Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Blast Impact Analysis (BIA)

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (January 2021)	Reference	Source of Comment	Applicant Response (June 2021)	JART Response	Applicant Response (June 2022)
Report/Date: Blast Impact Analysis, March 24, 2020 & April 23, 2020				**Author: Explotech Engineering Ltd.**		
1.	The introduction recommends that a vibration monitoring program be continued and maintained for the duration of all blasting activities. Is this a requirement of the MECP Certificate of Approval? Are there securities or other legal assurances that the monitoring will take place? Is it possible for the language of the Official Plan Designation to include this recommendation?	General	City of Burlington	The MNRF Provincial Standards require that all new licences monitor all blasts for ground vibration and blasts over pressure to ensure compliance with provincial guidelines. It is our understanding that provided the requirement for vibration and overpressure monitoring is included as a site plan condition, this requirement becomes legally binding. It is further our understanding that the recommendations of the Blast Impact Analysis (Pages 32 – 33) will be fully transcribed onto the final site plans thereby providing a vehicle for enforcement.	Request is for that monitoring to be done by a third- party engineering company independent of the explosive supplier and/or blasting contractor.	This request is not warranted. All monitoring is completed by experts independent of Nelson and conducted and reported in accordance with required standards and protocols.
2.	In the BIA report no mention is made regarding presence of any identified water body within the proposed extraction areas or within 500.0 metre stand off distance outside the extraction areas. There are water bodies in the area.	General	DST Consulting Engineers Inc.	Please refer to the supplemental technical memorandum addressing fish bearing waterbodies in direct vicinity of the Burlington Quarry dated January 19, 2021 based on additional information provided by project biologists. In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021	Comment addressed.	
3.	It is noted that the version of site plan drawings appended to BIA is missing the “Note” section. The same version of site plan drawings provided to the retained consultant by Halton includes “Notes” on the drawings.	General	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis to include the newest version of site plans dated April 2021. Refer to revised BIA dated June 16, 2021	Comment addressed conditional upon the site plan notes being updated to address the recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**.

4.	The impact of blasting in the context of production of vibration and overpressure and their effect on neighbouring sensitive receptors located at various standoff distance are considered by the BIA report. The BIA report identifies a number of these receptors to be owned by the applicant, and hence considers them as non-sensitive receptors for the purpose of predictive vibration and overpressure impact calculations. Should these be considered as sensitive receptors given current use and design?	General	DST Consulting Engineers Inc.	Nelson Aggregates has advised that upon commencement of extraction in the extension lands, the owned properties will be non-sensitive either as a result of their demolition, conversion into commercial space, or suspension of active use. As such, these properties would be exempt from the guidelines set out in NPC 119. For informational purposes, Explotech has included the vibration calculations anticipated at these properties as part of the BIA report.	Comment addressed.	
5.	In order to mitigate the potential vibration and overpressure on surrounding existing sensitive receptors, the BIA uses a well-known predictive model, namely the Bureau of Mines (BOM) prediction formula or Propagation law. The BIA states that this model has been used by Golder Associates (Golder) to develop a site-specific attenuation formula based on a study carried out at the existing Burlington Quarry in 2006. However, the attenuation curves referred to in the Appendix C of the report are dated 2004. The BIA solely relies on the site-specific attenuation curves established by Golder for the existing Burlington Quarry for their assessment of the impact of blasting on surrounding sensitive receptors in the proposed Burlington Quarry Extension area with no new data added, even though the new data is available.	General	DST Consulting Engineers Inc.	The attenuation study referenced in the Explotech BIA incorporates information gained through the attenuation study undertaken by Golder Associates in 2004 as part of an unrelated study at that time. Given the fact that this analytical effort was previously undertaken and there has been no change in material characteristics or blasting practices, it was determined that undertaking a duplicate study would provide no new information or insight. While compliance monitoring data is available for the period from 2014-2019, the majority of the data is lacking critical information regarding the location of the blasts and/or the location of the seismographs relative to the blast which is necessary to accurately append the data to the earlier attenuation study. Inclusion of this data into the attenuation equation would result in a less reliable model for predicting ground vibrations and air overpressures.	Comment addressed. Explotech has included the complete Golder's report in Appendix C of their updated BIA report of June 16, 2021 and has been reviewed by DST.	

6.	The BIA report under the heading “EXISTING CONDITIONS” identifies seventy-eight (78) sensitive receptors with respective standoff distance from the extraction zones comprising of residential dwellings and a Golf Course known as Camisle Golf Course. The civic addresses and the land use of these properties are also identified in the BIA report. Of the seventy-eight sensitive receptors, eleven (11) dwellings are presently owned by the proponent and may be converted to offices, in which case will be eliminated from the list of sensitive receptors. The properties owned by the proponent are amongst the closest to the proposed extraction areas. The BIA identifies Buildings located at 2280 No. 2 Side Road presently owned by the proponent as structures classified as “culturally significant” and will be vacant at the time of extraction, and thus will not be considered as sensitive receptors. Should all of these building be considered as sensitive receptors given current use and design?	Existing Conditions	DST Consulting Engineers Inc. and Halton Region	Please refer to the answer in question 4. Additionally, the heritage structure located at 2280 No. 2 Side Road was given special consideration in the BIA due to its heritage status regardless of its status as a receptor. Specifically, the BIA recommends that “In order to safeguard the structural integrity of the structures located at 2280 No 2 Side Road, ground vibrations shall be maintained below 50mm/s (>40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s”. This recommendation is based on the understanding that the building need not be subject to the MECP nuisance criteria as it will be vacant but should be subject to the damage criteria so as to prevent any adverse impacts on the structure(s).	Comment addressed.	
7.	Page 7 recommends that vibrations at 2280 No. 2 Side Road be maintained below 50.0 millimetres/second, and the closest structure on the property shall be monitored for ground vibration and over pressure when vibration calculations suggest vibrations in excess of 35.0 millimetres/second. Page 8 indicates Nelson Quarry is the owner of the property, please confirm that the vibration monitoring equipment will be or has been installed and monitored	Page 7	City of Burlington	The BIA prepared by Explotech recommends that all blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments – one installed in front of the blast and one installed behind the blast. Additionally, it is recommended that the …structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s. Provided this recommendation is included on site-plans, this will be a condition of site plan approval in the	Comment addressed conditional upon the site plan notes being updated to address the recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**. Regarding the request related 2280 No. 2 Side Road this has requirement has been included in Blasting Note 2 c).

				extension lands. Monitoring practices at the existing licence can be confirmed by others.		
8.	Page 10 provides recommendations on blast monitoring, please provide confirmation on where the vibration monitors will be (or are currently) installed (municipal address, and location on property) and if necessary (for non-owned properties) provide written confirmation from landowners that they have given permission for the vibration monitors to be installed on their property.	Page 10	City of Burlington	The BIA prepared by Explotech recommends that all blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments – one installed in front of the blast and one installed behind the blast. Specific installation locations can only be determined at the field level in response to each individual blast locations and orientation. Location of seismographs provided in the 2014 - 2019 blast documentation are provided on Page 26 of the BIA.	Comment addressed conditional upon the site plan notes being updated to address the recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**.
9.	Page 20 references the Sun Canada Pipeline. The BIA report provides a detailed assessment of the impact of blasting on the Sun Canadian High Pressure Oil Pipeline and recommendation on changes in the blast design parameters to protect the pipeline based on the Sun Canadian vibration limit policy. GIS mapping indicates there is also an Enbridge Pipeline and Imperial Oil Pipe line south of the south expansion, have any of those agencies been contacted to see if there are any precautions or requirements for blasting in proximity to the pipelines?	Page 20	City of Burlington	The Enbridge specification “Third Party Requirements in the Vicinity of Natural Gas Facilities” states that Enbridge must be notified of blasting operations if they are undertaken within 300m of the pipeline. Similarly, Imperial Oil requires notification of blasting operations if they encroach within 300m of the pipeline. Given the approximate 430m from the closest point of the southern extraction area to both the Enbridge and Imperial Oil Pipelines these agencies are not required to be contacted. Additionally, both pipelines fall further removed than the Sun Canadian Pipeline and hence the Sun Pipeline	Comment addressed.	

				will govern from both a compliance and blast design perspective.		
10.	The BIA report under the heading “REVIEW OF HISTORICAL BURLINGTON QUARRY DATA” states that vibration and overpressure data has been collected in recent years for all blasts conducted at the Nelson Aggregate Burlington Quarry (for 2014 through 2019) and provided to Explotech as part of their analysis. The historical vibration and overpressure data are included in Appendix C of the report. As part of their analysis, the BIA further confirms that the data reveals occurrence of 18 exceedances over the period from 2014 to 2019. List of exceedance occurrences, their location, exceedance level, date and time are presented in Table 5 of the BIA report. Although the data has been reviewed, it is not used in the BOM model prediction model for predicting expected vibration and overpressure levels for the quarry extension. If the prediction formula established by Golder is used for calculation of predicted vibration and overpressure levels for the new extension, then the data collected from actual quarry blasting during the period of 2014 to 2019 should have been incorporated in the model.	Review of Historical Burlington Quarry Data	DST Consulting Engineers Inc.	Please refer to the answer in question 5.	Comment addressed. Please refer to JART comment #5.	
11.	The Recommendations section (pages 28/29) does not address warning clauses, are there any warning clauses recommended for surrounding residential properties and/or to be included in the Official Plan Designation?	Pages 28-29	City of Burlington	At this time Explotech is not aware of any warning clauses recommended for surrounding residential properties. MHBC advises that for new or expanded mineral aggregate operations, warning clauses are not put in place on surrounding residential properties and it is the applicant’s responsibility to operate in compliance with provincial guidelines to ensure no adverse impacts to surrounding properties. When the subdivisions were approved in the area (Paletta, Illingsworth and Bunkowsky), as part of that approval, the Owners were	Comment addressed.	

				required to include in all Offers of Purchase, Agreements of Purchase and Sale, or Lease and Reservation Agreements a warning clause regarding Nelson's operation. The following is the excerpt from the Paletta subdivision. The other approvals included a similar warning clause: *"Purchasers are advised that Nelson Aggregate Company ("Nelson") is the owners of lands located in Lots 1 and 2, Concession 2 and 3, N.S., City of Burlington, in the Regional Municipality of Halton and which lands are in proximity to those lands being developed for residential purposes by Paletta International Corporation.* *The Nelson lands are presently licensed and operated for aggregate extraction industrial purposes and it is the intention of Nelson, through its licensees, agents, successors and assigns, to use the lands for the purpose of extraction, processing, manufacturing and transportation of aggregates.* *(i) Purchasers are also advised and acknowledge that noise, vibrations, dust, visual unsightliness, large equipment, maneuvering and permitted working hours are all incidental to the lawful operation of aggregate extraction site and the lawful operation of heavy vehicles on the public roads.* *(j) Purchasers are further advised that even though noise and vibration control features may be incorporated within the development area,*		

				noise and vibration levels may be of potential concern."		
12.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following need to be addressed: • Critical conditions recommended by the BIA be included in the site plan notes.	Recommendations	DST Consulting Engineers Inc.	Explotech has reviewed the site plans and all required conditions are included and MHBC will be further updating the site plans to include the additional recommendations found in the revised BIA dated June 16, 2021	Comment addressed conditional upon the site plan notes being addressed. Please refer to comment #21 for the site plan recommendation related to flyrock. The critical conditions have since been revised to include conditions of approval (with the exception of reference to latest Explotech's BIA report, please refer to Explotech's BIA report of June 16, 2021, Nelson_-_Blasting_Response_to_JART_June_2021_Package).	See Response to Comment # 21.
13.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following need to be addressed: • The Golder Associates vibration attenuation study report referred to in the BIA report be provided for ease of technical review and cross reference.	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021	Comment addressed. Please refer to JART comment #5.	
14.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following need to be addressed: • The source of the Nelson Quarry vibration and Air Attenuation Curves included in Appendix C (Figures 5 and 6) of the BIA report be identified.	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021	Comment addressed. The source of the Nelson Quarry vibration and air attenuation curves has since been identified by Explotech in their updated June 16, 2021 and reviewed by DST.	

15.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following need to be addressed: • Vibration and overpressure data collected in the first 12 months of the proposed quarry extensions be incorporated in the data attenuation data base to develop a more reliable and new site-specific attenuation formula.	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis to include the following recommendation: Vibration and overpressure data collected during the first 12 months of extraction in the proposed quarry extension lands will be used to calibrate and update the 2004 Golder Associates attenuation equation. The proponent shall ensure information collected includes all relevant blast and monitoring details to permit and facilitate inclusion of the data in the attenuation data and resultant equation.	Comment addressed. Explotech in their updated BIA report of June 16, 2021, has addressed this concern by adding the following recommendation: • "Vibration and overpressure data collected during the first 12 months of extraction in the proposed quarry extension lands will be used to calibrate and update the 2004 Golder Associates attenuation equation. The proponent shall ensure information collected includes all relevant blast and monitoring details to permit and facilitate inclusion of the data in the attenuation data and resultant equation."	
16.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following need to be addressed: • Provide the rational why the attenuation formula established by Golder in 2004 was used, but the historical vibration and overpressure data from the same site was not incorporated in formula.	Recommendations	DST Consulting Engineers Inc.	Please refer to the answer in question 5	Comment addressed. Explotech has provided explanation regarding the exclusion of the historical vibration and overpressure data obtained during the 2014-2019 blasting campaigns. The exclusion is due to lack of details of blasting parameters required to establish site-specific attenuation equation. Recording of details are generally not required when vibration and overpressure monitoring are conducted for compliance purposes. DST is satisfied with Explotech rational after reviewing the historical data.	
17.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following need to be addressed: • According to the "Level 1 and Level 2 Natural Environment Technical Report, April 2020, page 60, Fish Habitat Summary" conducted by SAVANTA, there are potential direct fish habitat within 120.0 metres of the adjacent lands, and no fish habitat within the extraction areas. A review of historical supporting information and current Level 1 and Level 2 Natural Heritage Reports provided by the applicant was also carried out by the Halton Region Environmental Consultants Matrix	Recommendations	DST Consulting Engineers Inc.	Please refer to the technical memorandum dated January 19, 2021 addressing fish bearing waterbodies in direct vicinity of the Burlington Quarry based on additional information provided by project biologists. In response and for continuity, Explotech has revised the Blast Impact Analysis to included the details of this technical memorandum. Refer to revised BIA dated June 16, 2021	Comment addressed. In their updated BIA report of June 16, 2021, Explotech has included a section under the heading "Blast Impact on Adjacent Fish Habitats'. This section provides mitigation procedures and set back distances required by DFO to allow blasting operations in the vicinity of fish habitats. DST has reviewed this section and is satisfied with Explotech's recommendation.	

	Solutions Inc. (MSI). “This review provides the following overview of fish habitat within 500.0 metres of the proposed Burlington Quarry Extension areas: • West Arm of the West Branch of Mount Nemo Tributary of Grindstone Creek • East Arm of the West Branch of Mount Nemo Tributary of Grindstone Creek • Willoughby Tributary of Bronte Creek In addition to these, there are waters containing fish within the existing quarry and proposed extension areas. Within the existing quarry, it can be assumed that all pond features contain fish. In historical reports prepared by ESG International (October 2000) the following features were noted: • Pond 1 – support a largemouth bass population • Pond 2 – supports a stickleback and pumpkinseed population • Pond 3 – supports a largemouth bass population • Pond 4 – supports largemouth bass, pumpkinseed and stickleback population Although there are fish within these features, earlier reports do not classify these as “fish habitat” due to the isolation of these watercourses. According to MSI, the applicant has been requested to provide DFO concurrence that this is the case. Within the West Extension area, largemouth bass is present in all of the irrigation ponds within the golf course. Although the fish are present within these watercourses, they are currently not viewed as “fish habitat” by the applicant. These irrigation ponds are hydrologically connected to Willoughby Creek Tributary. The applicant has been requested to provide DFO concurrence that this is not fish habitat”. In the case that DFO confirms that the above noted features are considered as “fish habitat”, the applicant’s blasting consultant should revise their BIA to include a section addressing the impact of blasting on these features and recommend mitigation measures to address the potential impact on the fish habitat in accordance with the “Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters”. The document can be sourced online at https://www.racerocks.ca/wp-content/uploads/2015/09/DND-explosive-guidelines.pdf.					

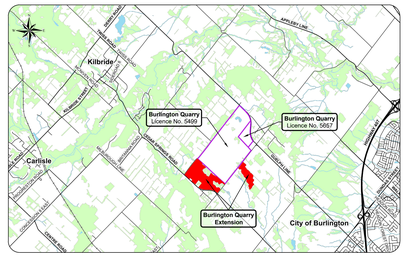
	The potential impact of blasting may be insignificant on the fish habitat within 120.0 metres of the adjacent lands considering the proposed blasting parameters. However, the potential impact should have been addressed by the BIA. The Location of these water bodies are also shown in the site plan drawings and described as “Water Features”.					
18.	The BIA report under the heading “RECOMMENDATIONS” provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following need to be addressed: • Considering that the proposed blasting operations at one point will approach a standoff distance of 12.8 metres from Sun Canadian Pipeline corridor, all requirements of their blasting specifications outlined in Appendix 2, section 8.3 to 8.5 under the heading “Vibration and Blasting Control” be implemented (copy attached for reference).	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021. Blast Impact Analysis now includes recommendations to follow the blasting specifications outlined in Appendix 2, Section 8.3 to 8.5 under the heading “Vibration and Blasting Control” be implemented.	Comment addressed conditional upon the site plan notes being addressed. Please refer to comment #21 for the site plan recommendation related to flyrock. Explotech has incorporated the requirements of the third-party pipeline company, namely Sun Canadian Pipelines guidelines for vibration and blasting control in their updated BIA report of June 16, 2021, which satisfies the pipeline companies concerns. Comment addressed condition upon the site plan notes incorporating these recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**. Also see Response to Comment # 21.
	JART Technical Comments (November 2021)	**Reference**	**Source of Comment**	**Applicant Response (May 2022)**		
19.	Item 1 and item 7 in the response matrix refers to a “site plan” and “site plan approval”, to ensure vibration monitoring but the response matrix for Registered Agreement & Reference Plan, item 1 states “the proposed quarry application does not include site plan control.” If there is no site plan approval required, how will vibration monitoring be ensured?		City of Burlington	The proposed Burlington Quarry Extension does not require Site Plan approval from the City of Burlington, however there will be an Aggregate Resources Act Site Plan that is approved and enforced by NDMNRF. This site plan includes the required vibration monitoring and therefore it will be a requirement to implement. See Burlington Quarry Extension Site Plans dated March 2022 included as **Tab 1**.		
20.	At the Region’s statutory public meeting, a delegate raised the issue of a 2005 blast that exceeded a vibration limit. Are there any monitoring or other records from this blast and any subsequent investigation, or any monitoring records for blasts carried out by Nelson since that time?	Raised at Public Meeting	Halton Region	General practice while completing a blast impact analysis is to review the trailing five (5) years of monitoring records from the quarry in question. As such, the June 2021 Blast Impact Analysis, included as **Tab 2**, contains the monitoring results from the 2014-2019 blasting campaigns. While monitoring records for the quarry would exist prior to 2014, Explotech has not reviewed these records for the purpose of this report and as a result cannot comment on the events that took place in 2005.		
	JART Site Plan Comments (November 2021)	**Reference**	**Source of Comment**	**Applicant Response (May 2022)**		
21.	As of January 1, 2022, the aggregate Resources Act will require a licensee or permittee to take all reasonable measures to prevent flyrock from leaving the site during blasting if a sensitive receptor is located within 500 meters of the boundary of the site. Although this flyrock range prediction model is a useful tool used in proper blast design and planning to mitigate flyrock from escaping the site, visual inspection of the rock face, top bench, and communications between the drilling crew and the blasting crew plays a more crucial role. This is because the parameters in model does not include unexpected sources that may play a major role in production of flyrock in a given blast.		DST Consulting Engineers Inc.	As confirmed by NDMNRF the revised Aggregate Resources Act effective January 1, 2022 does not apply to the proposed Burlington Quarry Extension. Regardless, Explotech has reviewed and is in agreement with DST’s recommendation. Drawing 1 does not require an update since it references the date of the current Blasting Impact Assessment. Drawing 2 includes the blasting requirements and the Burlington Quarry Extension Site Plans dated March 2022 will be further updated to include the following condition: “The licensee shall take all reasonable measures to prevent flyrock from leaving the site during blasting.”		

