time after mining activities have begun and

continue well after mining has ceased. Many of the impacts described below are cascading impacts [see footnote].⁴⁰

Natural and Anthropogenic Hazards in Karst

Karst ground water resources are an extremely important source of drinking water. Human activities such as quarrying in a karst terrain can have severe impacts on ground water systems,⁴¹ some of which are briefly summarized below:⁴²

The distinctive hydrology and landforms of karst create a very special environment. Although several types of karst have been identified worldwide, a common thread is the dominantly subterranean drainage. The paucity of water flowing at the surface, a consequence of rapid infiltration underground through a network of discontinuities in the soluble rock mass, results in two important but contrasting points: the considerable value of karst water resources (representing about 25% of the drinkable supply in the world) is strongly counteracted by the ease with which human activities can negatively impact this precious resource. The same narrow discontinuities, and the larger dissolution conduits and karst caves, are the main pathways through which potential pollutants may travel swiftly to regional groundwater bodies, or directly to springs.

Contaminants can be introduced by means of dispersed infiltration as well as from point sources and are frequently transmitted with minimal filtering. This example, just one of the many natural and/or anthropogenic hazards that may affect karst areas, illustrates the fragility of karst environments. Their high vulnerability is further expressed by a very simple concept that is true for many other environments but probably shows its best evidence in karst: it is very easy to damage or destroy natural resources but restoration to a pristine situation is an extremely difficult and commonly impossible, task. Where some degree of remediation is possible, the economic cost is commonly very high.

Interference with Home Owners' Reasonable Use of Groundwater

In 1982, Charles and Elsie Paul, along with fifty other plaintiffs filed a law suit against American Aggregates Corporation. The plaintiffs alleged that the corporation in the conduct of its business of quarrying limestone had caused the level of the water table in the artesian aquifer underlying the plaintiffs' land to drop, causing problems with both the *quantity* and *quality* of water in their wells. The Ohio appeals court found in favour of the owner of the

⁴⁰ William H. Langer, "Potential Environment Impacts of Quarrying Stone-A Literature Review," U.S. Department of the Interior and U.S Geological Survey (Version 1.0 2002). <https://pubs.usgs.gov/of/2001/ofr-01-0484/ofr-01-0484po.pdf>.

⁴¹ See a 2005 study of a number of pits and quarries in Minnesota, which identified a number of adverse hydraulic impacts. J.A. Green, J.A. Pavlish, R.G. Merritt, and J.L. Leete, Minnesota Department of Natural Resources, Division of Waters, for the Legislative Commission on Minnesota Resources, 2005, <https://files.dnr.state.mn.us/publications/waters/hdraulic-impacts-of-quarries.pdf>.

⁴² M. Parise and J. Gunn, "Natural and anthropogenic hazards in karst areas: an introduction," *Geological Society, London, Special Publications*, (Volume 279, January 2007): 1-3. <https://sp.lyellcollection.org/content/279/1/1>.

quarry, applying the “English Rule”⁴³ of non-correlative rights with respect to groundwater in *Frazier*:⁴⁴

[T]here are no correlative rights existing between the proprietors of adjoining lands, in reference to the use of the water in the earth, or percolating under its surface. Such water is to be regarded as part of the land itself, to be enjoyed absolutely by the proprietor within whose territory it is; and to it the law governing the use of running streams is inapplicable.’ Id. at 308.

On appeal, the Ohio Supreme Court⁴⁵ overturned the lower court’s ruling, recognizing the injustice of such a policy, stating, in part,

If the English rule is to obtain, a man may discover upon his own land springs of great value for medicinal purpose or for use in special forms of manufacture, and may invest large sums of money upon their development; yet he is subject at any time to have the normal supply of such springs wholly cut off by a neighboring landowner, who may, with impunity, sink deeper wells and employ more powerful machinery, and thus wholly drain the sub-surface water from the land of the first discoverer.”

“Traced to its true foundation, the rule is simply this: that owing to the difficulties the courts will meet in securing persons from the infliction of great wrong and injustice by the diversion of percolating [sic] water, if any property right in such water is recognized, the task must be abandoned as impossible, and those who have valuable property acquired by and dependent on the use of such water must be left to their own resources to secure protection for their property from attacks of their more powerful neighbors, and failing in this, must suffer irretrievable loss; that might is the only protection.

The Ohio Supreme Court broke with precedent and applied a “reasonable use” doctrine to underground water (Restatement of the Law 2d, Torts, Section 858):

(1) A proprietor of land or his grantee who withdraws ground water from the land and uses it for a beneficial purpose is not subject to liability for interference with the use of water by another, unless

(a) the withdrawal of ground water unreasonably causes harm to a proprietor of neighboring land through lowering the water table or reducing artesian pressure,

b) the withdrawal of ground water exceeds the proprietor’s reasonable share of the annual supply or total store of ground water, or

(c) the withdrawal of the ground water has a direct and substantial effect upon a watercourse of lake and unreasonably causes harm to a person entitled to the use of its water.

The court ruled that the Restatement theory provides security that one’s source of ground water cannot be usurped by a neighbor. A damaged property owner will be able to recover costs necessitated by the lowering of the water table. The party causing the harm will be

⁴³ *Acton v. Blundell* (Exch. 1843), 12 M. W. 324, 152 Eng. Rep.1223. See, also, Note, Establishing Liability for Damage resulting From the Use of Underground Percolating Water: *Smith-Southwest Industries v. Friendswood Development Company* (1978), 15 Houston L. Rev. 454.

⁴⁴ *Frazier v. Brown* (1861), 12 Ohio St. 294.

⁴⁵ *Cline v. American Aggregates Corp.*, 15 Ohio St. 3d 384 (Ohio) 474 N.C.2d 324, *aff’d*. *Cline v. American Aggregates Corp.*, 582 N.E.2d 1,7 (Ohio App. 10 Dist. 1989). An appeal from that decision was dismissed *Cline v. American Aggregates Corp.*, 550 N.E.2d 479 (OH 1990).

liable for the damages. Ground water law has been profoundly affected by scientific advances and an understanding of hydrology.⁴⁶

In *McNamara et al. v. City of Rittman, Hensley et al. v. City of Columbus et al*, the Ohio Supreme Court was asked to determine the certified question “Does an Ohio homeowner have a property interest in so much of the groundwater located beneath the land owner’s property as is necessary to the use and enjoyment of the owner’s home?” The Supreme Court of Ohio answered the question affirmatively and ruled that,

Ohio recognizes that landowners have a property interest in the groundwater underlying their land and that governmental interference with that right can constitute an unconstitutional taking.

This case followed *Cline v. Am. Aggregates Corp.*,⁴⁷ a landmark court ruling protecting landowners’ property right in groundwater:

Through Cline, a property owner has a remedy against another property owner with land overlying a common aquifer, if the other landowner's use of the water unreasonably diminishes his water supply. Under Cline, a property owner's right to use the water underlying his property is not subject to a neighboring property owner's superior pumping system...[A] landowner's right to the water underlying his property is protected by law. A property owner has a potential cause of action against anyone who unreasonably interferes with his property right in groundwater. That cause of action arises only from the effect on the landowner's water rights -- no other effect on the overlying property is necessary for the cause of action to proceed.