	DST recommend that the notes on the following Site Plan Drawings be revised to incorporate the changes in Explotech's updated BIA report of June 16, 2021: 1. Drawing Sheet 1 of 4, Existing Features, H. Technical Reports – References, Item 7. 2. Drawing Sheet 2 of 4, Operational Plan, N. Report Recommendations, Item 2.			

Tabs

Tab **1**

Key Map
(N.T.S.)



A. General

1. This site plan is prepared under the Aggregate Resources Act (ARA) for a Class 'A' Licence, Category 2.
2. Area Calculations:

i. Licence Area (total)	**76.9 ha**
• South Extension	18.1 ha
• West Extension	58.8 ha

B. References

1. Contours were obtained from the City of Burlington's Open Data Catalogue based on 2017 data and are displayed in one metre intervals. Elevations shown are in metres above sea level (masl).
2. Topographic information was obtained from numerous sources including Ontario GeoHub (Land Information Ontario), City of Burlington's Open Data Catalogue, Google Earth Pro aerial photography captured on May 7, 2018 and field investigations for technical reports.
3. All topographic features and structures are shown to scale in Universal Transverse Mercator (UTM) with North American Datum 1983 (NAD83), Zone 17 (metre), Central Meridian 81 degrees west coordinate system.
4. The licence boundaries were established using Municipal Property Assessment Corporation (MPAC) parcel fabric data. Distances are approximate and for reference purposes only.
5. Land use designations on and within 120 metres of the licences are from the Niagara Escarpment Plan, Map 3 - Regional Municipality of Halton, approved June 1, 2017. The Burlington Quarry Extension lands are designated Escarpment Rural Area.
6. Land use information and structures identified on or within 120 metres of the licence boundaries were determined using Google Earth Pro aerial photography captured on May 7, 2018.

C. Drainage

1. Surface drainage on and within 120 metres of the licence boundaries are by overland flow in the directions shown by arrows on the plan view, or by infiltration.

D. Groundwater

1. The established groundwater table varies between 264 masl to 273 masl in the South Extension and 263 masl to 265 masl in the West Extension (EarthFX 2020).

E. Site Access and Fencing

1. There are four existing site accesses on Side Road No. 2 and a single existing site access on Cedar Springs Road.
2. Post and wire fencing (unless noted otherwise) exists in the locations shown on the plan view.

F. Aggregate Related Site Features

1. There are no existing aggregate operations or features on either Extension such as internal haul roads, processing, stockpiles, scrap, fuel storage, berms or excavation faces.

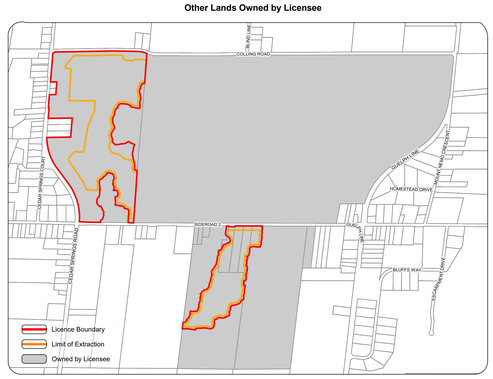
G. Cross Sections

1. See drawing 4 of 4.

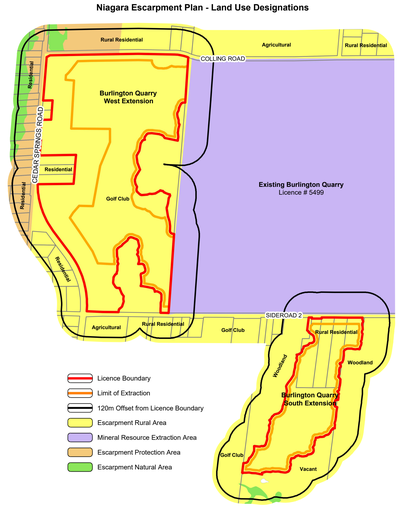
H. Technical Reports - References

1. Adaptive Management Plan, Proposed Burlington Quarry Extension, EarthFX Inc., Savanta, and Tatham Engineering, March 2022.
2. Agricultural Impact Assessment, Nelson Aggregate Co. Burlington Quarry Expansion, April 2020.
3. Air Quality Study for Nelson Aggregate Co., Burlington Quarry Extension, BCX Environmental Consulting, March 2020.
4. Archaeological Assessment (Stages 1, 2 & 3), Nelson Aggregates Quarry Expansion, Archaeologix Inc., August 2003.
5. Archaeological Assessment (Stage 4), Nelson Aggregates Quarry Expansion, Archaeologix Inc., August 2004.
6. Stage 1-2 Archaeological Assessment, Proposed West Extension of the Burlington Quarry, Golder Associates, September 2020.
7. Blast Impact Analysis, Burlington Quarry Extension, Explotech Engineering Ltd, June 16, 2021.
8. Cultural Heritage Impact Assessment Report, Burlington Quarry Extension, MacNaughton Hermsen Britton Clarkson Planning Limited (MHBC), June 2021.
9. Financial Impact Study, Proposed Burlington Quarry Extension, Nelson Aggregates Co., September 30, 2021.
10. Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, Proposed Burlington Quarry Extension, EarthFX Incorporated, April 2020.
11. Level 1 and 2 Natural Environment Technical Report, Proposed Burlington Quarry Extension, Savanta, April 2020.
12. Noise Impact Assessment, Nelson Aggregate Quarry Extension, Howe Gastmeier Chapnik Limited, November 15, 2021.
13. Nelson Aggregate Company, Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.
14. Surface Water Assessment, Burlington Quarry Extension, Tatham Engineering, April 2020.
15. Visual Impact Assessment Report, Proposed Extension of the Burlington Quarry, MacNaughton Hermsen Britton Clarkson Planning Limited (MHBC), June 2021.
16. Safety Review of the Proposed Access Plan for a Proposed Quarry Extension, True North Safety Group, June 2021.

Other Lands Owned by Licensee



Niagara Escarpment Plan - Land Use Designations



Legal Description

Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

Legend

- Licence Boundary
- Limit of Extraction
- Contours with Elevation (Metres above sea level (MASL))
- Public Road
- Fence (1.2m post & wire fence unless otherwise noted)
- Water Feature
- Irrigation Pond
- Significant Woodlands
- Woodlands
- Wooded Feature
- Dripline (Staked December 3, 2021 by Savanta and Region of Halton)
- Wetland (Surveyed by Savanta/MNRF in Accordance with OWES - Assumed Significant for Planning Purposes)
- Wetland (MNRF Evaluated - Provincially Significant)
- Wetland (MNRF Evaluated - Other (Non Provincially Significant))
- Wetland (MNRF - Unevaluated (Assumed Significant for Planning Purposes))
- 120m Offset From Licence Boundary
- Existing Licence (Existing Licenced Boundary (solid line) Existing Limit of Extraction (dashed line))
- Parcel Fabric
- Diversion or Discharge Pipe (Existing - Single Dash)
- Discharge Location
- Jefferson Salamander Regulatory Boundary
- Fish Habitat (Direct - solid Indirect - dash)
- Sun-Canadian Pipe Line (Pipe line location and easement)
- Entrance / Exit (Existing)
- Direction of Surface Drainage
- Building/Structure
- Cross Sections
- ANSI - Earth Science (Area of Natural and Scientific Interest) Lake Medad Meltwater Channel
- ANSI - Life Science (Area of Natural and Scientific Interest) Medad Valley

Significant Wildlife Habitat

- Amphibian Breeding (Woodland)
- Bat Maternity Colony
- Turtle Wintering Area
- Rare Vegetation Community

Species of Conservation Concern

- Unicorn Clubtail
- Eastern Wood-pewee
- Large Toothwort Community

Species at Risk

- Butternut Category 1
- Butternut Category 2
- Bat Habitat (Little Brown Myotis and Tri-coloured Bat)
- Bobolink (BP18)
- Barn Swallow Nest Observation (BSNO C)

Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licencing)

No.	Date	Description	By
1.	September 2020	Update date of Archaeological Assessment Report in Section H.	CAP
2.	April 2021	Included MNRF wetlands for South Extension. Added Significant Wildlife Habitat, Species of Conservation Concern and Species at Risk. Update legend.	CAP
3.	January 2022	Updated to address agency comments.	CAP
4.	February 2022	Updated to address agency comments.	CAP
5.	March 2022	Updated limit of extraction in the West Extension. Added dripline and setback dimensions from the dripline to the plan view. Revised note H.1.	CAP

No.	Date	Description	By

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
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MHBC Stamp

Applicant

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Project

Burlington Quarry Extension

MNRF Licence Reference No. 626477

Pre-approval review:

Plan Scale: 1:3000 (Arch E)
0 100 200 Meters

Date March 2022
Drawn By C.P.
Checked By B.Z.
File No. 9135D

File Name

Existing Features

Drawing No. 1 of 4

File Path N:\Brian\9135D- Nelson - Project Sideways\Drawings\ARA Site Plans\Extension Site Plan\CAD\9135D - Site Plan.dwg

A. General

1. Area Calculations:
   - i. Licence Area (total) **76.9 ha**
     - South Extension 18.1 ha
     - West Extension 58.8 ha
   - ii. Limit of Extraction (total) **47.4 ha**
     - South Extension 14.3 ha
     - West Extension 33.1 ha
2. The maximum annual tonnage is 2,000,000.
3. The existing golf course use in the West Extension may continue to operate until site preparation for that Extension commences.

B. Hours of Operation

1. Hours of operation are Monday to Friday from 7:00am to 7:00pm excluding statutory holidays.
2. Blasting is permitted Monday to Friday between 8:00am to 6:00pm excluding statutory holidays. Blasting will typically occur once per week but may occur more often based on operational needs.

C. Site Access and Fencing

1. Prior to extraction within the South or West Extension, post and wire fencing (at least 1.2 metres in height) shall be erected and maintained (for the life of that extension) along the licence or property boundary. Portions of the West Extension licence boundary shall be exempt from this requirement (see Section O. Variations from Provincial Standards). Where the licence boundary is not fenced, it will be delineated with marker posts every 30 metres.
2. Where the licence boundary abuts significant woodlands, fencing shall be in accordance with the Tree Protection Zone detail on this drawing.
3. Prior to extraction in the South Extension, exclusion fencing (*as per MNRF 2013 Species at Risk Branch Best Practices Technical Note Reptile and Amphibian Exclusion Fencing Version 1.1*) shall be installed along the perimeter of the licence boundary (see plan view for approximate location).
4. Prior to extraction in the West Extension, exclusion fencing (*as per MNRF 2013 Species at Risk Branch Best Practices Technical Note Reptile and Amphibian Exclusion Fencing Version 1.1*) shall be installed along the west limit of extraction and extended a minimum 50 metres beyond the northern extent of the infiltration pond. The exclusion fencing shall also be installed along the southern limit of extraction until it reaches No. 2 Side Road in the southeast corner (see plan view for approximate location).
5. A new operational entrance/exit for the South Extension shall be established in the location shown on the plan view (see Section N. Report Recommendations for additional details under Traffic). Material being transferred from the South Extension to existing Licence # 5499 (see Section O. Variations from Provincial Standards) shall occur through an at grade roadway crossing on Side Road No. 2 in this location.
6. A gate shall be installed at the operational entrance/exit of the South Extension on Side Road No. 2, kept closed during hours of non-operation, and maintained throughout the life of that Extension.
7. A gate shall not be required for the field/property access located at 2280 and 2015 Side Road No. 2 (see Section O. Variations from Provincial Standards).
8. The West Extension shall be accessed through the common licence boundary with existing Licence #5499 in Phases 3 and 5. The locations shown on the plan view are approximate only.
9. Access for farm equipment shall be provided from the new operational entrance/exit in the South Extension. During operations, the eastern extraction setback may be used to transport farm equipment to the areas that have not been extracted to facilitate ongoing agricultural operations in the South Extension.

D. Drainage and Siltation Control

1. Drainage of undisturbed areas will continue in the directions shown on drawing 1 of 4.
2. Prior to site preparation, an Erosion and Sedimentation Control (ESC) Plan shall be prepared and implemented to prevent erosion or sedimentation impacts to the natural environment from operation and rehabilitation of the quarry (see Section N. Report Recommendations - Natural Environment note "a").
3. Prior to extraction in the West Extension, the infiltration pond located in the west setback (including the diversion/discharge pipe and bottom draw outlet) shall be constructed. The pond shall be excavated to an elevation of ±267 masl into bedrock. Non-aggregate material excavated from the infiltration pond will be utilized for the creation of acoustic and visual berms in the West Extension. For the portions of the pond located above bedrock, 3:1 slopes shall be established. The purpose of the diversion pipe is to convey water from the weir pond to the infiltration pond in the west setback and to provide the diffuse discharge in the northwest corner of the site.
4. Within the West Extension, the diversion and discharge pipes shall be placed in the locations shown on the plan view (see Section N. Report Recommendations - Natural Environment note "f" for timing to install the diversion pipe within the weir pond). The centreline of the diversion pipe along the north boundary of Phase 5 shall remain a minimum of 7.0 metres from the Sun-Canadian Pipe Line easement and be installed prior to constructing the berm in this vicinity.
5. Prior to removal of the irrigation ponds and irrigation channel in the West Extension, the downstream end of the golf course channel shall be blocked to isolate surface water. If water is to be pumped from the feature to facilitate site preparation, it shall be directed to the existing sump for discharge in accordance with MECP, ECA and PTTW requirements.

E. Site Preparation

1. All existing structures within the South Extension (excluding the house and barn located at 2280 Side Road No. 2) and West Extension (excluding the house and barn located at 2015 Side Road No. 2) shall be demolished prior to extraction in each Extension, in accordance with all applicable regulations (see Section N. Report Recommendations - Natural Environment note "c" as well as note "p" regarding removal of three structures within the West Extension that contain Barn Swallow habitat).
2. No new buildings are proposed for either Extension.
3. Tree removal shall not occur in the West Extension during the active season for Eastern Small-footed Myotis between March 15th and November 30th (see Section N. Report Recommendations - Natural Environment note "e").
4. Timber resources (if any) will be salvaged for use as saw logs, fence posts and fuel wood where appropriate. Stumps, trees, shrubs and brush cleared will be used for rehabilitation of this site and License #5499 to provide coarse and fine wood debris to enhance soils and create habitats during site rehabilitation.
5. Prior to the commencement of stripping in the South Extension, agricultural baseline conditions shall be established by a qualified professional for the entire extraction area, using an accredited lab for any analytical testing. Soil inspections shall be conducted at a density to allow for sufficient coverage of the area. The parameters for the baseline conditions soil testing shall be determined by the qualified professional and shall include items such as: soil macro and micronutrients, soil chemistry (e.g. pH, etc.), organic matter, soil texture and structure and bulk density.
6. In the South Extension, topsoil and subsoil for agricultural rehabilitation shall be stripped separately and used for agricultural rehabilitation in Licence #5499 in accordance with the agricultural rehabilitation notes on this page (see Section N.9 Agricultural and Section O. Variations from Provincial Standards). The remaining overburden in the South Extension not required for agricultural rehabilitation will be stripped separately and used for the construction of acoustic/visual berms and rehabilitation in the south extension. In the west extension, topsoil and overburden shall be stripped and stored separately wherever feasible (see Section O. Variations from Provincial Standards).
7. With the exception of topsoil and subsoil from the South Extension that will be used for agricultural rehabilitation in Licence #5499, the remaining topsoil and overburden shall be placed in perimeter acoustic/visual berms, pond construction or used immediately for progressive rehabilitation in either Extension or existing Licence #5499 (see Section O. Variations from Provincial Standards).
8. With the exception of topsoil and subsoil from the South Extension that will be used for agricultural rehabilitation in Licence #5499, excess topsoil and overburden not required for immediate use in berms or rehabilitation may be temporarily stockpiled on the quarry floor. Topsoil and overburden stockpiles shall be located within the limit of extraction and remain a minimum of 30 metres from the licence boundary (except where the West Extension licence boundary abuts existing Licence #5499) and 90 metres from a property with a residential use (see Section O. Variations from Provincial Standards).
9. With the exception of topsoil and subsoil from the South Extension that will be used for agricultural rehabilitation in Licence #5499, temporary topsoil and overburden stockpiles which remain for more than one year shall have their slopes vegetated to control erosion.

F. Berms and Screening

1. Acoustic and visual berms shall be constructed to the heights or elevations specified in the locations shown on the plan view. See Section N. Report Recommendations - Visual Impact Assessment notes and the Typical Acoustic & Visual Berm detail on this drawing for additional information.
2. Berms adjacent to key natural heritage features shall be constructed in accordance with Section N. Report Recommendations - Natural Environment note "d".
3. Berm side slopes shall not exceed the following maximums:
   - i. South Extension
     - Northwest, north and northeast setback = 1.5:1
     - Southwest setback = 2:1
   - ii. West Extension
     - North and west setback = 2:1
     - Southeast setback = 1.5:1
4. Berms in the South Extension shall be constructed prior to extraction in that extension.
5. Berms in the West Extension shall be constructed prior to extraction in that extension.
6. The north toe of the perimeter berm in the West Extension shall not be located within 1 metre of the Sun-Canadian Pipe Line easement.
7. Berms shall be vegetated with a native mix of wildflowers and grasses to stabilize slopes and minimize mowing and maintenance. The vegetation on the berms shall be maintained until the berms are removed for rehabilitation.
8. Existing vegetation within the setbacks shall be maintained except where acoustic berms, visual berms, ponds or diversion/discharge pipes are required (see Section O. Variations from Provincial Standards). Setbacks disturbed will be vegetated with a native mix of wildflowers and grasses to restore areas and minimize mowing and maintenance. A portion of the setback areas, as shown on the operations schematic, will also be forested in accordance with Section N. Report Recommendations - Natural Environment note "l".
8. Setbacks identified as forested setbacks on the plan view shall be forested (see Section N. Report Recommendations - Natural Environment notes "e" and "h" for additional information).

G. Site Dewatering

1. During the initial stages of extraction within the South Extension, a temporary settling pond will be constructed within the extraction area (eg. Phase 2). Once sufficient extraction has occurred in Phase 2, the sump and settling pond will be constructed on the quarry floor. See Adaptive Management Plan for additional details.
2. The discharge location for the South Quarry Extension shall be constructed in accordance with Section N. Report Recommendations - Natural Environment note "g".
3. For the West Extension, the water will be diverted to existing Licence #5499 and discharged from the existing sumps and discharge locations.
4. The licensee shall operate in accordance with Environmental Compliance Approval (ECA) and Permit to Take Water (PTTW) requirements.

H. Extraction Sequence

1. General
   a. Prior to set preparation in each phase, ensure all requirements contained in Sections C through G are met.
2. Phase 1
   a. Prepare Phase 1 (South Extension) for extraction and ensure all requirements pertaining to this Extension in Sections C through G of this drawing are met.
   b. Strip Phase 1 in accordance with Site Preparation notes (see Section E) and Agricultural Rehabilitation notes (see Section N.9). Any overburden not used for agricultural rehabilitation shall be used to construct perimeter berms. Should there be insufficient overburden in Phase 1 to construct berms, import excess soils to complete the perimeter berms.
   c. Create sinking cut.
   d. Commence extraction in a southerly direction and complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors. Noise audit records shall be kept by the licensee and made available to agencies upon request.
   e. Phase 1A may be extracted to a maximum depth of 271 masl.
   f. Phase 1B may be extracted to a maximum depth of 270 masl.
   g. Prepare Phase 2 for extraction.
3. Phase 2
   a. Strip Phase 2 in accordance with Site Preparation notes (see Section E) and Agricultural Rehabilitation notes (see Section N.9) in sequence as extraction progresses in a southerly direction. Stripping shall be limited to what is required for the season of operation to maximize areas remaining in agricultural production.
   b. Extract Phase 2 in a southerly direction from Phase 1 and complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors. Noise audit records shall be kept by the licensee and made available to agencies upon request.
   c. Phase 2 may be extracted to a maximum depth of 252.5 masl.
   d. As extraction advances, complete progressive rehabilitation of Phase 2.
   e. Prepare Phase 3 (West Extension) for extraction and ensure all requirements pertaining to this Extension in Sections C through G and Archaeology note "a", under Section N. Report Recommendations, of this drawing are met.
   f. Remove wooded features in Phase 3 (see Section N. Report Recommendations - Natural Environment note "o").
4. Phase 3
   a. Strip Phase 3 and a portion of Phase 4 (if required) to construct perimeter berms in West Extension.
   b. Extract Phase 3 by commencing at the common boundary with existing Licence #5499 and proceeding westerly before heading in a northwesterly direction. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors. Noise audit records shall be kept by the licensee and made available to agencies upon request.
   c. Phase 3 may be extracted to a maximum depth of 252.5 masl.
   d. Complete progressive and final rehabilitation in Phases 1 and 2.
   e. Prepare Phase 4 for extraction.
5. Phase 4
   a. Strip Phase 4 and use the material for progressive rehabilitation in Phase 3 and existing Licence #5499.
   b. Extract Phase 4 in a westerly and southwesterly direction from Phase 3. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors. Noise audit records shall be kept by the licensee and made available to agencies upon request.
   c. Phase 4 may be extracted to a maximum depth of 252.5 masl.
   d. Refer to Section N. Report Recommendations - Blasting for additional requirements regarding the Sun-Canadian Pipe Line easement.
   e. Phase 5 may be extracted to a maximum depth of 252.5 masl.
   f. Prepare Phase 6 for extraction.
   g. Remove wooded feature in Phase 6 (see Section N. Report Recommendations - Natural Environment note "o").
6. Phase 5
   a. Strip Phase 5 and use the material for progressive rehabilitation in Phase 5 and existing Licence #5499.
   b. Continue progressive rehabilitation in Phases 3 and 4.
   c. Extract Phase 5 by commencing at the common boundary with existing Licence #5499 and proceeding in a westerly direction. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors. Noise audit records shall be kept by the licensee and made available to agencies upon request.
   d. Refer to Section N. Report Recommendations - Blasting for additional requirements regarding the Sun-Canadian Pipe Line easement.
   e. Phase 5 may be extracted to a maximum depth of 252.5 masl.
   f. Prepare Phase 6 for extraction.
   g. Remove wooded feature in Phase 6 (see Section N. Report Recommendations - Natural Environment note "o").
7. Phase 6
   a. Strip Phase 6 and use the material for progressive rehabilitation in Phases 4, 5 and existing Licence #5499.
   b. Prior to extraction commencing in Phase 6, side sloping within Phase 3 shall be completed.
   c. Extract Phase 6 in a southerly direction from Phase 5. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors. Noise audit records shall be kept by the licensee and made available to agencies upon request.
   d. Phase 6 may be extracted to a maximum depth of 252.5 masl.
   e. Complete progressive and final rehabilitation of the West Extension.

I. Extraction Details

1. The maximum height of a lift shall be 25 metres.
2. The maximum depth of extraction for the South Extension is 29.5 metres. Phase 1 shall be extracted in one lift and Phase 2 shall be extracted in a maximum of two lifts.
3. The maximum depth of extraction for the West Extension is 23.5 metres and the maximum number of lifts is two.
4. Extraction shall be permitted in two Phases simultaneously to allow for transition between Phases.
5. Internal haul road locations will vary as extraction progresses and will be located on the quarry floor with the exception of the at grade roadway crossing between the South Extension and existing Licence #5499.
6. Blasted aggregate will be transported back to existing Licence #5499 for processing and shipping.
7. Berms that encroach within the limit of extraction shall be removed, and the underlying aggregate may be extracted, as part of final extraction for each Extension.

J. Equipment and Processing

1. Equipment used for site preparation, extraction, pond construction, and site rehabilitation includes drills, front-end loaders, graders, bulldozers, backhoes, conveyors, water trucks, fuel trucks and haul trucks. See Section N. Report Recommendations for additional details from the Noise report regarding equipment.
2. No processing shall occur in the South or West Extension. Aggregate extracted in the South and West Extension shall be hauled to existing Licence #5499 for processing.

K. Fuel Storage

1. No fuel shall be stored in the South or West Extension.
2. Fuel trucks will be used to transfer fuel to on-site equipment in accordance with the Liquid Fuels Handling Code.
3. A Spills Contingency Program will be developed prior to site preparation.

L. Dust

1. Dust shall be mitigated on-site.
2. Water or another provincially approved dust suppressant shall be applied to internal haul roads as often as required to mitigate dust.
3. The licensee shall implement all air quality recommendations outlined in Section N. Report Recommendations.

M. Scrap and Recycling

1. No scrap shall be stored in the South and West Extension.
2. No recycling shall occur in the South and West Extension.

N. Report Recommendations

1. Air Quality

a. The Licensee shall implement their Best Management Practices Plan (BMPP) for the Control of Fugitive Dust dated March 2020, as may be amended from time to time to reflect current best management practices.

b. The Licensee shall construct the acoustic berms as shown on the operational plan. See Section F for additional detail.

2. Blasting

a. All blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments - one installed in front of the blast and one installed behind the blast.

b. Vibration and overpressure data collected during the first 12 months of extraction in the proposed quarry extension lands will be used to calibrate and update the 2004 Golder Associates attenuation equation. The proponent shall ensure information collected includes all relevant blast and monitoring details to permit and facilitate inclusion of the data in the attenuation data and resultant equation.

c. In order to safeguard the structural integrity of the structures located at 2280 No 2 Side Road, ground vibrations shall be maintained below 50mm/s (=40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s.

d. All blasts within 60m of the adjacent Sun-Canadian High Pressure Oil Pipeline will be designed and monitored by a registered engineer, licensed in the province of Ontario, or any distance specified in later revisions of the Sun-Canadian guidelines or when vibration calculations suggest vibrations in excess of 35mm/s at the pipeline.

e. To protect adjacent fish habitat, the Department of Fisheries and Oceans (DFO) has established limits for water overpressure and ground vibrations. Water overpressures are to be limited to 130kPa (year round), and in the presence of active spawning beds (March 15th to July 15th), ground vibrations at the bed are to be limited to 13mm/s. Fish habitat and assumed spawning beds are present in the Unnamed Tributary of Willoughby Creek, the Unnamed Tributary of Lake Medad and the East and West Arms of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The utilization of shallower blast holes, decks, smaller hole diameters and/or changes in blasting patterns may be necessary when blasting adjacent to fish habitat at any time of year. These mitigation measures would also apply, when adjacent to spawning beds from March 15th to July 15th.

f. From March 15th to July 15th of any year, blasts shall be designed to maintain vibrations below 13mm/s at the closest point of any spawning habitat to the blast. One (1) additional seismograph shall be installed on the shoreline adjacent the closest spawning habitat to any blast performed between March 15th and July 15th when calculations suggest vibrations in excess of 75% of the DFO vibration limit may be reached at the location of a potential active spawning habitat.

g. All blasting operations encroaching the Sun Canadian High Pressure Oil Pipeline will follow all requirements in the Sun Canadian Guidelines outlined in Section 8.3 to 8.5 under the heading "Vibration and Blasting Control" and any requirements specified in later revisions of the Sun-Canadian Guidelines.

h. The guideline limits for vibration and overpressure shall adhere to standards as outlined in the MECP Model Municipal Noise Control By-law publication NPC 119 (1978) or any such document, regulation or guideline which supersedes this standard.

i. In the event of an exceedance of NPC 119 limits or any such document, regulation or guideline which supersedes this standard, blast designs and protocol shall be reviewed prior to any subsequent blasts and revised accordingly in order to return the operations to compliant levels.

j. Orientation of the aggregate extraction operation will be designed and maintained so that the direction of the overpressure propagation will be away from structures as much as possible.

k. Blast designs shall be continually reviewed with respect to fragmentation, ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with current applicable guidelines and regulations.

l. Blasting procedures such as drilling and loading shall be reviewed on a yearly basis and modified as required to ensure compliance with industry standards.

m. Detailed blast records shall be maintained in accordance with current industry best practices.

3. Noise

a. Site preparation, pond construction, rehabilitation, drilling, extraction activities, and transporting material to the existing quarry for processing and shipping may only occur Monday to Friday during daytime hours (7:00 - 19:00).

b. Prior to extraction in the South Extension, all berms in this Extension shall be constructed to the heights specified in the locations shown on the plan view. Berms shall not be required in the West Extension until prior to extraction in that Extension.

c. Prior to extraction in the West Extension, all berms in this Extension shall be constructed to the heights specified in the locations shown on the plan view.

d. Equipment used on-site shall operate within the sound power levels specified below:

   - drills - 110 dBA
   - front-end loaders - 101 dBA
   - haul trucks - 114 dBA

e. Up to three haul trucks will be used to transport material from this site to the processing area in License #5499, with a posted speed limit of 35 km/hr along this route.

f. Equipment used for site preparation, pond construction and rehabilitation shall satisfy the noise emission levels of MOE - 115, "Noise Construction Equipment".

g. If a noise compliant is received, the noise complaint will be responded to and investigated in a timely manner by the licensee in a manner commensurate to the specific context of the complaint.

4. Visual Impact Assessment

a. For both Extension areas, existing vegetation located along the site perimeter and within the setback area will be retained where possible. Berms will be laid out in a way that favours the retention of existing vegetation where possible. Any and all areas marked for tree protection shall utilize appropriate tree protection hoarding and ensure that no construction activities, grading or compaction occurs within the tree protection zone (see Tree Protection Zone detail on this drawing for additional information). This includes using these areas for the storage or staging of any materials or aggregate.

b. Visual and acoustic berms are to be installed in the location shown on the plan view and berm elevation details (on drawing 4 of 4) and to the requirements outlined below.

c. Where berms are deemed to be required, they are to only be constructed where shown on the plan view. Berms are to be constructed in a smooth, rolling manner with varying highpoints (respecting minimum height requirements), and variations along the berm frontage to create a more natural appearance. Berms should be seeded with a native mix of wildflowers and grasses to stabilize slopes and minimize mowing and maintenance.

d. The existing deciduous trees and shrubs located within 15 metres of No. 2 Side road and in front of the proposed southern noise berm in the West Extension are to be retained.

e. Visual berms proposed for the South Extension are to be planted with trees (see plan view for berm locations). Larger species will be planted along the visual berm on No. 2 Side Road while smaller species will be planted on the berm adjacent to the Camiole Golf Course. Trees will be planted at a spacing of 5 to 10 m on centre, depending on species. Plantings are to be randomly spaced and staggered up on the berm up to one third of its maximum height to appear more natural, where possible. All vegetation is to be selected for wind and salt tolerance hardiness. Native species that complement the existing surroundings are to be utilized wherever possible.

f. For the visual berm adjacent to Side Road No. 2, deciduous trees of minimum 40mm caliper, coniferous trees of minimum 1.2m height, and shrub species of minimum 40cm height shall be planted.

g. For the visual berm in the southwest corner of the South Extension, deciduous tree whips of minimum 1.2m height, coniferous trees of minimum 0.6m height, and shrub species of minimum 20cm height (or bare root stock when in season) shall be planted.

h. Plant species for the visual berm planting referenced in note 4e, f, and g may include, but are not limited to the following trees (White Pine, Common Hackberry, Chokecherry, White Spruce, Paper Birch, Pin Oak Sugar / Silver Maple, Trembling Aspen, Basswood, White Pine, White Spruce or White Cedar) and shrubs (Nannyberry, Common Ninebark, American Elder, Dogwood, or Highbush Cranberry).

i. To ensure survival and positive growth rate, the vegetative screening is to be maintained and managed appropriately so that it remains an effective visual screen over time. Allowance of natural succession to occur is encouraged, in keeping with restoration objectives.

j. During the first year of quarry operations, the planted trees will be watered and monitored until established. After the first year, the trees will be inspected twice each year. Once in spring after leaf break, and once in fall prior to leaf drop, to ensure any trees which are in poor condition at the time, are re-fertilized, watered and monitored, as needed, to improve their health and vigor.

k. If any of the planted trees die, they will be replaced yearly, and will be planted in spring or late summer. With annual maintenance and monitoring, the trees will have the best chance of survival, and overall, it is anticipated that the need for tree replacements during the life of the operation will be reduced.

5. Traffic

a. The northbound and southbound approaches to Side Road No. 2 shall be controlled by stop sign control.

b. The new roadway crossing will be located on the crest on Side Road No. 2 (in the location shown on the plan view) with a clear sight distance of at least 215 metres in each direction along Side Road No. 2 for both the northbound and southbound approaches.

c. The roadway geometry and road bed structure will be designed to accommodate the rock trucks that the licensee plans to operate.

d. Prior to extraction commencing in the South Extension, the licensee will be responsible to upgrade the crossing on Side Road No. 2 to municipal standards. During operations in the South Extension, the licensee will be responsible for maintaining this crossing. The licensee is responsible for all costs associated with the crossing, including any signage at the crossing (Financial Report).

e. The following notes apply for the crossing at No. 2 Side Road:

   e.a. The proposed crossing location shall be constructed and maintained to provide the appropriate approach sight triangles and departure sight distances for a 70 km/hr design speed. Vegetation shall be trimmed or removed as necessary during construction to provide the recommended approach sight triangles and departure sight distances in all four quadrants.

   e.b. "Truck Entrance" warning signs shall be installed on the approaches to the crossing to warn drivers along No. 2 Side Road of the possible presence of slow-moving trucks entering the roadway.

   e.c. Regulatory or information signs shall be installed prohibiting the general public from using the crossing.

   e.d. Vegetation shall be maintained to ensure the approach sight distances at all accesses are provided.

   e.e. Based on the existing conditions, the municipality may wish to revisit the frequency of maintenance for pavement markings, shoulder grading and pavement condition along No. 2 Side Road.

6. Water Resources and Natural Environment

a. The licensee is required to operate in accordance with the Adaptive Management Plan, prepared by EarthFX Inc., Tatham Engineering and Savanta dated March 2022, as may be amended from time to time with approval from MNRF, in consultation with NEC, Region of Halton, City of Burlington and Conservation Halton.

7. Water Resources

a. Based on current approvals for the existing quarry, the water discharge pumping at both locations will cease once extraction is complete, which would have a negative impact on flow and associated fish habitat in both watercourses (Savanta, 2020). The proposed revised rehabilitation plan would stipulate that dewatering and pumping will continue at the same locations and in the same manner to ensure there are no negative impacts to any of the hydrological features that rely on this water input. This will result in long-term enhancements to downstream fish habitat compared to the existing approved post-extraction water management plan.

b. Post rehabilitation, the West Extension is to be maintained in a dewatered state using the main discharge points to the north and south from Quarry Sump 0100 and 0200 in licence #9499 in accordance with the conditions of the PTTW and ECA to provide public water management benefits.

c. Prior to extraction commencing in each of the South and West Extensions, the licensee shall complete a residential well survey for properties within one kilometre of the extraction area.

d. If a water well (including agricultural wells) complaint is received by the licensee the following actions will be taken:

   d.a. The licensee will notify MNRF and MECP of the complaint.

   d.b. The licensee will contact a well contractor in the event of a well malfunction and the property will be provided a temporary water supply within 24 hours, if the issue cannot be easily determined and rectified.

   d.c. The well contractor will contact the resident/owner with the supply issue and rectify the problem as expediently as possible, provided the landowner gives authorization for the work. If the issue raised by the landowner is related to loss of water supply, the licensee will have a consultant/contractor determine the likely causes of the loss of water supply, which can result from a number of factors, including pump failure (owner's expense), extended overuse of the well (owner's expense) or lowering of the water level in the well from potential quarry interference (licensee expense). This assessment process would be carried out at the expense of the licensee and the results provided to the landowner.

   d.d. If it has been determined that the quarry caused the water supply interference, the quarry shall continue to supply water at the licensee's expense until the problem is rectified. The following mitigation measures shall be considered and the appropriate measure(s) implemented at the expense of the licensee:

   - adjust pump pressure;
   - lowering of the pump to take advantage of existing water storage within the well;
   - deepening of the well to increase the available water column;
   - widening of the well to increase the available storage of water;
   - relocation of the well to another area on the property;
   - drilling multiple wells; and
   - only at the request of a landowner would a cistern be installed.

e. If the issue raised by the land owner is related to water quality, the licensee will have a consultant/contractor determine the likely causes of the change in water quality, and review monitoring results at the quarry and background monitoring results from the baseline well survey to determine if there is any potential correlation with the quarry. If it has been determined that the quarry caused a water quality issue, the quarry shall continue to supply water at the licensee's expense until the problem is rectified. The licensee shall be responsible for restoring the water supply by replacing the well or providing a water treatment system. Only at the request of a landowner would a cistern be supplied. The licensee is responsible for the expense to restore the water quality.