As reported by the Ontario Municipal Board (OMB),⁴⁸

The PPS mandates that that all relevant policies must be considered by the planning authority.⁴⁹ The Ontario Municipal Board found in Ontario (Ministry of Natural Resources)...that Part III 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.⁵⁰ [para. 30]

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

⁴⁶ “Who Owns The Water?”, *Water Systems Council*, updated August 2016. <http://nationalaglawcenter.org/wp-content/uploads/2017/03/Who-Owns-the-Water-2016-Update-FINAL.pdf>.

⁴⁷ *Cline v. Am. Aggregates Corp.*

⁴⁸ *Kevin Matthews et al v. Lempiala Sand & Gravel Limited*, File no. PL180754, <https://www.cela.ca/sites/cela.ca/files/TLCA%20Case%20Synopsis.pdf>.

⁴⁹ PPS, Part III, policy 4.4.

⁵⁰ *Ontario (Ministry of natural Resources), Re*, 2012 CarswellOnt 10693, at para 25 [*Ontario (MNR)*], in TLCA Book of Authorities, Tab 2, applying Part III of PPS, 2005.

*"as is realistically possible" only includes the physical existence of the aggregate resource.*⁵¹
[para. 36]

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 2014 Provincial Policy Statement (PPS)⁵² sets out the provincial expectation when planning for major facilities such as a quarry in proximity to a sensitive or incompatible land uses:

Major facilities and sensitive land uses should be planned to ensure they are appropriately designed, buffered and/or separated from each other to prevent or mitigate adverse effects from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term viability of major facilities.

The PPS takes its definition for "adverse effects" from the *Environmental Protection Act* (EPA), 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 flow from the provincial interests articulated in s.2 of the *Act*, including,

- i) "(h) the orderly development of safe and healthy communities" and
- j) "(o) the protection of public health and safety"

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, if the discharge causes or may cause an adverse effect.

⁵¹ 2220243 *ONT Inc., Re*, [2015] OMBD No 418, at para 41, in TLCA Book of Authorities, Tab 4.

⁵² <http://www.mah.gov.on.ca/AssetFactory.aspx?did=10463>.

The *EPA* is to be given a broad and liberal meaning.⁵³ 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 causes or may cause an *adverse effect*. ***Flyrock*** is a "solid" and one of a number of potential contaminants associated with quarry blasting.⁵⁴

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).⁵⁵ The primary legislative basis for this *guideline* is *Section 14(1) of the Environmental Protection Act*, RSO, 1990.

Synopsis

This guideline identifies the direct interest of the Ministry in recommending separation distances and other control measures for land use planning proposals to prevent or minimize adverse effects from the encroachment of incompatible land uses where a facility either exists or is proposed. This guideline sets the context for all existing and new guidelines relating to land use compatibility.

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.

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.

Nothing in this guideline is intended to alter or modify the definition of 'adverse effect' in the Environmental Protection Act.

⁵³ "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.

⁵⁴ 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>.

⁵⁵ <https://www.ontario.ca/page/d-1-land-use-and-compatibility#section-0>.

Irreconcilable Incompatibilities (3.4)

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. More details for specific facilities may be identified in other Ministry guidelines listed in Procedure D-1-2, "Land Use Compatibility: Specific Applications". [emphasis added]

Unpredictability of Flyrock and Its Consequences

It has long been known that when planning blasts flyrock remains one of the most erratic and dangerous factors, even when predictive formulae are based on measurements of worst case scenarios:

In the blasting industry, flyrock causes more deaths, injuries and asset damage than all other causes put together. A surprising statistic? A North American study of 412 lethal and non-lethal accidents in 2001 found that 27.7 per cent of these accidents were caused by wild flyrock outside the clearance zone and 45.6 per cent were due to localised flyrock within the clearance zone.

A final word of caution: these predictive formulae are based on measurements of worst case scenarios of flyrock throw. Flyrock is notoriously inconsistent and a prediction of 200m does not mean that flyrock will travel 200m from every blast.

Worst case occurrences generally happen when a blast hole intersects a fault zone or is collared in broken rock which has been fractured during previous blasting.

It is easy to use an observational approach and keep on incrementally reducing the stemming. This might work for dozens of blasts, and then there will be that one rogue blast hole that proves the formulae correct. It only takes one hole to create enough wild flyrock to create a possibly tragic situation, and at the same time risk the loss of the quarry licence, the shotfirer's licence and the company's insurance policy.⁵⁶ [emphasis added]

Various empirical relationships have been established to predict flyrock resulting from blasting. In calculating flyrock distance, the existing empirical methods only consider a limited number of effective parameters. Whereas the measure of flyrock distance is also affected by other parameters such as blast geometry, geological conditions and human error. Consequently, the empirical methods are not accurate enough in many cases, even though prediction of the exact values of flyrock distances is crucial to estimate the extent of the blast safety area.⁵⁷

Most flyrock incidents go unnoticed or unreported concealing the true extent of the problem of blasting. The percentage of documented flyrock accidents occurring due to

⁵⁶ Article by John Butchart from Quarry posted February 1, 2014 <https://www.quarrymagazine.com/Article/3569/Flyrock-prediction-From-mystery-to-science>.

⁵⁷ In a controlled study of 113 blasting operations at Putri Wangsa quarry, the most influential parameters on flyrock including hole depth, burden to spacing ratio, stemming length, maximum charge per delay, powder factor, rock density and Schmidt hammer rebound number were considered as input parameters, whereas the flyrock distances were assigned as the output parameter. Actual flyrock distances measured 43.7 meters to 205.5 meters. <https://www.hindawi.com/journals/tswj/2014/643715/#B10>, Table 1.

flyrock justifies its significance irrespective of the fact that the problem is seldom reported.⁵⁸

A sample of documented cases of flyrock that have caused various *adverse effects* are summarized as follows:

- On April 10, 2018, during a standard drill and blast operation at Albury Quarry, northeast of Albury, New South Wales, flyrock flew between 300 and 340 metres from the blast location, striking three light vehicles parked a short distance away from people. Seven people narrowly escaped being injured by flyrock. **The blasting contractor estimated the blast exclusion zone for personnel to be 400 to 500 metres from the blast site** [emphasis added]. The incident was not immediately reported, and did not come to the attention of the NSW Resources Regulator until September 7, 2018.

“Dangerous incidents must be reported to the NSW Resources Regulator in accordance with section 15 of the Work Health and Safety (Mines and Petroleum Sites) Act 2013 and regulations.”

<https://www.quarrymagazine.com/Article/9011/Flyrock-incident-in-NSW-quarry>.

- On August 8, 2017, a blast at Jefferson Quarry, Minnesota, sent flyrock as large as 82 pounds (37 kilograms) into a residential neighbourhood. One rock sailed a distance of about 570 feet (174 metres) punching a hole in the siding of a home, another sheared off large tree branches, and a witness described the sound of dozens of rocks flying through treetops and bouncing off roofs. A building struck by one of the larger rocks is city-owned subsidized housing apartment building. The quarry owner had its blasting permit suspended.

Tim Slipy, a Mankato resident who lives next door to the home that was struck by one of the large flying rocks, told the news agency that the blasts are frequent enough that he gave little thought to the quarry’s warning horn on August 8. “The horn blew. They do three blows before a blast, and about a minute later it goes off,” Slipy said. “This one, they did three blasts and, about five seconds later, there was a blast.” Then he noticed the sound of the rocks flying through the air.

A subsequent investigation of the August 8, 2017 quarry blast disclosed that,

In regard to loading and detonating the explosives...everything was pretty routine other than one or two holes that seemed to be leaking explosives, the workers...told Mankato fire and police officials.

[W]orkers were pouring 4,124 pounds of ammonium nitrate and fuel oil into 47 holes that had been drilled deep into a shelf of limestone. Known as ANFO, the legal explosive was the same type used by terrorist Timothy McVeigh in 1995’s Oklahoma City bombing, and the amount was only about 18 percent less than the 4,800 pounds McVeigh detonated outside the Alfred P. Murrah Federal Building, killing 168 people.

⁵⁸ <https://www.currentscience.ac.in/cs/Volumes/108/04/0660.pdf>.

This time the ANFO was being used by certified explosives experts with hundreds of blasts on their resumes.⁵⁹

The same quarry had its blasting permit suspended for 60 days following a prior blast on April 25, 2017 that was immediately followed by an earthquake-like tremor measuring 2.8 on the Richter scale, and strong enough to rattle buildings, prompting more than two dozen property damage reports.⁶⁰ U.S. Geological Survey scientists said it's unlikely the tremors occurred naturally.⁶¹ After the August 8, 2017 quarry blast, the quarry's blasting permit was again suspended, and the Department of Public Safety informed Jordan Sands it would not reactivate the permit.⁶² Following an investigation into the August 8, 2017 incident, the Attorney's office decided against criminal charges as it would be difficult to prove a "negligent discharge," a charge that can be levelled when someone "negligently causes an explosive or blasting agent to be discharged" in a manner that was in "gross disregard for human life or property."

<https://www.aggman.com/blasting-permit-suspended-for-mankato-quarry-after-large-rocks-fly-into-neighborhood/>.

- On May 17, 2017, six workers were exposed to the risk of death or serious injury when flyrock from mine blasting landed near the workers, within the mine's **500 metre personal exclusion zone** at the Moolarben Coal Mine near Mudgee. The workers were standing 246 metres from the blast site, and a 20 kg rock landed on a light vehicle. (**One of the workers had suggested to the group that they should report to the mine that the damage to the vehicle was caused by the car hitting a kangaroo while being driven off site.**)⁶³ The operator and one of its former contract workers were taken to court by the NSW Resources Regulator for alleged contraventions of the *Work Health and Safety Act*. **The alleged offences carry a maximum penalty of \$1.5 million in the case of the operator and \$300,000 in the case of the contract worker.**
<https://www.aihs.org.au/news-and-publications/news/moolarben-coal-operators-face-court-after-dangerous-shot-firing-incident>.
- On March 22, 2016, **Tracy L. Hockemeier was killed instantly when he was struck in the head by flyrock, weighing approximately 20 pounds (9 kilograms) and travelling at about 240 mph (386 kph) at the point of impact**, during blasting operations in the Winterset section of Plant 862 in Madison County, Earlham, Iowa.

⁵⁹ https://www.mankatofreepress.com/news/local_news/when-a-blast-goes-wrong-investigation-raising-questions-about-proper/article_4ca204bc-b5cf-11e7-a675-9f0c59ef8bc4.html.

⁶⁰ "Criminal charges possible in quarry blast," *The Free Press*, September 22, 2017, https://www.mankatofreepress.com/news/local_news/criminal-charges-possible-in-quarry-blast/article_32e3fd88-9fb7-11e7-b0eb-9b4c6c47ff17.html.

⁶¹ <https://www.insurancejournal.com/news/midwest/2017/08/17/461435.htm>.

⁶² "County attorney declines to file charges in quarry blast," *The Free Press*, October 11, 2017, https://www.mankatofreepress.com/news/local_news/county-attorney-declines-to-file-charges-in-quarry-blast/article_ed0f241e-aece-11e7-b449-0bee8d49d9c0.html.

⁶³ "Executive Summary," https://www.resourcesregulator.nsw.gov.au/_data/assets/pdf_file/0008/1086677/Investigation-Report-Moolarben-Shot-Firing-Incident.pdf.

Hockemeier was sitting in a pickup truck, approximately 1,200 feet (366 metres) from the blast site, preventing others from entering the blast area. When the blast was initiated, flyrock was propelled upward, landing on and penetrating the roof of the truck and striking the victim.

The mine operator failed to ensure that either the operator or the blasting contractor designated a safe distance from the blast site as a “blast area” to be cleared of persons prior to the blast. The mine operator also failed to ensure that either the operator or the blasting contractor adequately assessed and considered several of the factors listed in 30 C.F.R. § 56.2 in determining the boundaries of the “blast area” as that term is used in 30 C.F.R. § 56.6306(e). Those factors included, but were not limited to, the poor geologic conditions of the blast site and the material to be blasted; the loose rock; the voids, cracks and mud seams encountered during the drilling and loading process; the excessive water and mud infiltration into the blast holes, and the loss of loadable drilled holes due to excessive mud and water; powder factors; stemming issues; the operator’s blasting experience; and the effect of these factors on the potential distance of fly rock. Proper and adequate consideration of such factors would have led a reasonable and prudent operator and blaster to determine that the safe boundary of the blast area should have been further away from the blast site than the approximately 1,200 feet [366 metres] that the leadman was positioned from the blast site at the time of the blast.

<https://www.msha.gov/data-reports/fatality-reports/2016/fatality-3-march-22-2016/final-report>.

- On September 19, 2016, a blast at Gateway Materials quarry that sent rocks flying onto an occupied Halifax apartment building more than a kilometer (1000 metres) away. The blast threw rocks over the Bicentennial Highway and struck Parkland Arms apartment building at 390 Parkland Drive.⁶⁴ The explosives company pleaded guilty to an Occupational Health and Safety Act charge. In 2005, the same company was fined \$43,500 for a more serious incident that damaged the same building in 2003. In August 2003, flyrock ranging in mass from pebbles to 150 kilograms crashed into the same apartment building.
<https://www.thechronicleherald.ca/news/local/blasting-company-fined-40000-after-rocks-hit-apartments-in-2016-halifax-mishap-257818/>
- On May 21, 2015, a blast at a Loudoun County, Virginia, quarry sent rocks and debris smashing into homes and cars, leaving one person injured. A security camera video shows a rock flying through the air and shattering glass in the nearby Fairfax Auto Parts store, and a half dozen cars damaged in the store’s parking lot. Three large windows at the store were shattered when a rock went through the front of the store. Employees said they are used to the building shaking from nearby quarry blasts, but the size of these rocks was unprecedented. A huge rock from the quarry tore through the roof of a house a half mile (805 metres) away and landed in a bedroom. The person who was sleeping in the room was cut by debris that fell from the ceiling and needed eight stitches.