8. Natural Environment

a. Prior to site preparation, an Erosion and Sedimentation Control (ESC) Plan will be prepared and implemented to prevent erosion or sedimentation impacts to the natural environment from operation and rehabilitation of the quarry. Basic elements of the plan should include consideration of: Construction and operation phasing to minimize the amount of time soils are barren and therefore, more susceptible to erosion; Requirements and timing for rehabilitation of disturbed areas; Stormwater management strategies during construction; Grading and removal of golf course surface water features during periods when the features are not flowing, to minimize potential for adverse effects on downstream water quality; Erosion prevention measures (e.g., hydroseeding, sodding, erosion control matting, tarping of stockpiles); Sedimentation control measures (e.g., silt fences); and Inspection and performance monitoring requirements and adaptive management.

b. Prior to site preparation, the Burlington Quarry Spills Prevention and Response Plan (2020) shall be updated to include the West and South Quarry Extension. The spill prevention and response plan shall outline the material handling and storage protocols, mitigation measures (e.g., spill kits on-site), monitoring measures and spill response plans (i.e., emergency contact procedures, including the Spills Action Centre, and response measures including containment and clean-up).

c. Prior to the removal of structures within the South or West Extension, the licensee shall conduct species at risk bat exit survey as per provincial protocols. If species at risk bats are confirmed to be using the structures, then authorization (e.g. permit) under the Endangered Species Act may be required prior to removal; removal of the structures shall only occur between December 1st and March 14th. The licensee shall complete the tree planting requirements as outlined on this drawing and drawing 3 of 4 and installation of bat boxes and artificial bark stations adjacent to the pond and woodland in the West Extension. If the bat exit surveys determine that the structures are not habitat, the restricted timing window for the structure's removal shall not be required.

d. The limit of extraction shall be setback from key natural heritage features within the South and West Extension (as shown on the plan view) and no operational activities shall occur within the 30 metres of wetlands and significant woodlands except as noted hereafter. The limit of extraction shall be setback 15 metres from the significant woodland (the cultural coniferous plantation) that runs along the east side of the South Extension. Moreover, berms will be located adjacent to certain key natural heritage features as shown on the plan view. In the South Extension, a berm shall be permitted within the 15 metre setback adjacent to the significant woodlands in the northeast corner of the site. In the southwest corner of the South Extension, a berm shall be permitted within the extraction setback, however, a minimum 15 setback from the significant woodlands shall be maintained. Prior to berm construction adjacent to key natural heritage features, limit of workspace indicators (flagging and silt fencing) will be installed to ensure there is no encroachment into adjacent features. During berm construction an Erosion and Sedimentation Control Plan will be implemented and the berms shall be vegetated to control erosion. Flagging and silt fencing shall be maintained until the berm vegetation has been established and there is no evidence of erosion or risk of erosion. Any area of the setback disturbed during construction of the berm will be vegetated and restored to a natural condition.

e. Prior to extraction commencing in Phase 2, with the exception of the eastern setback, the forested setback areas shown on the plan view in Phase 2 will be planted with trees and shrubs in accordance with Section D. Seeding and Planting on drawing 3 of 4. The eastern setback will be planted once farming operations cease within the South Extension and access for farm equipment is no longer required.

f. Authorization under the Fisheries Act shall be obtained where required to conduct operations at the quarry.

g. The South Extension discharge location in the West Arm of the West Branch shall be installed between July 16 and March 14 to prevent disturbance to fish and fish habitat during the critical reproductive period. Erosion and sedimentation control measures shall be installed prior to commencement of any ground disturbance associated with installation of the outlet or any associated components. Standard spill prevention measures shall be implemented during all installation activities within 30 m of the watercourse. If workspace isolation and dewatering is required, fish shall be removed from the isolated area prior to complete dewatering, in accordance with the conditions of a License to Collect Fish for Scientific Purposes. To prevent negative impacts on fish habitat, any shoreline disturbances associated with the outlet shall be constructed outside the average annual high-water mark of the watercourse. If a conveyance channel is required from the outlet, disturbance to the existing watercourse shall be limited to the minimum footprint at the in-water location. The outlet shall be oriented to direct flows into the watercourse at an appropriate angle to prevent channel bed and bank erosion. Erosion protection required at the outlet shall be minimized to the extent possible. Any riparian vegetation disturbed during the installation of the outfall should be rehabilitated with appropriate native vegetation species. Following completion of detailed design of the outlet, the licensee shall consult with DFO to ensure compliance with Provisions of the Fisheries Act.

h. Prior to extraction commencing in Phase 3, the forested setback areas as shown on the plan view in Phases 3, 4, 5 and 6 will be planted with trees and shrubs in accordance with Section D. Seeding and Planting on drawing 3 of 4.

i. Prior to extraction commencing in Phase 3, the infiltration pond shall be constructed in the location shown on the plan view.

j. Alterations required to the weir plate and installation of the diversion pipe in the weir pond in the West Extension shall take place between July 16th and August 30th to minimize potential for impacts to downstream fish habitat.

k. Prior to removal of the irrigation ponds and irrigation channel in the West Extension, the downstream end of the golf course channel shall be blocked to isolate surface water. If water is to be pumped from the feature to facilitate site preparation, it shall be directed to the existing sump for discharge in accordance with MECP ECA and PTTW requirements.

l. Golf course irrigations ponds and channel in the West Extension shall be removed between July 16th and March 14th to prevent disruption to the sensitive life stages of the Unnamed Bass population within this water feature.

m. Prior to removal of the irrigation ponds and channel in the West Extension, a fish rescue shall be completed to remove fish in accordance with the conditions of a License to Collect Fish for Scientific Purposes.

n. Prior to removal of one Category 2 Butternut tree in Phase 3, as shown on drawing 1 of 4, the area surrounding the Category 2 tree will be re-surveyed to confirm that Butternut saplings are not identified. If Butternut saplings are identified, they will be assessed by an approved Butternut Health Assessor. The licensee shall register the activity under the appropriate Regulation of the Endangered Species Act and implement the requirements. In addition to the Butternut sapling survey, the health of the Category 2 Butternut tree will be reassessed by an approved Butternut Health Assessor to confirm that the tree is still Category 2 and has not regressed to a Category 1. If the Category 2 designation persists, the licensee shall register the activity under of the Endangered Species Act and implement the requirements of the registration. If the Butternut health reevaluation determines that the tree has regressed to Category 1, registration of the activity would no longer be required.

o. Removal of the wooded features in the West Extension shall only occur between December 1st and March 14th to avoid impacts to species at risk bat habitat, significant bat maternity roost habitat, species at risk significant wildlife bat species and Eastern Wood-pewee. To mitigate for the removal of these habitat designations, the licensee shall complete the tree planting requirements as outlined on this drawing and drawing 3 of 4; install bat boxes and artificial bark stations adjacent to the pond and woodland in the West Extension.

p. Prior to the removal of the three structures in the West Extension (Phase 3 - BSNO R1, Phase 5 - BSNO E and in the setback where the pond is to be constructed - BSNO B) as shown on drawing 1 of 4, the licensee shall register the activity under section 23.5, O.Reg. 242/08 of the Endangered Species Act and implement the requirements of the registration. BSNO C shall not be removed.

q. Complete rehabilitation of the site in accordance with the requirements outlined on drawing 3 of 4 to create key natural heritage and key hydrologic features, including wetlands, lakes and forested areas.

r. As part of rehabilitation of the site, regrade the area along the north boundary of Phase 3, as shown on drawing 3 of 4 to provide surface water flow to the adjacent wetland to reinstate its catchment area.

s. Post rehabilitation, maintain the West Extension in a dewatered state; maintain discharge to north and south from Quarry Sump 0100 and 0200 within License # 5499 and passive discharge from a bottom draw outlet in the infiltration pond to provide water to the wetland north of No. 2 Side Road adjacent to West Extension in accordance with the conditions of the MECP, PTTW and ECA. This pumping regime is consistent with current management from License # 5499 and provides long term public water management benefits and mitigates impacts to natural heritage features that depend on quarry discharge from the adjacent License # 5499.

t. Tree planting shall be in accordance with the species listed, planting design and approach, densities, spacing, maintenance and monitoring requirements as listed on drawing 3 of 4.

u. Complete rehabilitated side sloping in Phase 3 prior to extraction commencing in Phase 6.

v. Areas within the 30m setback from the watercourse, wetland, weir pond and infiltration pond, which are not disturbed by construction of the berm and that currently consist of manicured golf course lawns, shall be naturalized with vegetation plantings.

9. Agricultural

a. The soils being transferred to License #5499 for agricultural rehabilitation will be used directly for rehabilitation where feasible. If storage is required, the agricultural soils will be stored in low profile stockpiles and appropriate erosion protection will be implemented. The intent is to avoid storage of material and where storage is required, it will be minimized to the extent possible.

b. Stripping shall be limited to what is required for the season of operation to maximize areas remaining in agricultural production.

c. Topsoil and subsoil used for agricultural rehabilitation will be stripped and stored separately. Depths of soil being removed during stripping shall be documented and prepared to the pre-extraction depths as found in the Soil Survey completed by DBH to facilitate agricultural rehabilitation on Licence #5499.

d. Soil material for agricultural rehabilitation shall not be handled during frozen conditions. The soil shall only be handled under dry conditions and a wet weather shut down procedure shall be put in place.

10. Cultural Heritage

a. The house and barn located at 2280 Side Road No. 2 shall be conserved.

11. Archaeology

a. No-site alteration shall occur in the West Extension until the area is cleared of archaeological concerns and the report is accepted in the registry for the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI).

b. Should deeply buried archeology remains be found during the course of site preparation and/or extraction related activities, the MHSTCI shall be notified.

c. In the event that human remains are encountered during construction or extraction activities, the licensee shall immediately contact both the MHSTCI and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Government and Consumer Services (MGCS).

O. Variations from Provincial Standards

Progressive Rehabilitation

A. General

1. Area Calculations:

   i. To be extracted (total) **47.4 ha**
   - South Extension 14.3 ha
   - West Extension 33.1 ha

   ii. To be rehabilitated (total) **47.4 ha**
   - South Extension 14.3 ha
   - West Extension 33.1 ha

2. The final rehabilitated land form will include the creation of 5.9 hectares of woodland located in the setback area not proposed to be extracted and 23.5 hectares of woodland located within the rehabilitated extraction area.

B. Phasing

1. As excavation reaches the limit of extraction or maximum depth, progressive rehabilitation shall commence.
2. Progressive rehabilitation shall follow the direction and sequence of extraction identified on the plan view and described in the notes on drawing 2 of 4.
3. Prior to extraction commencing in Phase 6, side sloping within Phase 3 shall be completed.

C. Slopes and Grading

1. Progressive rehabilitation will utilize a variety of rehabilitation techniques including:
   - Backfilling extraction faces and quarry floors;
   - Partially backfilling extraction faces to create a cliff with talus slope; or
   - Leaving extraction faces vertical
2. Excess soil, as defined in Ontario Regulation 406/19 under the Environmental Protection Act, may be imported to this site for the following rehabilitation purposes:
   - Creation of 3:1 and 2:1 slopes
   - Top dressing to establish vegetation
   - To establish the final elevations and grades depicted on the plan view
3. Excess soil imported for the rehabilitation purposes described above shall meet the soil quality standards set out in Table 1: "Full Depth Background Site Condition Standards", of the Rules for Soil Management and Excess Soil Quality Standards published by the Ministry of Environment, Conservation and Parks, as amended from time to time.
4. The South and West Extension contains approximately 1,190,000 m³ of topsoil and overburden that can be used for rehabilitation. It is assumed that 350,000 m³ will be transferred to the existing quarry for agricultural rehabilitation and some rehabilitation directly adjacent to the West Extension. As a result, 840,000 m³ of on-site materials will be utilized and the maximum total amount of excess soil that may be imported to this site for rehabilitation purposes is 2,160,000 m³.
5. The licensee shall ensure that the acceptance and reuse of excess soil imported for rehabilitation purposes is compliant with Part I: Rules for Soil Management of the "Rules for Soil Management and Excess Soil Quality Standards" published by the Ministry of Environment, Conservation and Park and as amended from time to time.
6. The final rehabilitated landforms established in the South and/or West Extension using the rehabilitation techniques will consist of lakes, islands, shoreline wetlands, vernal pools, beach, pond, woodlands, gradually sloping grades, 2:1 and 3:1 side slopes, cliff with talus slopes, and vertical faces as shown on the plan view.
7. Beach sand may be imported to establish the beach area in the South Extension.
8. As part of rehabilitation of the site, regrade the area along the north boundary of Phase 3, as shown on this drawing to provide surface water flow to the adjacent wetland to reinstate its catchment area.

D. Seeding and Planting

1. The side slopes and backfilled portions of the quarry floor will be seeded with the Ministry of Transportation's (MTO) Ontario Roadside Seed Mix (Creeping Red Fescue, Kentucky Bluegrass, Perennial Ryegrass and White Clover) or equivalent.
2. Ponds, wetlands, and tree planting areas identified in the plan view shall be planted in accordance with Table 1: Rehabilitation Plant List Recommendations on this drawing.
3. The planting design and approach will be guided by the Conservation Halton Landscaping and Tree Preservation Guidelines (2010).
4. Planting densities shall be determined based on the restoration objectives and presence/absence of existing natural features. For example, planting densities will be highest where the objective is to restore/establish a woodland, and meet the definition of woodland under the Forestry Act, but may be reduced if/when objective is to establish a buffer adjacent to a naturalized area. The type of species planted will also be dependent on adjacent habitat (e.g., greater reliance on shrub plantings when restoration occurs adjacent to a meadow, and tree plantings when planting next to woodland).
5. Where the restoration objective is the establishment of a woodland, trees will be planted at a minimum density of 10 trees per 100 m², in order to account for competition, stress or wildlife damage and to meet the definition of woodland under the Forestry Act. Within this area, the shrub to tree ratio will be 5:1, with trees planted no closer than 2.5 m on centre and shrubs planted between 0.75 m and 1.5 m apart.
6. Where the restoration objective is the establishment of a setback adjacent to a natural feature, planting densities will be dependent on the features they abut (e.g., densities will be higher when planting next to an existing forest relative to the densities when planting next to an anthropogenic or cultural feature). The planting design of a proposed setback adjacent to a natural feature will follow a 3-band approach, where woody planting densities will be highest within Band 1 (closest to the existing adjacent feature) and reduced in Band 2. No woody species will be planted in Band 3, which will be seeded with a soil and moisture-appropriate native seed mix. Where trees will be planted, the following planting densities will be applied: Band 1 - five trees per 100 m². Where shrubs are also being proposed, these will be planted at a shrub to tree ratio of 5:1; Band 2 - three trees per 100 m². Where shrubs are also being proposed, these will be planted at a shrub to tree ratio of 5:1.
7. Competing herbaceous vegetation will be controlled by placing mulch around each planted tree or shrub (50 cm radius of mulch around each planting). Rodent protection will be installed as necessary. Where access permits, planting will be watered during periods of drought (defined as a 30 day period between May and September with less than 25mm of precipitation) until establishment has occurred.
8. For planting in areas not extracted, plantings shall be monitored and evaluated by a qualified professional annually until "free-to-grow" conditions have been achieved. "Free-to-grow" is considered established based on a minimum stocking standard, a minimum height and freedom from competition that could impede growth. Monitoring, tending and additional planting shall occur until 1000 trees per hectare have reached "free-to-grow" condition.
9. For plantings in areas extracted, plantings shall be monitored and evaluated by a qualified professional annually until "free-to-grow" conditions have been achieved. "Free-to-grow" is considered established based on a minimum stocking standard, a minimum height and freedom from competition that could impede growth. Monitoring, tending and additional planting shall occur until 1000 trees per hectare have reached "free-to-grow" condition.

E. Drainage

1. Final surface drainage will follow the rehabilitated contours and directional arrows shown on the plan view.
2. Once the South Extension is depleted, pumping will cease and portions of the site below the ground water table will fill with water.
3. Runoff within the South Extension will drain into the lake.
4. Construct overflow outlet in the southwest corner of the South Extension.
5. Once the West Extension is depleted, the West Extension will remain in a dewatered state. Runoff within the West Extension will either drain north towards the lake or southeast into existing Licence #5499.
6. During rehabilitation the licensee shall maintain discharge to fish habitat to the north and south from Quarry Sump 0100 and 0200 within License #5499 and passive discharge from a bottom draw outlet in the infiltration pond to provide water to the wetland north of No. 2 Side Road adjacent to West Extension.
7. During rehabilitation the licensee shall operate in accordance with the conditions of the MECP, PTTW and ECA for the ongoing dewatering of the site. This pumping regime is consistent with current management from License #5499 and provides long term public water management benefits and mitigates impacts to natural heritage features that depend on quarry discharge from the adjacent License #5499.
8. The licensee has committed to: conveying the site into public ownership and to maintain the West Extension in a dewatered state by maintaining the pumping regime from License #5499 to provide long-term public water management benefits and mitigate impacts on natural heritage features which depend on quarry discharge from the adjacent License #5499.

F. Adaptive Management Plan

1. During progressive rehabilitation, until surrendering the licence, the licensee is required to operate in accordance with the Adaptive Management Plan, prepared by EarthFX Inc., Savanta and Tatham Engineering, dated March 2022, as may be amended from the time to time with approval from MNRF, in consultation with NEC, Region of Halton, City of Burlington and Conservation Halton.

Final Rehabilitation

A. General

1. All equipment shall be removed from the South and West Extension.
2. No internal haul roads shall remain in either Extension.
3. The residence and barn at 2280 Side Road No. 2 in the South Extension shall remain.
4. The residence and barn located at 2015 Side Road No. 2 in the southwest corner of the West Extension shall remain.
5. A field/property access entrance shall remain to access the residence and barn located at 2280 and 2015 Side Road No. 2.
6. The groundwater table post rehabilitation varies between 263.5 masl to 271 masl in the South Extension and 255.5 masl to 265 masl in the West Extension (EarthFX 2020) or ±269 masl if the West Extension is not maintained in a dewatered state.
7. The licensee, prior to the surrender of the licence, shall complete a Record of Site Condition for the Extensions in accordance with the Environmental Protection Act.
8. In the event that a third-party agreement is not arranged prior to site surrender, the licensee will be responsible to maintain the site in the condition consistent with this approved rehabilitation plan.

Table 1: Rehabilitation Plant List

Pond/Wetland (PW)
Grassland and Existing Trees (GL)
Gradual Grade/Side Slope with Trees (GG)
Forested Setback During Operation (FSO)
Forested Setback Post Berm (FSB)
Restored to Existing Grade and Forested (REG)

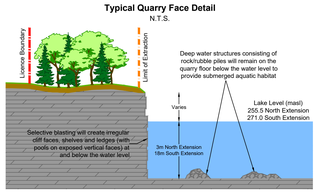
Location	LATIN NAME	COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	OWES WETLAND SPECIES	PROVINCIAL STATUS (S-RANK)	LOCAL STATUS HALTON (Varga 2005)
FSB, REG	*Sambucus racemosa ssp. pubens*	Red Elderberry	5	3		S5	X
FSB, REG	*Cornus alternifolia*	Alternate-Leaved Dogwood	6	3	T	S5	X
FSB, REG	*Cornus racemosa*	Grey Dogwood	2	0	T	S5	X
PW, FSB, REG	*Cornus sericea*	Red-Osier Dogwood	2	-3	FT	S5	X
FSB, REG	*Ribes cynosbati*	Eastern Prickly Gooseberry	4	3		S5	X
FSB, REG	*Prunus virginiana var. virginiana*	Chokecherry	2	3		S5	X
FSB, REG	*Rubus allegheniensis*	Alleghany Blackberry	2	3		S5	X
FSB, REG	*Rubus occidentalis*	Black Raspberry	2	5		S5	X
PW	*Salix discolor*	Pussy Willow	3	-3	I	S5	X
PW, FSB, REG	*Salix eriocephala*	Cottony Willow	4	-3	T	S5	X
PW, FSB, REG	*Salix interior*	Sandbar Willow	1	-3	T	S5	U
PW	*Salix petiolaris*	Meadow Willow	3	-3	T	S5	X
GG, FSB, REG	*Betula alleghaniensis*	Yellow Birch	6	0	T	S5	X
GG, FSO, FSB, REG	*Betula papyrifera*	Paper Birch	2	3	T	S5	X
GG, FSB, REG	*Carpinus caroliniana ssp. virginiana*	Blue-Beech	5	0	T	S5	X
GL, GG, FSO, FSB, REG	*Ostrya virginiana*	Eastern Hop-Hornbeam	4	3		S5	X
GL, GG, FSO, FSB, REG	*Fagus grandifolia*	American Beech	6	3		S4	X
GL, GG, FSO, FSB, REG	*Quercus macrocarpa*	Burr Oak	5	3	T	S5	X
GL, GG, FSO, FSB, REG	*Quercus rubra*	Northern Red Oak	6	3		S5	X
GL, GG, FSB, REG	*Carya cordiformis*	Bitternut Hickory	6	0		S5	X
GL, GG, FSO, FSB, REG	*Tilia americana*	Basswood	4	3		S5	X
GL, GG, FSO, FSB, REG	*Prunus serotina var. serotina*	Black Cherry	3	3		S5	X
GG, FSB, REG	*Populus balsamifera*	Balsam Poplar	4	-3	T	S5	X
GL, GG, FSO, FSB, REG	*Populus deltoides ssp. deltoides*	Eastern Cottonwood	4	0	T	S5	U
GL, GG, FSO, FSB, REG	*Populus tremuloides*	Trembling Aspen	2	0	T	S5	X
PW, GG, FSB, REG	*Salix amygdaloides*	Peach-Leaved Willow	6	-3	T	S5	U
GL, GG, FSO, FSB, REG	*Acer nigrum*	Black Maple	7	3	T	S4?	X
GG, FSB, REG	*Acer saccharinum*	Silver Maple	5	-3	I	S5	X
GL, GG, FSO, FSB, REG	*Acer saccharum*	Sugar Maple	4	3		S5	X
GG, FSB, REG	*Thuja occidentalis*	Eastern White Cedar	4	-3	T	S5	X
GG, FSB, REG	*Abies balsamea*	Balsam Fir	5	-3	T	S5	U
GL, GG, FSO, FSB, REG	*Picea glauca*	White Spruce	6	3	T	S5	U
GL, GG, FSO, FSB, REG	*Pinus strobus*	Eastern White Pine	4	3	T	S5	X
GL, GG, FSO, FSB, REG	*Tsuga canadensis*	Eastern Hemlock	7	3	T	S5	X

Herbaceous seed mixes will be applied where appropriate (e.g. if soil seedbank is deemed unsuitable). Potential mixes could include Upland Dry Meadow Mix, Early Succession/Riparian Mix, and Meadow Marsh Mix, following Conservation Halton guidelines.