⁶⁴ Reportedly, City Centre Property Management filed a lawsuit against Gateway Materials Ltd. and B.D. Stevens Ltd. in the Nova Scotia Supreme Court in September 2018.

<https://www.nbcwashington.com/news/local/Sterling-Quarry-Blast-Sends-Rocks-Into-Cars-Buildings-304624031.html>

- On May 28, 2014, one of Consbec's controlled blasts resulted in fly-rock being projected outside the blasting area and onto a neighbouring residential property, approximately twenty-five (25) feet from where the homeowner and an employee of Bruman were standing. Consbec Inc. and Bruman Construction Inc., were fined a total of \$150,000 for failing to notify the *Ministry of the Environment and Climate Change* ("MOECC") of a flyrock discharge from a quarry in North Bay.
<https://www.siskinds.com/failure-notify-brings-150000-fine-despite-no-damage-property/>.
- On September 3, 2014 Rock Breakers executed a blast at the quarry in Merrick Township that caused errant flyrock to project outside of the blast area and onto a neighboring residential property. Flyrock the size of a basketball among other pieces landed 50 to 75 meters from the front door of the residence. Rock Breakers failed to report the flyrock discharge. Rock Breakers (2007) Inc. pleaded guilty to two offences for discharging or permitting the discharge of flyrock into the natural environment, which may have caused an adverse effect, and for failing to report the discharge, contrary to the *Environmental Protection Act*. Rock Breakers (2007) Inc. was fined a total of \$60,000 plus a victim fine surcharge of \$15,000.
<https://news.ontario.ca/ene/en/2015/11/drilling-and-blasting-contractor-fined-60000-for-fly-rock-discharge-and-failing-to-report-incident.html>
- On July 19, 2013, an explosion at a quarry in Nepal hurled rocks and debris around a kilometer radius. Flyrock struck and killed one person in a factory 500 metres away, and eleven others were injured in the hail of rocks, and 14 other factories were damaged. Twenty cars were crushed by flying boulders. A total of 37 department personnel from the local fire departments were dispatched to the scene.
<https://www.thestar.com.my/news/nation/2013/07/20/one-killed-in-quarry-site-explosion>
- On September 20, 2011, blasting at a Vancouver Island (Shawnigan Lake) gravel quarry hurled baseball-sized, jagged rocks 400 to 500 meters, striking three people. One woman had her arm severed below the elbow, and two men were seriously injured. Boulders rained onto nearby truck yards, with one rock breaking a piece of one-inch plywood on a flatdeck truck in the driveway.⁶⁵ **(The B.C. government released a practical guidebook to help promote safety in aggregate mining operations in January 2008, after four workers were killed in separate incidents in B.C.'s quarries in 2007.)**
<https://canada.constructconnect.com/joc/news/projects/2011/09/investigation-launched-after-explosion-at-vancouver-island-gravel-quarry-injures-three-workers-joc046827w>.

⁶⁵ <https://bc.ctvnews.ca/gravel-pit-blast-severs-woman-s-arm-injures-2-1.700846>.

- On February 24, 2011, a blast at Brayford Quarry sent flyrock 200 metres onto public roads and damaged waiting cars, and narrowly struck a workmen who had halted traffic while the blasting took place. The two cars waiting in the queue on a nearby public road were hit by flyrock, which dented the bonnet of one and shattered the windscreen of the other. HSE inspectors discovered an 8.5 kilogram rock on the other side of the road, and six smaller pieces of flyrock were recovered from the road. Both the blaster and the quarry owner pleaded guilty in Barnstaple Magistrates' Court and were fined. After the hearing,

HSE Inspector of Quarries, Mike Tetley, said: 'This was a very serious incident that could easily have led to death or serious injury. 'Blasting operations at quarries are inherently high risk, and these risks must be rigorously controlled by good explosives engineering practice and in accordance with legal requirements.

<https://www.agg-net.com/news/firms-fined-for-quarry-blast-damage>.

- On May 12, 2010, the discharge of flyrock caused damage to a garage in Magnetawan, Ontario. Castonguay had been hired to do blasting at a nearby quarry located on Old Hwy Road West.

The Ontario Court of Justice...added a couple of expensive [sic] postscripts to a landmark legal case that confirmed the incident reporting requirements under section 15(1) of Ontario's Environmental Protection Act. Castonguay Blasting Ltd. was found guilty (yet again) of failing to report the discharge of a "contaminant" (fly rock from its blasting operations) that caused or is likely to cause an "adverse effect" (damage to a movie theatre, parked cars and a garage) in three separate incidents.⁶⁶

The Parry Sound Court fined Castonguay \$75,000 (plus a victim fine surcharge of \$18,750) for failing to notify the MOE about the discharge of fly rock.

<https://news.ontario.ca/ene/en/2014/03/dnx-castonguay-inc-fined-75000-for-failing-to-report-discharge-of-fly-rock.html>

- On July 20 and 23, 2009 during blasting flyrock was discharged beyond the control area of 200 metres at a limestone quarry near Arnprior, Ontario. 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. The blast damaged property and impaired the safety of people. **"It was also determined that the control zone should have been 500 metres for blasting of this nature at the quarry."** [emphasis added] Perth-Austin Powder Ltd. was fined \$130,000 plus 25% Victim Fine Surcharge after pleading guilty to discharging flyrock into the natural environment causing off-site impacts and failing to report the discharges, contrary to the *Environmental Protection Act*.

⁶⁶ Marc McAree, "Castonguay Convicted Again: Ontario Courts Continue To Recognize Section 15(1) EPA 'Duty to Report,'" https://www.willmsshier.com/docs/default-source/articles/castonguay-convicted-again.pdf?utm_source=Mondaq&utm_medium=syndication&utm_campaign=View-Original.

<https://news.ontario.ca/ene/en/2014/04/burlington-firm-fined-130000-for-arnprior-blasting-offences.html>

- On September 24, 2008, flyrock from a quarry blast detonated by Maine Drilling and Blasting in South Burlington, Vermont, was thrown several hundred yards and did over a million dollars in damage to vehicles, buildings and airplanes at the Burlington International Airport (para. 44).⁶⁷ The same company had a blast go awry in Raymond, NH, on April 25, 2005, with flyrock doing damage to buildings and vehicles over 1,000 feet (305 metres) away.

<https://www.valleyreporter.com/index.php/news/my-view/4368->

- On May 6, 2008, flyrock ranging from small pebbles to 22 kilogram (49 pound) boulders rained down on a trailer park in Whitehorse, Yukon Territory (Canadian Press, 2010). The rocks were launched up to 140 metres from the blast site and destroyed a shed, crashed into living rooms of occupied trailers (as seen in Figure 8), and sent one tenant running for his life (Davidson, 2010).⁶⁸ At trial, the judge concluded that the blaster acted irresponsibly, while noting that blasting is “inherently dangerous”:

“It wasn’t until ‘well after’ the May 6 blast that Hildebrand [the blaster] ever saw a map showing the distance between the boulevard extension and the homes. ‘I have no hesitation in finding that both Sidhu Trucking and Mr. Cratty failed in their duty because they did not ensure that Mr. Hildebrand was properly oriented to the site so as to be aware of the close proximity of persons or property likely to be affected by the blasting operations,’ Faulkner [the judge] wrote. ‘Moreover, blasting is an inherently dangerous undertaking, and it would be common sense to be well aware of the distance to persons or structures -- especially in an urban area’” (Canadian Press, 2010).[emphasis added]

- On April 22, 2008, flyrock from a blast at Percy Quarry, Morristown, Vermont, consisting of rocks four to eleven inches long, struck “neighboring houses and the Morristown Highway Garage [686 feet or 209 metres].” “Smaller pieces of flyrock impacted neighboring homes [Pine Crest mobile home park] with so much force the flyrock was found embedded in a metal post and a lawn landscaping rock.” The Morristown garage is located about 686 feet from the blast site, and in a different direction than the mobile home park (718 feet or 219 metres). A subsequent incident at the Percy Quarry on September 9, 2008 again saw flyrock thrown into Pine Crest mobile home park.
- On August 22, 2007, blasting at Miller Braeside quarry in the Township of McNab/Braeside hurled flyrock that structurally damaged the foundation of one home and another home (in another direction) took the brunt of the flyrock. Flyrock struck the Jameses’ residence and vehicle, reportedly, causing \$250,000 in damages.⁶⁹ Subsequently, the Jameses filed an action against the quarry owner and the blasting

⁶⁷ http://www.killthealbionquarry.org/flyrock_danger.pdf.

⁶⁸ “Regulatory Mitigation of the Adverse Environmental Effects of urban Blasting,” Jeffrey Thomas Loeb, A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Applied Science, 2010, p. 41. <https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0050876#downloadfiles>.

⁶⁹ *James v. Miller Group Inc*, 2013 ONSC 3266 (CanLII), <<http://canlii.ca/t/g2f5j>>, retrieved on 2019-10-12.

company claiming damages of \$250,000. A prior blasting incident in September 2005, labeled the “megablast,” caused damage to residences, driveways and wells. Reportedly, some neighbours received compensation but only if they signed a confidentiality agreement, and to never come after Miller again for any damages. “One neighbor, Mr. Battiston, described flyrock that landed on his roof over 400 m from the site.”⁷⁰ The vibrations in the bedrock from the blast caused one of two wells of a neighbouring farmer to go dry, and a new well had to be dug, for which, reportedly, no compensation was received. The water from the other well was so murky that water for his cattle had to be hauled from the Ottawa River for a number of days. After the second flyrock incidence, the MOE charged the company and issued a \$25,000 fine.

<https://www.insideottawavalley.com/news-story/4508046-company-guilty-of-pakenham-blasting-mishap/>.

- On June 11, 2007, in West Lebanon, NH, Green Mountain Explosives detonated a quarry blast that resulted in flyrock being thrown 3,000 feet (10 football fields) into an industrial park doing damage to a building and 11 vehicles in the Technica USA parking. This same blast also sent flyrock about 4,000 feet (1,219 m) in another direction that landed on a runway of West Lebanon Airport, spreading dirt and debris.

The manager of Technical Services of Green Mountain Explosives, Tim Rath, represented Rivers as his blasting expert in environmental court.⁷¹

Mr. Rath testified at an Act 250 environmental hearing⁷² on May 2, 2016, that during a blasting event the nearby residents near [proposed] Rivers’ Quarry [93 acres] should be in their homes and not out on their property. When asked specifically about the danger from flyrock, Mr. Rath said that,

“You can never say never.” No matter how careful a blaster is there is no certainty a blast will not cause flyrock. There are over 20 homes within 3,000 feet [914 metres] of the proposed quarry with the closest property lines just over 200 feet [61 metres] away. [emphasis added]

<http://www.killthealbionquarry.org/DEATH-FROM-THE-SKY-FLYROCK.html>.

⁷⁰ *Miller Paving Ltd.*, PL130785, OMB, October 27, 2015 [para. 55].

⁷¹ In a 71-page decision, the Vermont Environmental Court concluded “that the proposed Rivers quarry would not ‘fit’ into its surrounding area, which has been designated and is actively used as a scenic resource, and will therefore bring an undue adverse impact upon this area. The proposed quarry does not conform to criterion 8. The noises and activity that the proposed quarry will bring to this area will be unique; they are not currently experienced in any fashion within the Ag-Res District and along the scenic corridor that is Route 100B.” The court concluded that “Rivers quarry, as proposed, is in conflict with...the use and enjoyment of neighboring properties.”

<https://www.vermontjudiciary.org/sites/default/files/documents/Rivers%20Development%20LLC-1.pdf>.

⁷² State of Vermont “Act 250 hearing” is conducted by a three-member District Environmental Commission. Their responsibility is to consider evidence presented by legally designated parties and to evaluate each Act 250 application in accordance with the 10 Criteria.”

https://nrb.vermont.gov/sites/nrb/files/documents/Act%20250%20Hearing%20Information_0.pdf.

In rejecting the proposed Rivers' Quarry, the environmental court concluded that,

Blasting at the proposed quarry would have several materially adverse impacts upon the surrounding properties and uses, including substantial risks to the neighbors' water supply from toxic chemical spills and altered groundwater flow patterns, air quality impacts from dust, and aesthetic impacts including noise over 70 dBA beyond the Rivers' property line...and the hazard that flyrock poses to neighboring properties and uses.

- In December 2005, the NSW Department of Primary Industries issued a Safety Alert following a flyrock incident at a quarry. During a quarry blast, flyrock was projected more than 500 metres onto the Pacific Highway. A rock of approximately 100mm diameter was also projected onto a nearby property where it caused damage to a shed and parked vehicle. In addition, the windscreen of a front end loader in the quarry was broken. The drilling and blasting was carried out some 36 metres below the top level of the pit.
https://www.resourcesandgeoscience.nsw.gov.au/_data/assets/pdf_file/0010/66376/Safety-Alert-05-16-Blast-Control-Flyrock-incident.pdf.
- According to a "Flyrock Hazard Alert" issued by the Virginia Department of Mines Minerals and Energy, **"flyrock can travel 3,000 feet [914 m] or more, reach speeds of 400 miles per hour, and can penetrate buildings, smash vehicles, and cause great bodily harm."** "From December 2003 through August 2006, 5 serious flyrock incidents have occurred from blasting at surface mineral mines/quarries in Virginia." [emphasis added]
<https://www.dmme.virginia.gov/dmm/PDF/SAFETY/ALERTS/blastingflyrock/FlyrockHazardAlert.pdf>.
- On July 11, 1990, **flyrock from a Livingston County, IL limestone quarry blast traveled about 930 feet (283 metres) and struck a resident who was mowing grass on his property. He died from head injuries on July 17, 1990.** [Mine Safety and Health Administration, Department of Labor 1990B] [emphasis added].
<https://www.cdc.gov/niosh/mining/UserFiles/works/pdfs/sofad.pdf>.