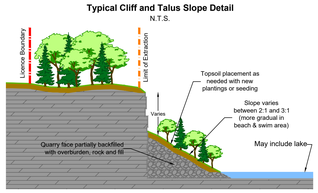
A nurse crop will be applied to exposed soil, the species of which will depend on season of application but will follow Conservation Halton guidelines.

Beach
Pond
Swim Area
Lake
Wetland / Shoreline Wetland
Vertical Face
3:1 slope (tree planting)
2:1 slope (tree planting)
Setback - grassland & existing trees
Setback - forested - planted during operations
Setback - forested - planted when berms removed
Restored catchment area and ecological linkage (tree planting)
Gradual grade (tree planting & vernal pools) or islands

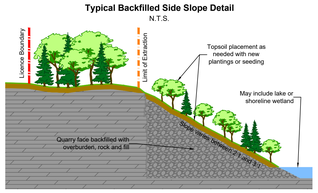
Typical Quarry Face Detail
N.T.S.



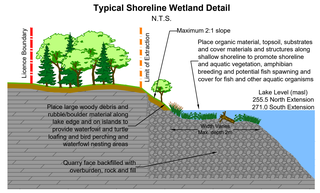
Typical Cliff and Talus Slope Detail
N.T.S.



Typical Backfilled Side Slope Detail
N.T.S.



Typical Shoreline Wetland Detail
N.T.S.



Legal Description

Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

Legend

- Licence Boundary
- Limit of Extraction
- Contours with Elevation (Metres above sea level (MASL))
- Public Road
- Fence (1.2m post & wire fence unless otherwise noted)
- Water Feature
- Lake / Pond Licence # 5499
- Significant Woodlands
- Woodlands
- Wooded Feature
- Wetland (Surveyed by Savanta/MNRF in Accordance with OWES - Assumed Significant for Planning Purposes)
- Wetland (MNRF Evaluated - Provincially Significant)
- Wetland (MNRF Evaluated - Other (Non Provincially Significant))
- Wetland (MNRF - Unevaluated (Assumed Significant for Planning Purposes))
- 120m Offset From Licence Boundary
- Existing Licence (Existing Licenced Boundary (solid line) Existing Limit of Extraction (dashed line))
- Parcel Fabric
- Diversion or Discharge Pipe (Existing - Single Dash Proposed - Double Dash)
- Discharge Location
- Sun-Canadian Pipe Line (Pipe line location and easement)
- Jefferson Salamander Regulatory Boundary
- Entrance / Exit (Field / Property)
- Gate
- Building/Structure
- Proposed Final Grade and Slope (3.0% / -1%)
- Final Elevation of Land and Lake (MASL) (270.5)
- Cross Sections (A1)

Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licencing)

No.	Date	Description	By
1.	September 2020	Adjust pond adjacent to dwelling in the southwest corner of the West Extension.	CAP
2.	April 2021	Included MNRF wetlands for South Extension. Updated notes per MNRF feedback. Updated legend.	CAP
3.	January 2022	Updated to address agency comments.	CAP
4.	February 2022	Updated to address agency comments.	CAP
5.	March 2022	Updated limit of extraction in the West Extension. Added dripline to the Existing Features and Operational Plan. Revised notes A.1.ii. and F.1.	CAP

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
113 COLLIER STREET, BARRIE, ON. L4M 1H2 | P: 705.728.0045 F: 705.728.2010 | WWW.MHBCPLAN.COM

MNRF Approval Stamp

MHBC Stamp

Applicant

NELSON AGGREGATE CO.
2433 No. 2 Sideroad
P.O.Box 1070 Burlington Ont. L7R 4L8
phone: (905) 335-5250

Project

Burlington Quarry Extension

MNRF Licence Reference No. 626477

Pre-approval review:

Plan Scale: 1:3000 (Arch E)

0 100 200 Meters

Date March 2022

Drawn By C.P.

Checked By B.Z.

File No. 9135D

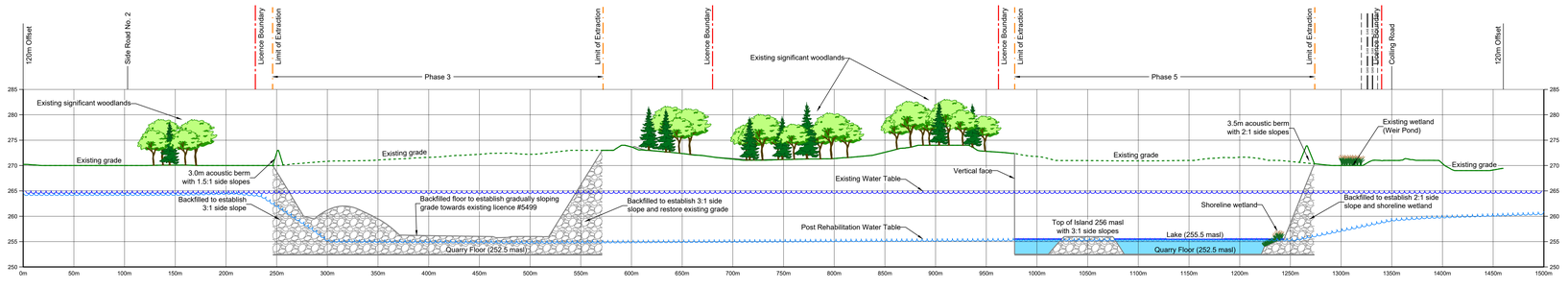
File Name

Rehabilitation Plan

Drawing No.

3 of 4

File Path N:\Brian\9135D- Nelson - Project Sideways\Drawings\ARA Site Plans\Extension Site Plan\CAD\9135D - Site Plan.dwg



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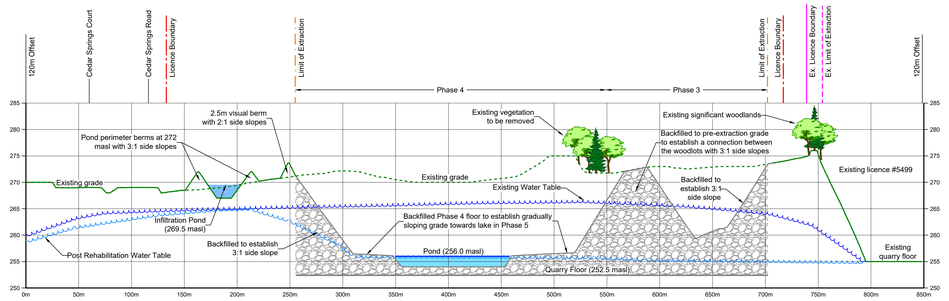

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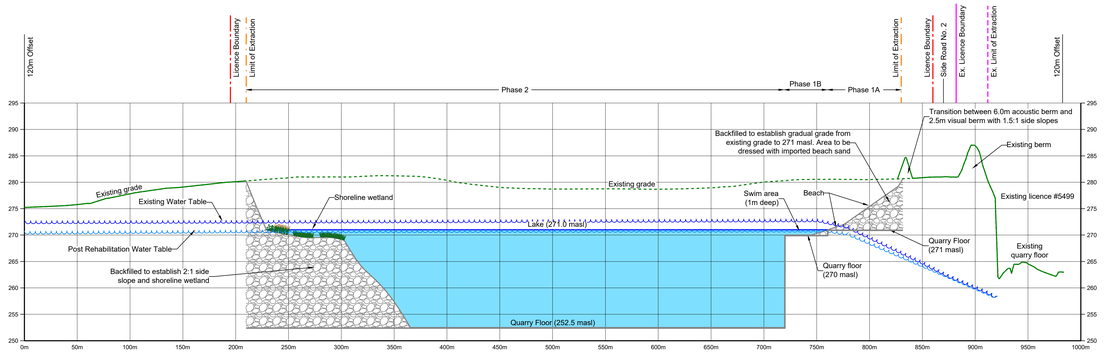

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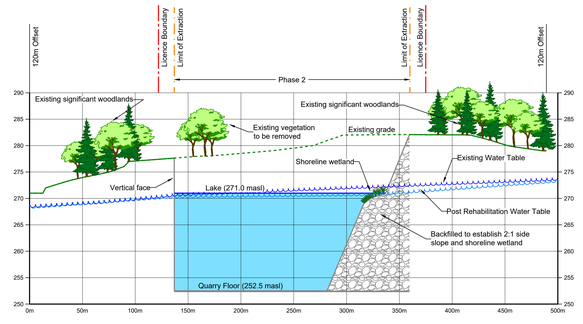
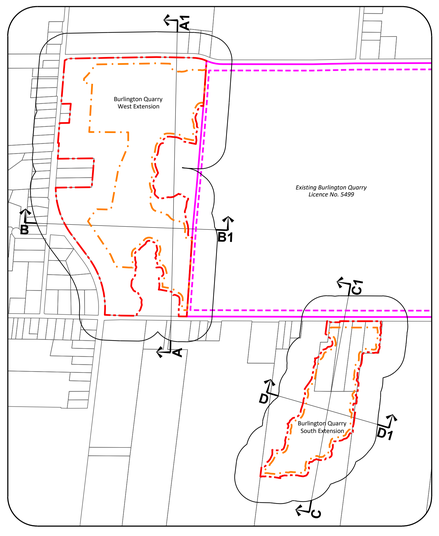


Cross Section D-D1

Key Map

Cross Sections



Legal Description

Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

Legend

- Licence Boundary
- Limit of Extraction
- Existing Licence
- Existing Limit of Extraction
- 120m Offset From Licence Boundary
- Existing Grade - Removed / Altered
- Existing Grade - Undisturbed
- Quarry Floor / Face
- Berm
- Existing Water Table
- Post Rehabilitation Water Table
- Backfilled
- Lake or Pond

Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licencing)

No.	Date	Description	By
1.	April 2021	Added additional cross section labels for clarity.	CAP
2.	January 2022	Updated to address agency comments.	CAP
3.	February 2022	Updated drawings 1, 2 and 3 of 4 to address agency comments.	CAP
4.	March 2022	Updated limit of extraction in the West Extension. Added dripline to the Existing Features and Operational Plan.	CAP

No.	Date	Description	By

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
113 COLLIER STREET, BARRIE, ON. L4M 1H2 | P: 705.728.0045 F: 705.728.2010 | WWW.MHBCPLAN.COM

MNRF Approval Stamp

MHBC Stamp

Applicant

NELSON AGGREGATE CO.
2433 No. 2 Sideroad
P.O.Box 1070 Burlington Ont. L7R 4L8
phone: (905) 335-5250

Project

Burlington Quarry Extension

MNRF Licence Reference No. 626477	**Pre-approval review:**
Plan Scale: Horizontal 1:2000, Vertical 1:400	**Date** March 2022
	Drawn By C.P.
	Checked By B.Z.
	File No. 9135D

File Name

Cross Sections

Drawing No.

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Tab **2**

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Blast Impact Analysis
Burlington Quarry Extension
Concession 2, Part Lot 1,2,17 &18
Township of Burlington

Submitted to:

Nelson Aggregate
2433 No. 2 Side Road
Burlington, ON
L7P 0G8

Prepared by

Explotech Engineering Ltd.
58 Antares Drive, Unit 5
Ottawa, Ontario
K2E 7W6

June 16, 2021

EXECUTIVE SUMMARY

Explotech Engineering Ltd. was retained in November 2018 to provide a Blast Impact Analysis for the proposed Nelson Aggregate – Burlington Quarry Extension operation located on Concession 2, Part Lot 1,2,17 and 18 – geographical City of Burlington, Ontario.

Vibration levels assessed in this report are based on the Ministry of the Environment, Conservation and Parks Model Municipal Noise Control By-law (NPC 119) with regard to guidelines for blasting in Mines and Quarries. We have assessed the area surrounding the proposed license area with regard to potential damage from blasting operations and compliance with the aforementioned by-law document. In addition, we have reviewed blast and/or vibration reports collected at the existing licenced quarry for the 2014 - 2019 blasting campaigns.

Golder Associates undertook a vibration attenuation study at the existing Burlington Quarry in 2004. The resultant data was analyzed in order to develop site specific vibration attenuation characteristics and equations.

We have inspected the site and reviewed the available site plans. Explotech Engineering Ltd. is of the opinion that the planned mineral extraction extension on the site can be carried out safely and within Ministry of the Environment, Conservation and Parks guidelines as set out in NPC 119 of the By-Law.

Recommendations are included in this report for blasting operations to be carried out in a safe and productive manner and to suitably manage and mitigate the possibility of damage to any buildings, wells, structures or residences surrounding the property.

EXPLOTECH

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INTRODUCTION

The proposed Nelson Aggregate – Burlington Quarry Extension operation is separated into two areas. The Burlington Quarry South Extension is located on the Southeast side of the existing licensed and operating Burlington Quarry (Licence 5499) while the Burlington Quarry West Extension is located along the Southwest face of the existing quarry. The legal description for the proposed licence is Concession 2, Part Lot 1,2,17 and 18 – geographical City of Burlington, Ontario.

This Blast Impact Analysis is based on the Ministry of the Environment, Conservation and Parks (MECP) Model Municipal Noise Control By-law (NPC 119) with regard to guidelines for blasting in mines and quarries. We have additionally assessed the area surrounding the proposed license with regard to potential damage from blasting operations. It is a recommendation of this report that a vibration monitoring program be continued on the existing licenced site as well as on the proposed Burlington Quarry extension lands and that this monitoring program be maintained for the duration of all blasting activities to permit timely adjustment to blast parameters as required.

While not specifically required as part of the required scope of the Blast Impact Analysis under the Aggregate Resources Act, this report reviews the topics of flyrock and residential water wells. Exhaustive details related to residential water wells are addressed in the hydrogeological report while specific flyrock control is addressed at the operational level given significant influences related to blast design, geology and field accuracy.

Recommendations are included in this report for blasting operations to be carried out in a safe and productive manner and to suitably manage and mitigate the possibility of damage to any buildings, wells, structures or residences surrounding the property.

EXISTING CONDITIONS

The current operating licensed area for the Nelson Aggregate Burlington Quarry (Licence 5499) is described as Concession 2, Lot 1 and 2 and Concession 3, Part Lot 1 and 2 – geographic City of Burlington. This property is bound by Colling Road to the Northeast, No. 2 Side Road to the Southeast, Burlington Springs Golf Club property to the Southwest and Guelph Line to the Northeast. The lands immediately surrounding the licence are sparsely populated with the areas of densest development lying to the Southwest.

The proposed Burlington Quarry extension is separated into two (2) areas designated as the South and West Extension Areas. The Burlington Quarry South Extension is legally described as Concession 2, Part Lot 17 and 18 and is located immediately Southeast of the existing licence separated by No 2.Side Road. The Burlington Quarry South extension lands are bound by vacant lands to the Northeast and Southeast, No. 2 Side Road and the existing Burlington Quarry to the Northwest and residential properties located along No. 2 Side Road as well as the Camisle Golf Course to the Southwest. The South Extension lands are generally highest towards the Northeast boundary of the extension lands. The maximum elevations are in the order of 282MASL. The land drops in the South corner of the South extension lands to an elevation of approximately 274MASL.

The Burlington Quarry West Extension is legally described as Concession 2, Part Lot 1 & 2 and lies Southwest of the existing licence. The West Extension lands are bound by the existing quarry and Colling Road to the North, Cedar Springs Road and residential properties along Cedar Springs Road to the West, residential properties located along No. 2 Side Road and Cedar Springs Road to the South and East. The West Extension lands are generally highest towards the Northeast and South boundaries of the extension lands. The maximum elevations are in the order of 275MASL. The existing topography drops along the West boundary of the West Extension lands to an elevation of approximately 262MASL.

The licenced area for the proposed Burlington Quarry extension lands encompasses a total area of approximately 78.4HA. The associated extraction area is approximately 50.2HA when allowing for setbacks and sterilized areas.

The closest sensitive receptors located to the existing Burlington Quarry licence boundary and the proposed Burlington Quarry Extension extraction boundaries are listed in Table 1 below as well as on the Sensitive Receptor Overviews contained in Appendix A:

Sensitive Receptor	Straight Line Distance from Existing Burlington Quarry Boundary to Receptor (m)	Straight Line Distance from proposed Burlington Quarry Extension Extraction Boundary to Receptor (m)	Extension Area Closest to Sensitive Receptor
2196 No. 2 Side Road	158	284	South
*2226 No. 2 Side Road	53	208	South
*2244 No. 2 Side Road	47	129	South
*2280 No. 2 Side Road	28	15	South
*2292 No. 2 Side Road	153	N/A	South
*2300 No. 2 Side Road	52	N/A	South
*2416 No. 2 Side Road	116	278	South
*2433 No 2 Side Road	69	280	South
2450 No. 2 Side Road	50	387	South
2462 No. 2 Side Road	60	423	South
2470 No. 2 Side Road	48	462	South
*2473 No. 2 Side Road	12	493	South
*2479 No. 2 Side Road	41	521	South
2485 No. 2 Side Road	75	549	South
2495 No. 2 Side Road	74	612	South
2496 No. 2 Side Road	449	636	South
2509 No. 2 Side Road	78	644	South
2519 No. 2 Side Road	118	664	South
4366 Guelph Line	613	740	South
4420 Guelph Line	380	517	South
4448 Guelph Line	349	663	South
4472 Guelph Line	312	674	South
4480 Guelph Line	288	669	South
4486 Guelph Line	183	535	South
4487 Guelph Line	329	672	South
4496 Guelph Line	282	668	South
5030 Guelph Line	35	697	South
1385 No. 2 Side Road	560	285	West
1405 No. 2 Side Road	500	239	West
1425 No. 2 Side Road	453	202	West
*2015 No. 2 Side Road	307	95	West

Sensitive Receptor	Straight Line Distance from Existing Burlington Quarry Boundary to Receptor (m)	Straight Line Distance from proposed Burlington Quarry Extension Extraction Boundary to Receptor (m)	Extension Area Closest to Sensitive Receptor
2080 No. 2 Side Road	144	143	West
2090 No. 2 Side Road	249	268	West
2102 No. 2 Side Road	90	118	West
2116 No. 2 Side Road	36	77	West
2126 No. 2 Side Road	39	100	West
2136 No. 2 Side Road	46	140	West
2170 No. 2 Side Road	167	298	West
5050 Cedar Springs Road	478	146	West
5070 Cedar Springs Road	523	154	West
5029 Cedar Springs Court	634	326	West
5059 Cedar Springs Court	620	279	West
5069 Cedar Springs Court	615	226	West
5079 Cedar Springs Court	610	188	West
5089 Cedar Springs Court	615	150	West
5106 Cedar Springs Court	735	237	West
5116 Cedar Springs Court	731	220	West
5132 Cedar Springs Court	738	245	West
5140 Cedar Springs Court	717	233	West
5158 Cedar Springs Road	707	237	West
5164 Cedar Springs Road	717	259	West
5165 Cedar Springs Road	625	189	West
5168 Cedar Springs Road	728	296	West
5172 Cedar Springs Road	729	266	West
5179 Cedar Springs Road	636	222	West
5191 Cedar Springs Road	542	139	West
5206 Cedar Springs Road	727	231	West
5214 Cedar Springs Road	747	234	West
5224 Cedar Springs Road	720	196	West
5234 Cedar Springs Road	712	184	West
*5235 Cedar Springs Road	327	N/A	West
5244 Cedar Springs Road	716	184	West
5245 Cedar Springs Road	642	110	West
5248 Cedar Springs Road	716	184	West

Sensitive Receptor	Straight Line Distance from Existing Burlington Quarry Boundary to Receptor (m)	Straight Line Distance from proposed Burlington Quarry Extension Extraction Boundary to Receptor (m)	Extension Area Closest to Sensitive Receptor
5254 Cedar Springs Road	713	173	West
5255 Cedar Springs Road	637	103	West
5258 Cedar Springs Road	704	152	West
5264 Cedar Springs Road	705	138	West
5268 Cedar Springs Road	705	131	West
5300 Cedar Springs Road	721	146	West
5318 Cedar Springs Road	717	140	West
5336 Cedar Springs Road	710	163	West
5352 Cedar Springs Road	721	225	West
5353 Cedar Springs Road	524	149	West
5360 Cedar Springs Road	725	235	West
5380 Cedar Springs Road	752	312	West
2129 Colling Road	94	114	West
2139 Colling Road	67	103	West

* Denotes properties owned by the proponent. If these properties are unoccupied at the time of blasting operations or their use has changed (eg converted to offices) they will no longer be considered sensitive receptors and are thereby exempt from the MECP Guideline vibration and overpressure limits.