Blasting is an "Ultrahazardous or Abnormally Dangerous" Activity

Blasting has been identified as "intrinsically dangerous," because of the impossibility of "predicting with certainty the extent or severity of resulting consequences" rendering blasting ultrahazardous.⁷³ Ultrahazardous activities are also known as "abnormally dangerous" activities. No amount of reasonable care can "eliminate the risk of serious

⁷³ *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.

harm” accompanying an ultrahazardous activity such as blasting.⁷⁴ Accordingly, courts have held that a rule of strict liability applies to actionable harms resulting from blasting.

Because these activities [blasting] are extremely dangerous, they must “pay their own way, [citation omitted] and the parties responsible must bear the cost regardless of whether they have been negligent. North Carolina courts have not yet recognized as ultrahazardous any activities other than blasting [para. 234].”⁷⁵

Case Study 1

In *Dyer*,⁷⁶ the appellate court noted that blasting is “inherently dangerous” and that “most courts have recognized that this inherent danger cannot be eliminated by the exercise of care.” The courts have allowed strict liability in blasting cases because of the unpredictability of the danger associated with even the most cautious blasting. (Worley, 210 S.E.2d at 163) In support of this assertion, the court demonstrated that “Dyers’ expert testified that blasting may cause damage even when it is within the [United States Bureau of Mines] guidelines.”

The court further justified imposing strict liability by contending that “although blasting is a lawful and often beneficial activity, the costs should fall on those who benefit from the blasting, rather than on an unfortunate neighbor.”

In order to prevail on an ultrahazardous or abnormally dangerous claim, the plaintiff needs to prove all of the following elements:⁷⁷

- ***The activity involves a verifiable risk of serious harm to persons or property***
- ***The activity cannot be performed without the risk of serious harm, no matter how much care is taken, and***
- ***The activity is not commonly engaged in by the people of the community***

Also, it must be proven that the defendant’s actions actually caused the plaintiffs’ injuries, and that the plaintiff did in fact sustain injury.

Case Study 2

Offences under the *Occupational Health and Safety Act*, R.S.Y., 2002, c. 159, are strict liability. On November 1, 2007, an explosive charge set off by P.S. Sidhu Trucking Ltd.⁷⁸ on the Hamilton Boulevard Extension in the City of Whitehorse sent a piece of flyrock, the size of the owner’s fist, through the roof of Trailer #23 and landed on the living room floor. Trailer #23 is located in Lobird Trailer Court approximately 350 metres from the blast site (para. 7). Again on May 6, 2008, a blast scattered flyrock along the road leading to the trailers in nearby Lobird Trailer Court. One rock flew 166 metres from the blast site and penetrated the roof of Trailer #212 and ended up in the living room, nearly hitting the

⁷⁴ See *Woodson v. Rowland*, 407 S.E.2d 222 (1991) 329 N.C. 330, at 350, 407 S.E.2d at 234.

⁷⁵ *Ibid.*

⁷⁶ *Dyer v. Maine Drilling and Blasting, Inc.*, 63 Me. Rev. 331 (2010). See “The Wrong Approach at the Wrong Time?": Maine Adopts Strict Liability for Abnormally Dangerous Activities

⁷⁷ LegalMatch, <https://www.legalmatch.com/law-library/article/ultrahazardous-activity-liability.html>. See *Restatement (Third) of Torts* § 20(b) (2009). A person who is found by a court to have carried on an abnormally dangerous activity will be subject to **strict liability** for physical harm resulting from that activity.

⁷⁸ *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 2019-09-28.

occupants. Trailer #112 and Trailer #218, 219 metres and 149 metres, respectively, from the blast site were also damaged. None of the occupants had been notified of the blast. Other flyrock hit roads, fences, sheds, vehicles and trailers. At trial court, the expert testified that, but for the flyrock incident, the blast was a 98% success (para. 50)!

An expert blaster called by counsel for the Director of Occupational Health and Safety indicated that blasting is not an exact science, and he appeared unwilling to blame the blaster. Had it not been for the flyrock incident, he testified that he would have considered the blast a success (para. 23). [The expert] did acknowledge that there was zero tolerance for flyrock in urban settings (para. 24) [but said] he might have made the same decisions as the blaster..(para. 25) [emphasis added]

The lower court ruled that the *OHS Act* is to promote safe practices in the workplace, protecting employees, and members of the public that are in proximity to the workplace. The damage from the blasting incident was foreseeable. Both the blaster and the expert acknowledged that blasting is inherently dangerous. The court's ruling, upheld on appeal, concluded that Sidhu Trucking did not exercise due diligence and failed as an employer to ensure that blasting processes under its control were safe and without risks to health (para. 75).

Richard Scott Parker, testifying in the trial court as an explosives expert with 40 years' experience, was quoted in a March 31, 2010 article,⁷⁹ stating that,

No one can do a perfect blast every time. That's why blasting companies carry insurance.

Case Study 3

As a result of blasting operations at the Vigus Quarry, the plaintiffs in *Donnell v. Vigus Quarries*⁸⁰ were awarded \$27,000 for damages caused to their property by *concussion* and *vibration*. In 1966, the plaintiff commenced construction of a barn. At that time there was no blasting at the quarry adjoining their property. In 1967, the Donnells noticed some blasting at the quarry. Concerned over the effect blasting might have on a home that the Donnells were planning to construct, a representative of the quarry was contacted. The quarry representative assured the Donnells that there would be no blast damage to structures on their property, which was about a quarter mile from the quarry. Construction of the home was completed in 1969, and the Donnells moved in the same year. In addition to the barn and house, they built a workshop and a pavilion. In late 1969 or 1970 after experiencing vibrations from blasting, the Donnells observed that the front and rear porches had cracked. On further inspection of the home, and other structures on the property, additional cracks were found in the house, barn, pavilion and workshop. Most of the cracks appeared in the fireplaces, the ceilings, basement and floors of the new buildings.

⁷⁹ "Blasting is not an exact science": expert," *Whitehorse Daily Star*, <https://www.whitehorsestar.com/News/blasting-is-not-an-exact-science-expert>.

⁸⁰ *Donnell v. Vigus Quarries, Inc.*, 526 S.W.2d 314 (1975). https://scholar.google.com/scholar_case?case=11912900217179761342&q=Donnell+v.+Vigus+Quarries+Inc&hl=en&as_sdt=2006.