The structures located at 2280 No 2 Side Road located directly adjacent the proposed south expansion license are classified as culturally significant and will be vacant at the time of extraction. In this instance, 2280 No 2 Side Road would not qualify as a sensitive receptor as defined by the MECP (refer to Appendix E for Definitions). In order to safeguard the structural integrity of these structures, we recommend that vibrations at the 2280 No 2 Side Road property be maintained below 50mm/s (>40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure on the property shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s.

PROPOSED MINERAL EXTRACTION

As per the April 2020 Extraction Plan (Refer to Appendix A), the proposed initial quarry operations will commence with a sinking cut at the North corner of the Burlington Quarry South extension area. The South Extension Area will be extracted in three (3) phases designated as Phase 1a, Phase 1b and Phase 2. Retreat of the face will progress in a general Southeast direction.

Initial blasting for the South Extension lands will be located approximately 410m from the closest sensitive receptor not owned by the proponent outside of the proposed limits of extraction, namely 2450 No. 2 Side Road. (Note: The property located at 2280 No. 2 Sideroad is located approximately 205m from the initial blasting. This property is owned by the proponent and will be vacant upon commencement of extraction operations in which case it would be exempt from NPC 119 guideline limits. In the event that the property is being used a residence upon commencement of blasting, the NPC 119 limits would be applicable at this property). As operations progress during the South Extension, quarry faces along the Southwest limits of extraction will come as close as 15m removed from the closest receptor (namely 2280 No.2 Side Road) owned by the proponent or approximately 300m (namely 2196 No. 2 Side Road) to the closest privately owned sensitive receptor.

The Burlington Quarry West Extension will be extracted in four (4) phases designated as Phases 3 through 6 (Refer to Appendix A). The West Extension area will leverage the existing Southwest face of the Burlington Quarry in Phases 3 and 5 with a general East to West face retreat in Phase 3, 4 and 5. The Phase 6 face will retreat in a general North to South direction leveraging the face created by the Phase 5 progress.

As operations progress during the Burlington Quarry West Extension, quarry faces along the East limits of extraction will come as close as 77m removed from the properties located on No. 2 Side Road. Table 2 denotes relevant extraction details as they pertain to each individual phase.

TABLE 2 Details for Extraction for Each Individual Phase of the Burlington Quarry Extension	
Phase 1a	• Phase 1a will commence with a sinking cut in the Northeast corner of the Burlington Quarry South Extension lands • Extracted to a depth of 271MASL • Retreat in a general Southeasterly direction • Likely extracted in 1-2 benches
Phase 1b	• Initial operations for Phase 1b will leverage the existing face of Phase 1a thereby initially eliminating the need for a sinking cut. • Extracted to a depth of 270MASL • Retreat in a general Southeasterly direction • Extracted in 1 bench
Phase 2	• Initial operations of Phase 2 will leverage the existing face of Phase 1b thereby initially eliminating the need for a sinking cut. • Once operations reach the quarry floor elevation achieved in Phase 1b a sinking cut will be required to extract rock to the Phase 2 final floor elevation of 252.5MASL. • Extracted to a depth of 252.5MASL • Retreat in a general Southeasterly direction. • Likely extracted in 1-2 benches
Phase 3	• Phase 3 will commence along the Southeast corner of the Burlington Quarry West Extension lands • Phase 3 will leverage the existing face of the Burlington Quarry thereby eliminating the need for a sinking cut. • Extracted to a depth of 252.5MASL • Retreat in a general Westerly direction • Likely extracted in 2-3 benches
Phase 4	• Phase 4 will leverage the face of the previously excavated Phase 3 therefore eliminating the need for a sinking cut. • Extracted to a depth of 252.5MASL • Retreat in a general Westerly and Southerly direction • Likely extracted in 2-3 benches
Phase 5	• Phase 5 will leverage the existing West face of the Burlington Quarry therefore eliminating the need for a sinking cut. • Extracted to a depth of 252.5MASL • Retreat in a general Westerly direction • Likely extracted in 2-3 benches

Phase 6	• Phase 6 will leverage the face of the previously excavated Phase 5 thereby eliminating the need for a sinking cut. • Extracted to a depth of 252.5MASL • Retreat in a general Southerly direction • Likely extracted in 2-3 benches

Current practice at the Nelson Aggregate Burlington Quarry operation employs 102-152mm diameter blast holes with a typical load per delay of between 10kg and 400kg per period. Calculations contained within this report suggest modifications to current blast designs will be necessary as operations progress towards adjacent receptors.

It is a recommendation of this report that all blasts shall, as a minimum, be monitored at the nearest sensitive receptors, or closer, in front and behind any given blast in order to ensure constant compliance with MECP guideline limits and to permit timely adjustment to blast designs as required.

BLAST VIBRATION AND OVERPRESSURE LIMITS

The Ontario MECP guidelines for blasting in quarries are among the most stringent in North America.

Recent studies by the U.S. Bureau of Mines have shown that normal temperature and humidity changes can cause more damage to residences than blast vibrations and overpressure in the range permitted by the MECP. The limits suggested by the MECP are as follows.

Vibration	12.5mm/s	Peak Particle Velocity (PPV)
Overpressure	128dB	Peak Sound Pressure Level (PSPL)

The above guidelines apply when blasts are being monitored. Cautionary levels are slightly lower and apply when blasts are not monitored on a routine basis. It is a recommendation of this report that all blasts at the operation be monitored to quantify and record ground vibration and overpressure levels employing a minimum of two (2) digital seismographs, one installed at the closest receptor behind the blast, or closer, and one installed at the closest receptor in front of the blast, or closer.

BLAST MECHANICS AND DERIVATIVES

The detonation of explosives within a blast hole results in the development of very high gas and shock pressures. This energy is transmitted to the surrounding rock mass, crushing the rock immediately surrounding the borehole (approximately 1 borehole radius) and permanently distorts the rock to several borehole diameters (5-25, depending on the rock type, prevalence of joint sets, etc).

The intensity of this stress wave decays quickly so that there is no further permanent deformation of the rock mass. The remaining energy from the detonation travels through the unbroken material in the form of a pressure wave or shock front which, although it causes no plastic deformation of the rock mass, is transmitted in the form of vibrations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. As such, for the purposes this report, ground vibration units have been listed in mm/s.

In addition to the ground vibrations, overpressure, or air vibrations, are generated through the direct action of the explosive venting through cracks in the rock or through the indirect action of the rock movement. In either case, the result is a pressure wave which travels though the air, measured in linear decibels (or dBL) for the purposes of this report.

VIBRATION AND OVERPRESSURE THEORY

Transmission and decay of vibrations and overpressure can be estimated by the development of attenuation relations. These relations utilize empirical data relating measured velocities at specific separation distances from the vibration source to predict particle velocities at variable distances from the source. While the resultant prediction equations are reliable, divergence of data occurs as a result of a wide variety of variables, most notably site-specific geological conditions and blast geometry and design for ground vibrations and local prevailing climatic conditions for overpressure.

In order to circumvent this scatter and improve confidence in forecast vibration levels, probabilistic and statistical modeling is employed to increase conservatism built into prediction models, usually by the application of 95% confidence lines to attenuation data.

The attenuation relations are not designed to conclusively predict vibration levels at a specific location as a result of a specific blast design, application of this probabilistic model creates confidence that for any given scaled distance, 95% of the resultant velocities will fall below the calculated 95% regression line.

While the data still provides insight into probable vibration intensities, attenuation relations for overpressure tends to be less reliable and precise than results for ground vibrations. This is due primarily to wider variations in variables outside of the influence of the blast design which impact propagation of the vibrations. Atmospheric factors such as temperature gradients and prevailing winds (refer to Appendix B) as well as local topography can all serve to significantly alter overpressure attenuation characteristics.

Our experience and analysis demonstrates that blast overpressure is greatest when blasting towards receptors, and blast vibrations are greatest when retreating towards the receptors.

VIBRATION LEVELS AT THE NEAREST SENSITIVE RECEPTOR

The most commonly used formula for predicting PPV is known as the Bureau of Mines (BOM) prediction formula or Propagation Law. We have used this formula to predict the PPV's at the closest house for the initial operations.

$$PPV = k\left(\frac{d}{\sqrt{w}}\right)^{e}$$

Where, PPV = the predicted peak particle velocity (mm/s)

K, e = site factors

d = distance from receptor (m)

w = maximum explosive charge per delay (kg)

The value of K is variable and is influenced by many factors (i.e. rock type, geology, thickness of overburden, blast parameters, etc.). Based on the data collected from the previous attenuation study prepared by Golder Associates, the values for "e" and “K” have been established at -1.32 and 896 respectively (refer to Appendix C).

An ***example*** of this calculation is as follows:

For a distance of 410m (i.e. the closest standoff distance to the nearest existing structure outside of the extraction limits for the initial blasting of **Phase 1a** not owned by the proponent, namely 2450 No. 2 Sideroad) and a maximum explosive weight of 80kg (10m deep, 102mm blast hole, 2.4m collar, single hole per period), we can calculate the maximum PPV at the nearest receptor as follows:

$$ppv = 896\left(\frac{410}{\sqrt{80}}\right)^{-1.32} = 5.75mm/s$$

As discussed in previous sections, the MECP guideline for blast-induced vibration is 12.5 mm/s (0.5 in/s). The calculated PPV based on the design parameters above would remain compliant at a calculated value of 5.75mm/s.

As noted previously, In the event that the proponent owned unit located at 2280 No. 2 Side Road qualifies as a sensitive receptor at the

commencement of blasting, the above theoretical design would need to be adjusted to ensure compliance with MECP guidelines (i.e at a separation distance of 205m and a load of 80kg per delay, the above calculation results in a calculated vibration level of 14.35mm/s).

For the Phase 3 area in the West Extension lands it is recommended that the initial blasting take place in the North corner of the common boundary between the extension lands and the existing quarry. At a separation distance of 350m (i.e. the closest standoff distance to the nearest existing structure outside of the extraction limits for the initial blasting of **Phase 3** not owned by the proponent, namely 2116 No. 2 Side Road, and a maximum explosive load per delay of 85kg (20m deep, 102mm blast hole, 2.5m surface collar, 2 explosive decks, single deck per period), we can calculate the maximum PPV at the nearest receptor to be 7.37mm/s.

Based on the data collected from the previous attenuation study, Table 3 below denotes the theoretical maximum charge per delay that can be used given the standoff distance to the nearest sensitive receptor:

TABLE 3
Maximum Load per Delay based on varied Stand-off Distance from Sensitive Receptors to Maintain 12.5mm/s Vibration Limit

Distance from Sensitive Receptor (m)	Maximum Load per Delay (kg)
100	15.5
125	24.1
150	34.8
175	47.3
200	61.8
225	78.2
250	96.5
275	116.8
300	139.0

As the separation distance between the blast and closest receptor decreases, it will be necessary to adjust blast parameters to ensure continued compliance with the guideline limit. Fortunately, a variety of blast design alternatives are available to accomplish this including but not limited to reductions in blast hole diameter, change in explosives types, adjustment in bench heights and decking of holes. Given the planned phasing of the extension, vibration data will be continually collected and analyzed as the adjacent receptors are approached in order to confirm the requirement for any design modifications.

OVERPRESSURE LEVELS AT THE NEAREST SENSITIVE RECEPTOR

It is unusual for overpressure to reach damaging levels, and when it does, the evidence is immediate and obvious in the form of broken windows in the area. However, overpressure remains of interest due to its ability to travel further distances as well as cause audible sounds and excitation in windows and walls.

Air overpressure decays in a known manner in a uniform atmosphere, however, a uniform atmosphere is not a normal condition. As such, air overpressure attenuation is far more variable due to its intimate relationship with environmental influences. Air vibrations decay slower than ground vibrations with an average decay rate of 6dBL for every doubling of distance.

As part of the attenuation study performed on site, air overpressure levels were measured and analyzed using cube root scaling based on the following equation:

$$PSPL = k\left(\frac{d}{\sqrt[3]{w}}\right)^{e}$$

Where, PSPL = the peak sound pressure level particle velocity (dBL)
K, e = site factors
d = distance from receptor (m)
w = maximum explosive charge per delay (kg)

The collection of points gathered in the linear arrays emanating from each blast vibration were again analyzed and used to develop the following 95% regression equation (refer to Appendix C). Based on the data collected from the previous attenuation study prepared by Golder Associates, the values for "e" and “K” have been established at -0.0867 and 181 respectively (refer Appendix C).

$$PSPL = 181\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.0867}$$

As discussed in previous sections, the MECP guideline for blast-induced overpressure is 128dBL. For a separation distance of

410m (i.e. the standoff distance to the closest existing structure located outside of the extraction limits in front of the blast for initial blasting for **Phase 1a** not owned by the proponent, namely 2450 No. 2 Sideroad) and a maximum explosive weight of 80kg per delay (10m deep, 102mm blast hole, 2.4m collar, single hole per period delay), we can calculate the PSPL at the nearest receptor as follows:

$$PSPL = 181\left(\frac{410}{\sqrt[3]{80}}\right)^{-0.0867} = 121.94dB(L)$$

As discussed in previous sections, the MECP guideline for blast-induced overpressure is 128dB(L). The calculated overpressure based on the above blast parameters would remain compliant at a calculated value of 121.94dBL.

In the event that the proponent owned unit located at 2280 No. 2 Sideroad qualifies as a sensitive receptor at the commencement of blasting, the above theoretical design would need to be adjusted to ensure compliance with MECP guidelines (i.e at a separation distance of 205m and a load of 80kg per delay, the above calculation results in a calculated overpressure level of 129.5dBL).

For the Phase 3 area in the West Extension lands, we again assume initial blasting will take place in the North corner of the common boundary between the extension lands and the existing quarry. At a separation distance of 350m (i.e. the closest standoff distance to the nearest existing structure outside of the extraction limits for the proposed initial blasting of **Phase 3** not owned by the proponent, namely 2116 No 2 Side Road and a maximum explosive load per delay of 85kg (20m deep, 102mm blast hole, 2.5m surface collar, 2 explosive decks, single deck per period), we can calculate the maximum overpressure at the nearest receptor to be 123.84dBL.

We reiterate that air overpressure attenuation is far more variable due to its intimate relationship with environmental influences and as such, the equation employed is less reliable than that developed for ground vibration. Overpressure monitoring performed on site shall be used to guide blast design as it pertains to the control of blast overpressures. Given the intimate correlation between overpressure and environmental conditions, care must be taken to avoid blasting on days when weather patterns are less favourable.

ADDITIONAL CONSIDERATIONS OUTSIDE OF THE BLAST IMPACT ANALYSIS SCOPE

The following headings are addressed for general information purposes and are not strictly required as part of the scope of the Blast Impact Analysis as required under the ARA to ensure compliance with MECP NPC-119 guidelines. The hydrogeological study prepared by EarthFX and Azimuth Environmental Consulting as part of the licence application will address residential water wells in detail. Flyrock control is addressed at the operational level given significant influences related to blast design, geology and field accuracy which render concrete recommendations related to control inappropriate at the licencing phase.

SUN CANADIAN HIGH PRESSURE OIL PIPELINE

A Sun Canadian High Pressure Oil Pipeline runs parallel to Colling Road adjacent to Phase 5 of the of the proposed West expansion quarry limits (refer to Appendix A). The MECP guideline for blast-induced vibration (12.5mm/s) does not apply to pipelines as they are not classified as sensitive receptors. Sun Canadian Policy employs a 50mm/s vibration limit for welded steel pipelines. For the Phase 5 area in the West Extension lands it is recommended that the initial blasting take place in the South corner of the common boundary between the extension lands of Phase 5 and the existing quarry. Initial blasting operations will take place approximately 370m from the subject pipeline if they are initiated at the South corner, however, will reach as close as 12.8m throughout the course of the Phase 5 extraction.

Applying the equation from Predicated Vibration Limits at the Nearest Sensitive Receptor, for a distance of 370m (the conservative standoff distance to the pipeline for the initial blasting in **Phase 5**) and a maximum explosives load per delay of 177kg (20m deep, 102mm blast hole, 2.5m collar, single hole per period), we can calculate the maximum PPV at the pipeline as follows for the initial blast:

$$ppv = 896\left(\frac{370}{\sqrt{177}}\right)^{-1.32} = 11.12 mm/s$$

The calculated 95% predicted PPV (based on the proposed blasting data discussed above) would be 11.12mm/s, well below the

Sun Canadian limit of 50mm/s for a steel welded pipeline located adjacent to the proposed quarry. While this initial value resides below the required threshold, it is anticipated that design modifications will be necessary to maintain compliance as the separation distance to the pipeline decreases and column loads increase. Fortunately, a variety of blast design alternatives are available to accomplish this including but not limited to reductions in blast hole diameter, change in explosives types, adjustment in bench heights and decking of holes.

We do note that the Sun Canadian Blasting Specification requires the presence of a vibration monitoring program conducted by an independent third party engineer when blasting operations are to be conducted within 60m of a pipeline. The proposed Operational Plan dictates that blasting is to encroach within approximately 12.8m of the ROW and as such, it remains a recommendation of this report that an independent third party firm be retained to conduct vibration monitoring on this pipeline when separation encroaches within 60m of the pipeline or when calculations suggest ground vibrations in excess of 35mm/s as measured at the pipeline are anticipated. The results of this monitoring program will determine what alterations shall be necessary as the separation distance to the subject pipeline decreases.

FLYROCK

Flyrock is the term used to define rocks which are propelled from the blast area by the force of the explosion. This action is a predictable and necessary component of a blast and requires that every blast have an exclusion zone established within which no persons or property which may be harmed are permitted.