Joseph Brooks, a consulting engineer with a masters degree in civil engineering, was retained by the Donnells. He testified that the home was above average in construction, and that the other buildings on the property were of typical construction. The home is on a rise and the home and other structures are built on hard clay with no fill. Accordingly, drainage settlements and differential settlement were ruled out as causes of the cracking and damages to the structures. Brooks inspected the property in April 1972 and again in February 1973. In response to a hypothetical question, Brooks testified that the damage to the plaintiffs' property was caused by blasting operations. While acknowledging that blasting may be lawfully pursued, the court held that when explosives are intentionally detonated there is absolute liability for injuries and damages.

Preliminarily we note that blasting is a work which may be lawfully pursued. However, when one intentionally detonates explosives he is absolutely liable for injuries and damages which are the proximate result of such explosions. Summers v. Tavern Rock Sand Company, 315 S.W.2d 201 (Mo. 1958).

The court was sensitive to the fact that “in cases such as this *vibrations* and *concussions* cannot be seen, and the case must, to a large extent be based on circumstantial evidence [citation omitted].” Damages to property in cases of explosion are measured as the difference in market value *before* and *after* the blasting operation or the cost of restoring the property, whichever is the lesser. A local real estate broker testified on behalf of the Donnells, without objection, that prior to the blast damage the value of the property was \$90,000, and because of the blasting the value of the property had decreased by \$35,000. The trial court awarded \$27,000 in damages, which was upheld by the appeals court.

Case Study 4

In *Laughon Johnson v. Burch*,⁸¹ the plaintiffs sustained property damage from nearby blasting in connection with road work. Severe *vibration* and *concussion* from the blasting caused cracks to the exterior and interior of the plaintiffs' residences. At trial,

plaintiffs conceded they had no evidence that defendant was negligent in either case. The plaintiffs' evidence showed that cracks developed in the interior and exterior of their homes following severe vibration and concussion associated with the blasting.

The trial court ruled in favour of the plaintiffs applying the rule of strict liability, finding as a fact that the *concussion* from the defendant's blasting operation proximately caused the damages. On appeal, the Supreme Court of Virginia upheld the lower court's ruling. The court concluded that “when property is damaged by vibration or concussion from blasting operations, there will be liability upon the blaster irrespective of negligence, provided, of course, the damage claimed is a direct and proximate result of the explosion,” quoting favourably from *Exner*:

It is true that some courts have distinguished between liability for a common-law trespass, occasioned by blasting, which projects rocks or debris upon the property or the person of the plaintiff, and liability for so-called consequential damages arising from concussion, and have denied liability for the latter where the blasting itself was conducted at a lawful

⁸¹ *Laughon Johnson v. Burch*, 278 S.E.2d 856 (1981).
https://scholar.google.com/scholar_case?case=3814718433162417000&hl=en&as_sdt=2006.

time and place and with due care. [Citations omitted.] Yet in every practical sense there can be no difference between a blasting which projects rocks in such a way as to injure persons or property and a blasting which, by creating a sudden vacuum, shatters buildings or knocks down people. In each case, a force is applied by means of an element likely to do serious damage if it explodes. The distinction is based on historical differences between the actions of trespass and case and, in our opinion, is without logical basis. [54 F.2d at 513-14].

Case Study 5

*Gateway Estates Park Condominium Association*⁸² manages a mobile home community of 220 homes and two vacant lots. The condominium association holds title to a number of common elements, including man-made South Lake that was excavated sometime before 1975 when the condominium was registered. In 2005, *SDI Quarry*, which operates the only mines at which blasting is conducted in close proximity to the community, began blasting at three mines near South Lake, no closer than 7,000 feet (2.13 kilometres) from the mobile home community, averaging about 20 blasts a year. Each blast was monitored and the vibrations recorded. All were within lawful levels established by state law (the limit is a particle velocity (PPV) of 0.5 inches per second). None exceeded 0.2 PPV at South Lake, with most being 0.1 PPV. No damage to South Lake was evident for five to six years of blasting until 2011, when its shore first began to show signs of destabilization.

In 2011, about five or six years after Appellee began its blasting activities, the shore of the South Lake began to destabilize, and saturated soil at the edge of the lake began to slough and slump into the water. This opened up fissures in the slope, which undermined the upward bank. In time, holes appeared in the bank, and pieces of the once level surface fell off, resulting in a narrowing of the horizontal area from roughly five feet to about a foot and a half. Residents observed the ground falling into the water in close temporal proximity to the blasting.

In late 2014 or early 2015, *Gateway Estates* retained James McNew, owner of Upper Keys Consulting, to give recommendations concerning restoration of the lake bank. Upper Keys Consulting prepared an estimate in the amount of \$840,000 for restoring the shore of South Lake and installing preventive devices to protect the shoreline against erosion from further blasting. This led to litigation against *SDI Quarry* under Florida's Construction Materials Mining Activities Administrative Review Act. Blasting continued without interruption, and between July 1, 2015 and October 17, 2016, there were twenty-five blasts. Based on this figure, the administrative law judge inferred that the number of historical blasts that had impacted South Lake was 200 to 250. Whether the detonations caused harm to South Lake's shoreline was the focal point of the administrative proceedings. That **"the blasts were all within state standards,...doesn't negate potential liability."** [emphasis added]

It was acknowledged that "no generally accepted scientific standard exists as to relevant threshold PPV levels for when man-made lakeshores would be adversely affected by vibrations from afar." McNew, over the objections of the *SDI Quarry*, was qualified to testify "as an expert on causation." McNew, holding a degree in mechanical engineering, had no training or significant education in seismology, geotechnical engineering, or geology.

⁸² *SDI Quarry v. Gateway Estates Park Condominium Association*, 249 So.3d 1287 (2018)

McNew testified that he consulted extensively with an engineer, and they produced a set of notes based on their extensive research of the literature, and these formed the basis of his opinion as the causes of the slope stability failures around South Lake.

McNew opined that vibrations from Appellant's blasting caused the problems at Appellee's lake. Specifically, he explained that these vibrations acted upon the soft layer of silt atop the shore and bank of the South Lake, causing the liquefaction of this saturated soil extending up to eight feet beneath the surface. This led to the compaction of the loose, wet soil around the edges of the lake, opening up cracks and holes and weakening the slope, which began to erode and fail. McNew conceded that there were no legal standards in Florida or elsewhere establishing thresholds above which lakeshore slope instability would be expected under the stress of blast-related vibrations. In formulating his opinion, McNew stated that he used Transit Authority Guidelines rather than mining guidelines because the transit guidelines provided a more realistic standard where the damages were not to buildings. McNew also ruled out other possible causes such as earthquakes or heavy truck hauling near the lake.

Ruling in favour of *Gateway Estates*, the administrative law judge found McNew's opinion on causation more persuasive than the competing view offered by *SDI Quarry's* experts. In doing so, the judge

noted that Steven Black's categorical opinion that blasting could not be a cause of the damage to Appellee's lake was undercut by his concession that heavy truck traffic could affect the silt layer of a lakeshore over a continuous period of time. The administrative law judge also found that the circumstantial evidence supported McNew's opinion. Specifically, he noted that "the South Lake had existed for at least 35 years without experiencing the deterioration of the shore and bank that became noticeable within just five or six years after the start of the blasting, and which worsened over time as the blasting has continued." He also noted "the persuasive evidence that visible damage occurs in the wake of individual blasts."