Government regulations strictly prohibit the ejection of flyrock off of a quarry property. The regulations regarding flyrock are enforced by the Ministries of Natural Resources and Forestry, Environment, Conservation and Parks and Labour. In the event of an incident where flyrock does leave a site, the punitive measures include suspension / revocation of licences and fines to both the blaster and quarry owner / operator. Fortunately, flyrock incidents are extremely rare due to the possible serious consequences of such an event. It is in the best interest of all, stakeholders and non-stakeholders, to ensure that dangerous flyrock does not occur. Through proper blast planning and design, it is possible to control and mitigate the possibility for flyrock.

THEORETICAL HORIZONTAL FLYROCK CALCULATIONS

Flyrock occurs when explosives in a hole are poorly confined by the stemming or rock mass and the high pressure gas breaks out of confinement and launches rock fragments into the air. The three primary sources of fly rock are as follows:

- **Face burst:** Lack of confinement by the rock mass in front of the blast hole results in fly rock in front of the face.
- **Cratering:** Insufficient stemming height or weakened collar rock results in a crater being formed around the hole collar with rock projected in any direction.
- **Stemming Ejection:** Poor stemming practice can result in a high angle throw of the stemming material and loose rocks in the blasthole wall and collar.

The horizontal distance flyrock can be thrown (L_H) from a blast hole is determined using the expression:

$$L_H = \frac{V_o^{\,2} Sin2\theta_0}{g} \qquad [1]$$

where:

V_o = launch velocity (m/s)

θ_0 = launch angle (degrees)

g = gravitational constant (9.8 m/s^2)

The theoretical maximum horizontal distance fly rock will travel occurs when θ_0 = 45 degrees, thereby yielding the equation:

$$L_{H\max} = \frac{V_o^{\,2}}{g} \qquad [2]$$

The normal range of launch velocity for blasting is between 10m/s - 30m/s. To calculate the launch velocity of a blast the following formula is used:

$$V_o = k\left(\frac{\sqrt{m}}{B}\right)^{1.3} \qquad [3]$$

where:

k = a constant

m = charge mass per meter (kg/m)

B = burden (m)

By combining equations 2 and 3 and taking into account the different sources of fly rock, the following equations can be used to calculate the maximum fly rock thrown from a blast:

Face burst:

$$L_{H\max} = \frac{k^2}{g} * \left(\frac{\sqrt{m}}{B}\right)^{2.6}$$

Cratering: $$L_{H\max} = \frac{k^2}{g} * \left(\frac{\sqrt{m}}{SH} \right)^{2.6}$$

Stemming Ejection: $$L_{H\max} = \frac{k^2}{g} * \left(\frac{\sqrt{m}}{SH} \right)^{2.6} Sin2\theta$$

where:
θ = drill hole angle
L_{hmax} = maximum flyrock throw (m)
m = charge mass per meter (kg/m)
B = burden (m)
SH = stemming height (m)
g = gravitational constant
k = a constant

For flyrock calculation purposes, we have applied the current blasting parameters used in the Burlington Quarry which utilize 102mm (4") diameter holes on a 3.5m x 3.5m (11.5'x 11.5') pattern, with total depths of up to 24m (80') and a collar length of 2m (8').

The range for the constant k is 13.5 for soft rocks and 27 for hard rocks. Given the proposed licence area is predominantly dolostone, we have applied a k value of 20. The explosive density is assigned to be 1.2 g/cc for emulsion products and the drill hole angles are assumed to be 90 degrees (i.e. vertical).

The following does not apply to the sinking cut which will require highly specialized designs and additional considerations for flyrock. Based on a free face blast, maximum anticipated horizontal flyrock projection distances are calculated as follows in Table 4:

Table 4 – Maximum Flyrock Horizontal		
Collar **Lengths** (m)	**Maximum Throw Face Burst** (m)	**Maximum Throw Cratering and Stemming Ejection** (m)
1.5	30	274
2.0	30	129
2.5	30	72
3.0	30	45
3.5	30	30

Different collar lengths are displayed in the table above to account for over or under loaded holes. As demonstrated with these various collar lengths, any deviation, no matter how slight, can greatly affect these maximum values. Blast mats or sand can be placed on top of the shot to further reduce the distance for potential flyrock.

Through proper blast design and diligence in inspecting the geology before every blast, flyrock can readily be maintained within the quarry limits. It may be necessary to increase collars and adjust designs accordingly when blasting along the perimeter to accommodate the reduced distance to receptors and to ensure flyrock remains within the property limit.

BLAST IMPACT ON ADJACENT FISH HABITATS

The detonation of explosives in or near water can produce compressive shock waves which initiate damage to the internal organs of fish in close proximity, ultimately resulting in the death of the organism. Additionally, ground vibrations imparted on active spawning beds have the ability to adversely impact the incubating eggs and spawning activity. In an effort to alleviate adverse impacts on fish populations as a result of blasting, the Department of Fisheries and Oceans (DFO) developed the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (1998). This publication establishes limits for water overpressure and ground vibrations which are intended to mitigate impacts on aquatic organisms while providing sufficient flexibility for blasting to proceed. Specifically, water overpressures are to be limited to 100kPa and, in the presence of active spawning beds, ground vibrations at the bed are to be limited to 13mm/s.

Current information suggests the presence of three waterbodies that have been classified as potential fish habitats located in close proximity to the proposed license areas. Specifically, these waterbodies are the Unnamed Tributary of Willoughby Creek located North of the proposed West extension along Colling Road, the Unnamed Tributary of Lake Medad located Southeast of the West extension along No. 2 Side Road and the East and West Arms of the West Branch of the Mount Nemo Tributary of Grindstone Creek located to Northeast and Southwest of the South extension area.

The operational plan shows an approximate minimum extraction setback distance of 55m to the Unnamed Tributary of Willoughby Creek, 130m to the Unnamed Tributary of Lake Medad and 85m to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Based on these separation distances, it is anticipated that alterations to blast designs will be necessary when blasting in close proximity to the identified waterbodies to maintain compliance with DFO water overpressure guidelines of 100kPa. A review of available topographic maps identifies elevations in the extraction areas closest to the above noted waterbodies ranging from 271-281masl, which will require blasting hole depths of up to 20m in some areas to reach the design quarry floor. The utilization of shallower blast holes, decks, smaller hole diameters and/or

changes in blasting patterns may be necessary to maintain compliance with DFO Guidelines.

In the event that blast designs for any given blast are scheduled to exceed maximum loads per delay as specified in the DFO *"Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (1998)"* publication Table 1, we recommend that a hydrophone sensor be installed in the closest point of the waterbody to verify water overpressure levels, provided water depth is a minimum of 1m. The DFO Table 1 load restrictions are reproduced in part in Table 5 below for continuity.

Separation distance between possible fish bearing waterbody and closest borehole (meters)	Maximum recommended explosive load per delay (Kilograms)
150	887
125	616
100	394
90	319
80	252
70	193
60	142
50	98.7
40	63.1
30	35.5

Table 5: Maximum Loads per Delay to Maintain 100kPa at Various Separation Distances

Active spring spawning beds (March 15 – July 15) are assumed to be present in all three (3) waterbodies listed above. During the spawning season, these waterbodies are subject to a vibration limit of 13mm/s recorded at the shoreline of the closest spawning location to the blast. Vibration monitoring will be required in order to confirm compliance with DFO limits for ground vibration.

Table 6 below is provided as initial guidance demonstrating maximum permissible loads per delay based on various separation distances from spawning beds. The following maximum loads per

delay are derived from the equation for ground vibrations listed earlier in this report and are based on a maximum vibration intensity of 13.0mm/s as experienced at the active spawning habitat:

Separation distance between possible spawning bed and closest borehole (meters)	Maximum recommended explosive load per delay (Kilograms)
500	410
450	332
400	262
350	200
300	147
250	102
200	65.5
150	36.8
100	16.4
75	9.2
50	4.1
30	1.5

Table 6: Maximum Loads per Delay to Maintain 13.0mm/s at Various Separation Distances

Should blasting operations take place outside of the active spawning window (March 15 – July 15), the above 13mm/s vibration limit would not apply.

It is a recommendation of this report that all blasts shall, as a minimum, be monitored for ground vibrations at the closest active spawning bed from March 15 – July 15 to ensure compliance with DFO guidelines when calculations suggest vibrations in excess of 75% of the DFO vibration limit may be reached at the location of a potential active spawning habitat.

RESIDENTIAL WATER WELLS

Possible impacts to the water quality and production capacity of groundwater supply wells is a common concern for residents near blasting operations. Complaints related to changes in water quality often include the appearance of turbidity, water discolouration and changes in water. Complaints regarding water production most often involve loss of quantity production, air in water and damage to well screens and casings. A review of research and common causes of these problems indicates that most of these concerns are not related to blasting and can be shown to be the direct impact of environmental factors and poor well construction and maintenance.

There is an intuitive belief that blasting operations have dramatic and disastrous impacts on residential water wells for large distances around such operations. Unfortunately, there is no scientific basis for such claims. Outside of the immediate radius of approximately 20-25 blasthole diameters from a loaded hole, there is no permanent ground displacement. As such, barring blasting activity within several meters of an existing well, the probability of damage to residential wells is essentially non-existent.

Despite the scientific support for the above conclusion, numerous studies have been performed to verify the validity of this statement. These studies have investigated the effects of blasting on varied well configurations and in varied geological mediums to ensure results could be readily extrapolated to all blasting operations. The conclusion of these studies has confirmed that with the exception of possible temporary increases in turbidity, blasting operations did not result in any permanent impact on wells outside of the immediate blast zone of the blast until vibrations levels reached exceedingly high intensities. Applying universally accepted threshold levels for ground vibrations eliminates the possibility for any long term adverse effects on wells in the vicinity of blasting operations.

In a study by Froedge (1983), blast vibration levels of up to 32.3mm/s were recorded at the bottom of a shallow well located at a distance of 60 meters (200 feet) from an open pit blast. There was no report of visible damage to the well nor was there any change in the water pumping flow rate. This study concluded that the commonly accepted limit of 50mm/s PPV level is adequate to protect wells from any damage. We reiterate, the current guideline limit for vibrations from quarry and mining operations is 12.5mm/s.

REVIEW OF HISTORICAL BURLINGTON QUARRY DATA

A vibration and overpressure monitoring program has been in place for all blasts conducted at the Nelson Aggregate Burlington Quarry in recent years. As part of this analysis, Nelson Aggregates has provided copies of vibration data summaries collected for 2014 through 2019 inclusive. For continuity, summaries of the historical data collected and supplied by Nelson Aggregate are included in Appendix C to this report.

2014-2019 DATA

Vibration monitoring conducted during 2014 – 2019 has included the installation of seismographs at the following locations:

- 2479 No. 2 Side Road
- 2470 No. 2 Side Road
- 2450 No. 2 Side Road
- 2582 No. 2 Side Road
- Southwest Corner of the Quarry property along No. 2 Side Road (N 43.39339, W 79.88880)
- Colling Road and Blind Line Intersection (N 43.40605, W 79.89400)
- Northwest Corner of the Quarry Property along Colling Road
- Gas Line (N 43.40466, W 79.88098)

All vibration monitoring was performed by either the blasting contractor or the quarry owner. A review of the data supplied confirms that for 2014 through 2019 inclusive, two (2) blasts exceeded the MECP guideline limit of 12.5mm/s set for ground vibrations, while sixteen (16) blasts exceeded the MECP guideline limit of 128dB for overpressure. Table 7 below lists the blasts that exceeded these limits:

Table 7: Exceedances of NPC 119 Recorded During 2014-2019 Blasting Operations				
Date	***Time***	***Location***	***Limit Exceeded***	***Value of Exceedance***
August 25, 2014	13:52	*SW Corner	**>128dB(L)**	132.2dB(L)
September 16, 2014	12:12	*Colling Road and Blind Line Intersection	**>128dB(L)**	134.6dB(L)
October 2, 2014	13:40	*2479 # 2 Side Road	**>128dB(L)**	131.8dB(L)
October 22, 2014	12:02	*SW Corner	**>128dB(L)**	128.4dB(L)
November 11, 2014	12:00	*2479 # 2 Side Road	**>128dB(L)**	130.6dB(L)
November 24, 2014	12:08	*2479 # 2 Side Road	**>128dB(L)**	128.7dB(L)
December 2, 2014	11:57	*Colling Road and Blind Line Intersection	**>128dB(L)**	132.8 dB(L)
June 12, 2015	12:18	*SW Corner	**>128dB(L)**	133.0 dB(L)
June 17, 2015	12:03	*Colling Road and Blind Line Intersection	**>128dB(L)**	130.7 dB(L)
July 13, 2015	12:02	*Colling Road and Blind Line Intersection	**>128dB(L)**	129.2 dB(L)
July 30, 2015	12:00	*2479 # 2 Side Road	**>128dB(L)**	130.7 dB(L)
September 1, 2015	12:01	*2479 # 2 Side Road	**>128dB(L)**	130.5 dB(L)
October 21, 2015	12:03	*2479 # 2 Side Road	**>128dB(L)**	134.3 dB(L)
May 4 , 2016	12:00	SW Corner	**>12.5mm/s**	12.8 mm/s
May 9 , 2016	12:00	Colling Road	**>128dB(L)**	129.5 dB(L)
July 5, 2016	12:00	Colling Road	**>128dB(L)**	128.3 dB(L)
August 30, 2016	12:00	Colling Road	**>128dB(L)**	128.8 dB(L)
April 11, 2017	11:56	SW Corner	**>12.5mm/s**	15.6 mm/s

* These locations are assumed but cannot be verified due to insufficient information being recorded during the 2014 and 2015 blasting campaigns.

Although the above table denotes exceedances of the MECP guidelines, given the heavy conservatism inherent to the guideline, the risk of damage associated with these vibrations and overpressures remain extremely low.

RECOMMENDATIONS

It is recommended that the following conditions be applied for all blasting operations at the proposed Nelson Aggregates – Burlington Quarry Extension areas:

1. All blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments – one installed in front of the blast and one installed behind the blast.

2. Vibration and overpressure data collected during the first 12 months of extraction in the proposed quarry extension lands will be used to calibrate and update the 2004 Golder Associates attenuation equation. The proponent shall ensure information collected includes all relevant blast and monitoring details to permit and facilitate inclusion of the data in the attenuation data and resultant equation.

3. In order to safeguard the structural integrity of the structures located at 2280 No 2 Side Road, ground vibrations shall be maintained below 50mm/s (>40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s.

4. All blasts within 60m of the adjacent Sun-Canadian High Pressure Oil Pipeline will be designed and monitored by a registered engineer, licensed in the province of Ontario or any distance specified in later revisions of the Sun-Canadian guidelines or when vibration calculations suggest vibrations in excess of 35mm/s at the pipeline.

5. To protect adjacent fish habitat, the Department of Fisheries and Oceans (DFO) has established limits for water overpressure and ground vibrations. Water overpressures are to be limited to 100kPa (year round), and in the presence of active spawning beds (March 15 – July 15), ground vibrations at the bed are to be limited to 13mm/s. Fish habitat and assumed spawning beds are present in the Unnamed Tributary of Willoughby Creek, the Unnamed Tributary of Lake Medad and the East and West Arms of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The utilization of shallower blast holes, decks, smaller hole diameters and/or changes in blasting

patterns may be necessary when blasting adjacent to fish habitat at any time of year. These mitigation measures would also apply, when adjacent to spawning beds from March 15 – July 15.

6. From March 15 – July 15 of any year, blasts shall be designed to maintain vibrations below 13mm/s at the closest point of any spawning habitat to the blast. One (1) additional seismograph shall be installed on the shoreline adjacent the closest spawning habitat to any blast performed between March 15 and July 15 when calculations suggest vibrations in excess of 75% of the DFO vibration limit may be reached at the location of a potential active spawning habitat.

7. All blasting operations encroaching the Sun Canadian High Pressure Oil Pipeline will follow all requirements in the Sun Canadian Guidelines outlined in Section 8.3 to 8.5 under the heading “Vibration and Blasting Control” and any requirements specified in later revisions of the Sun Canadian guidelines.

8. The guideline limits for vibration and overpressure shall adhere to standards as outlined in the MECP Model Municipal Noise Control By-law publication NPC 119 (1978) or any such document, regulation or guideline which supersedes this standard.

9. In the event of an exceedance of NPC 119 limits or any such document, regulation or guideline which supersedes this standard, blast designs and protocol shall be reviewed prior to any subsequent blasts and revised accordingly in order to return the operations to compliant levels.

10. Orientation of the aggregate extraction operation will be designed and maintained so that the direction of the overpressure propagation will be away from structures as much as possible.

11. Blast designs shall be continually reviewed with respect to fragmentation, ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with current applicable guidelines and regulations.

12. Blasting procedures such as drilling and loading shall be reviewed on a yearly basis and modified as required to ensure compliance with industry standards.

13. Detailed blast records shall be maintained in accordance with current industry best practices

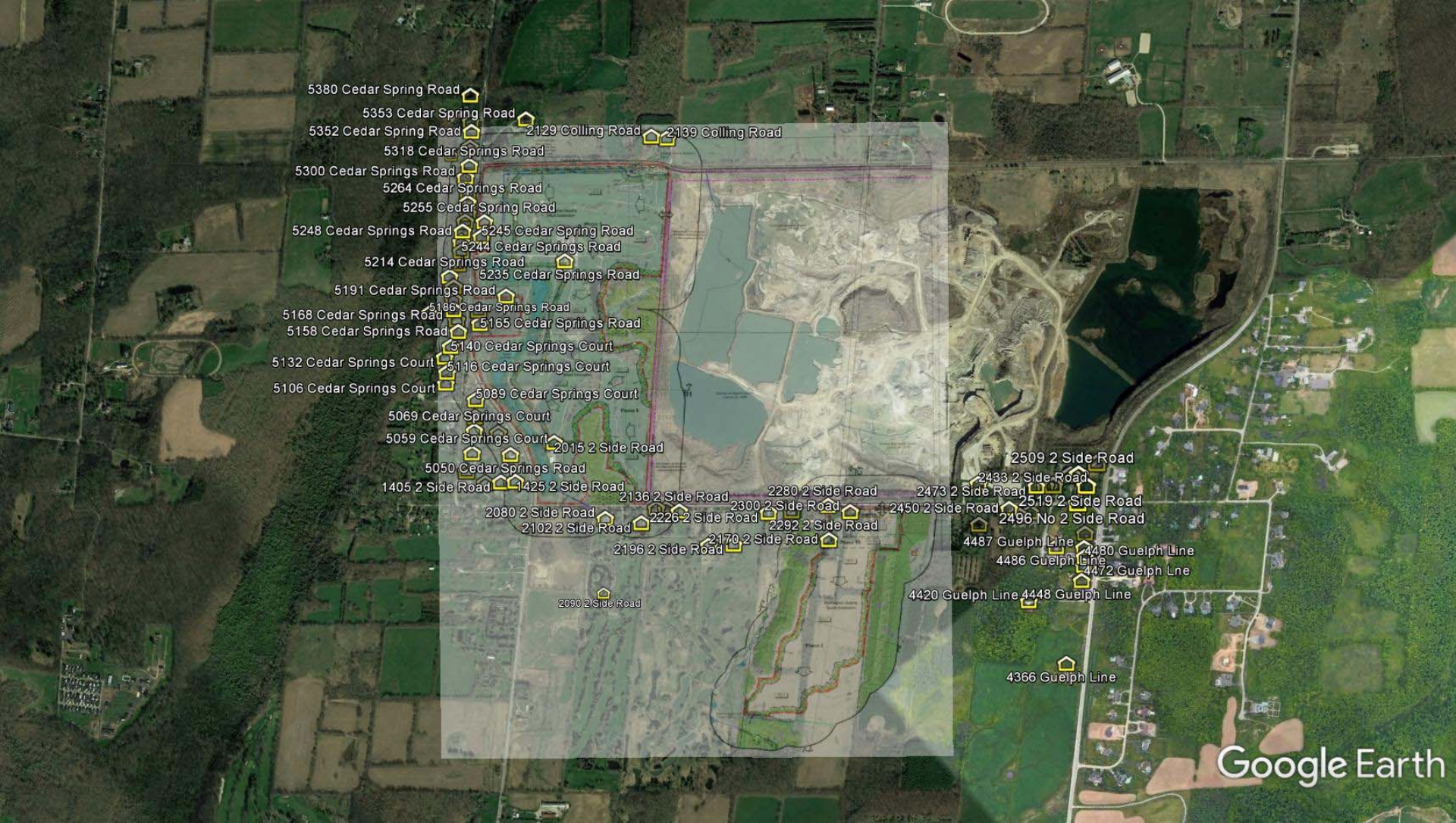
The blast parameters described within this report are supported by the modeling in the attached appendices. As the quarry progresses and as site-specific data is collected from the on-going operation, the blast parameters can be refined, as necessary, to ensure continual compliance with MECP Guidelines.