The administrative law judge accepted Black's evidence to the extent that wind, wave and rainwater was a natural cause of some of the bank erosion at South Lake, and found that *SDI Quarry's* blasting combined with the natural forces constituted a legal cause of the claimed property damages. Adding, "as a matter of fact, the property damage at issue is present and continuing; the harm to the lakeshore is cumulative, indivisible, and inseparable." Finding that blasting is an ultra-hazardous activity for which strict liability is imposed, the administrative law judge concluded that *Gateway Estates* was not required to prove *SDI Quarry* was negligent or that *SDI Quarry's* blasting was the sole cause of *Gateway Estates'* damage. *Gateway Estates* was awarded \$840,000 in damages. In a continuing tort (trespass), the statute of limitations runs from the time of the last tortious act.⁸³ The Florida appeals court, in an unanimous ruling, upheld the administrative order.

⁸³ In *Plaunt v. Renfrew Power Generation Inc.*, 2011 ONSC 4087 (CanLII) the reference to "The Law of Torts, 9th ed., John G. Fleming (Sydney: LBC Information Services, 1998), at page 48," that [i]n many American blasting cases it has been held that damage from flying rocks is trespass, but from vibration or concussion at most nuisance," no longer reflects the state of common law. Claims of damages occasioned by "vibration or concussion" as a consequence of blasting are now treated as the tort of "trespass."

Case Study 6

In Consbec Inc. v. Her Majesty the Queen, it was alleged that Sidon's well (a neighbouring residential property) had been damaged and gone dry, as a consequence of a blast on March 28, 2004 at Weeks' quarry. The same blast also propelled flyrock beyond the limits of the property. Consbec, the blasting company, was charged under the Environmental Protection Act for releasing a contaminant "flyrock" into the environment. On May 12, 2008, Consbec pleaded guilty to the offence before the trial Justice of the Peace, resulting in a fine and restitution order to replace the neighbour's well. Nine crown witnesses and one witness on behalf of Consbec appeared at the sentencing. Most of the evidence of the witnesses called to give testimony at the sentencing hearing, including two experts, Mr. Hawley for the prosecution and Mr. Jambakhsh for Consbec, was reviewed by the trial Justice of the Peace. Consbec presented no contrary evidence,

including, significantly, the lack of any pre-blast inspection of the Sidon's well, that "the water in the Sidon well prior to the blast in question was acceptable and usable, potable water".

Despite the defendant's preliminary examination and challenge to the qualifications of the Crown's expert witness, Mr. Hawley, was accepted by the trial Justice of the Peace "as an expert in well construction, well inspection and well water quality." The court also qualified Mr. Hawley "as an expert in well inferences including inferences from blasting based on his experience in resolving complaints of interference with well water quality or quantity during 57 investigations." According to Mr. Hawley,

In his opinion, he testified that the blast in question has shaken the local bed rock sufficiently to create two likely problems. First, the vibration was sufficient to re-suspend soils in the bedrock fractures supplying the Sidon well and second, the seal that existed between the casing and the bedrock has been broken by the vibration. This would account for the re-occurrence of the cloudy water following a rainfall event and could explain the bacterial contamination of the well.

Case Study 7

In 1991, the City of Greenwood (City) and Martin Marietta Materials, Inc. (MMM) entered into a contract that allowed trucking companies to use Second Avenue when traveling to and from the quarry. Use of Second Avenue occurred without incident until 2006, when, in an effort to control traffic, the city passed an ordinance (by-law) imposing weight restrictions on trucks travelling along Second Avenue. Subsequently, the City passed a second ordinance that prohibited commercial vehicles from using the city's streets unless the street was designated "Commercial Route. In effect, the ordinance prevented trucks from using Second Avenue. Both ordinances were subsequently ruled invalid by the courts. The City of Greenwood then designated Second Avenue as the route to be used for quarry traffic. Greenwood is a town of about 4,500 in southeast Jackson County, MO. It straddles the Jackson/Cass county line. In December 2017, after a six-year legal battle, MMM was ordered to pay 18 current and former Greenwood residents a total of \$831,000, with separate verdicts ranging from \$6,590 to \$156,974, as damages for a claim of nuisance.

Testimony at the three-week trial revealed that as many as 750 trucks a day rumble past their homes, shaking houses, breaking windows, spitting gravel and dust, sometimes

exceeding the speed limit and preventing parents from letting their children play outside in their front yards.

Origin of the Rule – Strict Liability

The origin of the rule of strict liability stems from common law dating back to an 1868 case in England:⁸⁴

Courts have often identified blasting (the controlled use of explosives to break down or remove rocks) as the paradigm of an abnormally dangerous activity because of its inherent dangers, and they applied strict liability in cases where blasting resulted in physical harm. The victims of physical harm resulting from blasting were often totally innocent and uninvolved in the activity, while the persons conducting the blasting were doing so for their own financial benefit and were well-aware of the risks. Courts therefore took the position that defendants should be held strictly liable for any harm caused by projected debris. [emphasis added] See Restatement (Third) of Torts § 20, cmt.(e) (2009).

In Rylands v. Fletcher, an English case from 1868, the opinion read that "[a] person who for his own purposes brings on his lands and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril." American courts often cite this case as providing the origin of the rule on abnormally dangerous activities. In US jurisdictions, courts have never required that the activity take place on the defendant's land. However, they retained the requirement of "unnatural use" in the form of "not of common usage", meaning an activity that is unreasonable or inappropriate in light of the circumstances. See Restatement (Third) of Torts § 20, cmt.(d) (2009).

Conclusions & Observations

- 1) The Ontario government has a moral responsibility and legal duty to protect its citizens and the environment from the potentially lethal consequences of flyrock. Most incidents of flyrock go unreported, concealing the extent of the problem.
- 2) Blasting is "ultrahazardous" or "abnormally dangerous," and proposed quarries that intend to blast to extract aggregate must be restricted to sparsely populated rural areas, far removed from settlements, and appropriately setback from all wells, residences, livestock, infrastructure (e.g., major arterial roads and highways, gas lines), sensitive landmarks, watercourses and topographical features.
- 3) The idea that residents and pets must hustle into their homes (which may not protect them or their homes from flyrock) at the alarming sound of warning horns and blasts is akin to being under siege in wartime, with the potential for long-term physical, emotional and psychological issues (e.g., hearing loss, Tinnitus, Post-traumatic Stress Disorder, respiratory illnesses from dust inhalation, etc.)
- 4) Petty fines and short-term license suspensions are an inadequate deterrent to operators of quarries who cause injury or potentially injury to the public, the environment, livestock, pets, wildlife, services (e.g., well, septic, hydro, cable, gas) and property values.

⁸⁴ https://www.law.cornell.edu/wex/abnormally_dangerous_activity.

- 5) To avoid many of the potential adverse effects associated with quarry blasting, a minimum setback of 800 metres from any sensitive land use (or activity) should be imposed.