CONCLUSION

Blasting operations required for mineral extraction at the proposed Nelson Aggregates – Burlington Quarry Extension lands can be carried out safely and within governing guidelines set by the Ministry of the Environment, Conservation and Parks.

Modern blasting techniques will permit blasting to take place with explosives charges below allowable charge weights ensuring that blast vibrations and overpressure will remain minimal at the nearest receptors.

Appendix A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4487 Guelph Line
4480 Guelph Line
4486 Guelph Line
4472 Guelph Line
4420 Guelph Line
4448 Guelph Line
4366 Guelph Line
Google Earth


Phase 3
2015 2 Side Road
Existing Burlington Quarry Licence No. 5499
Area subject to separate Site Plan Amendment to reduce setback below
Bottom Drain Outlet
5030 Guelph Line
2495 2 Side Road
2433 2 Side Road
2509 2 Side Road
2473 2 Side Road
2519 2 Side Road
2280 2 Side Road
2126 2 Side Road
2136 2 Side Road
2300 2 Side Road
2450 2 Side Road
2470 2 Side Road
2496 No 2 Side Road
2080 2 Side Road
2226 2 Side Road
2244 2 Side Road
Phase 1A
2462 2 Side Road
2102 2 Side Road
2416 2 Side Road
2292 2 Side Road
Phase 1B
4496 Guelph Line
2170 2 Side Road
4487 Guelph Line
2196 2 Side Road
4486 Guelph Line
4480 Guelph Line
4472 Guelph Lne
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Burlington Quarry South Extension
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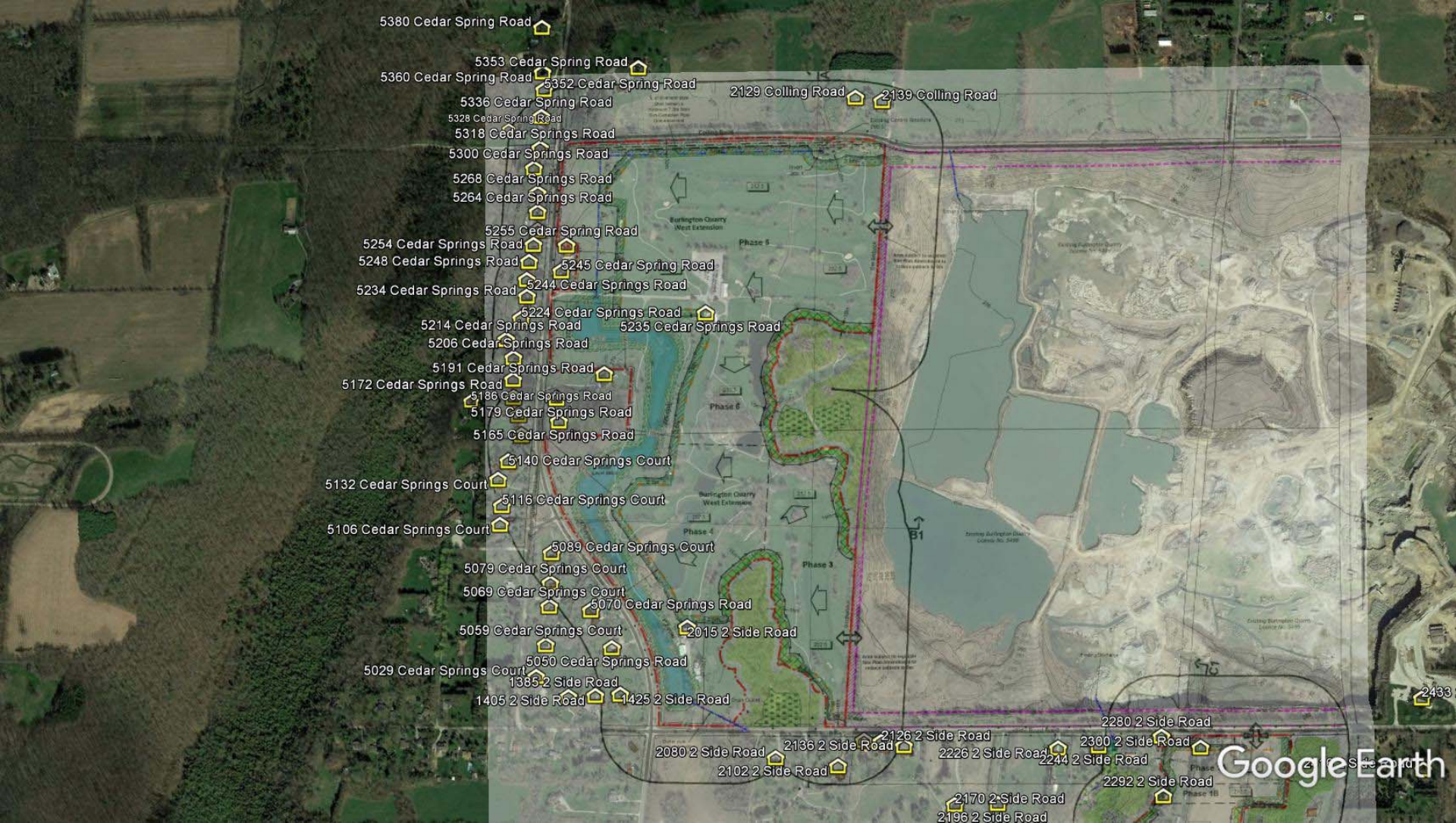
Phase 2
4366 Guelph Line
Overflow Outlet invert 274.0
Google Earth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Burlington Quarry West Extension
Phase 5
Phase 6
Phase 4
Phase 3
B1
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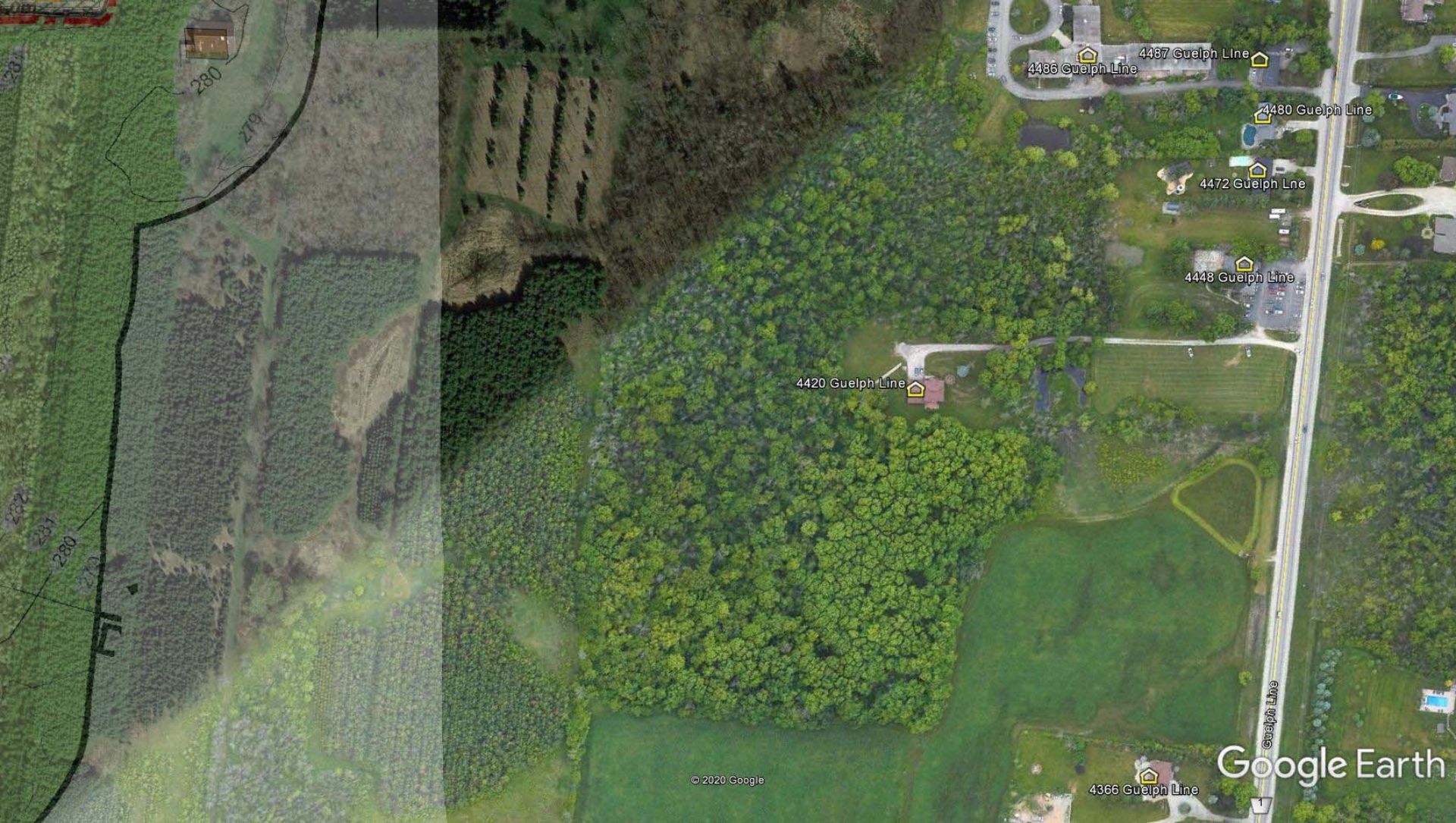
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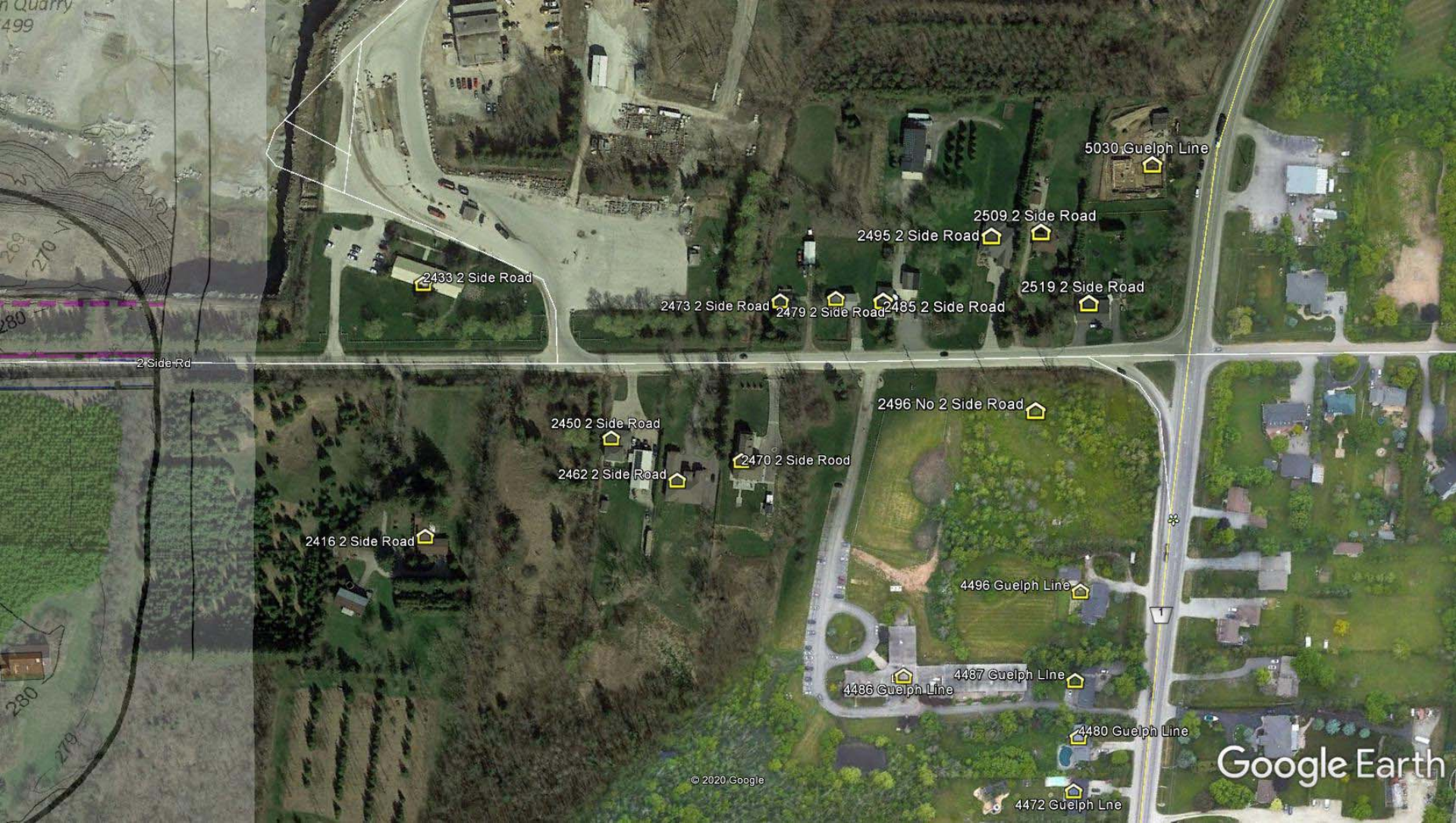
© 2020 Google
Google Earth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2470 2 Side Rood
2462 2 Side Road
2416 2 Side Road
4496 Guelph Line
4487 Guelph Line
4486 Guelph Line
4480 Guelph Line
4472 Guelph Lne
© 2020 Google
Google Earth


15m
0m Setback
252.5
Area subject to separate Site Plan Amendment to reduce setback to 0m
30m
Existing Burlington Quarry Licence No. 5499
Existing Discharge
C1
2116 2 Side Road
2126 2 Side Road
2136 2 Side Road
2102 2 Side Road
2226 2 Side Road
2244 2 Side Road
2280 2 Side Road
2300 2 Side Road
Phase 1A
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Phase 1B
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2292 2 Side Road
2170 2 Side Road
2196 2 Side Road
252.5
© 2020 Google
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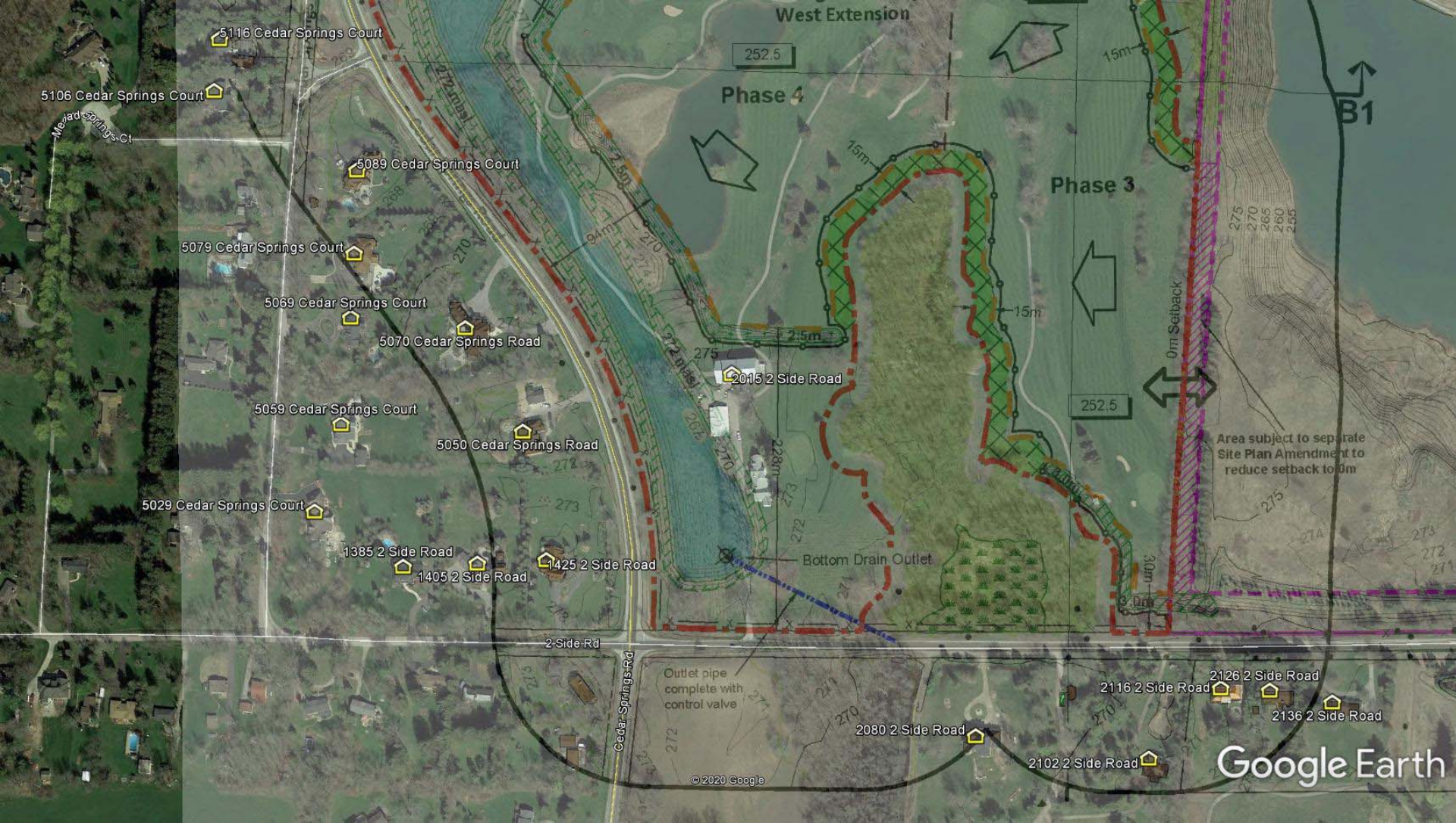
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Phase 4
Phase 3
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15m
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Meadow Springs Ct
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5069 Cedar Springs Court
5070 Cedar Springs Road
5059 Cedar Springs Court
5050 Cedar Springs Road
5029 Cedar Springs Court
1385 2 Side Road
1405 2 Side Road
1425 2 Side Road
2015 2 Side Road
2.5m
272 mtsl
94m
0m Setback
Area subject to separate Site Plan Amendment to reduce setback to 0m
Bottom Drain Outlet
2-Side-Rd
Cedar Springs Rd
Outlet pipe complete with control valve
2126 2 Side Road
2116 2 Side Road
2136 2 Side Road
2080 2 Side Road
2102 2 Side Road
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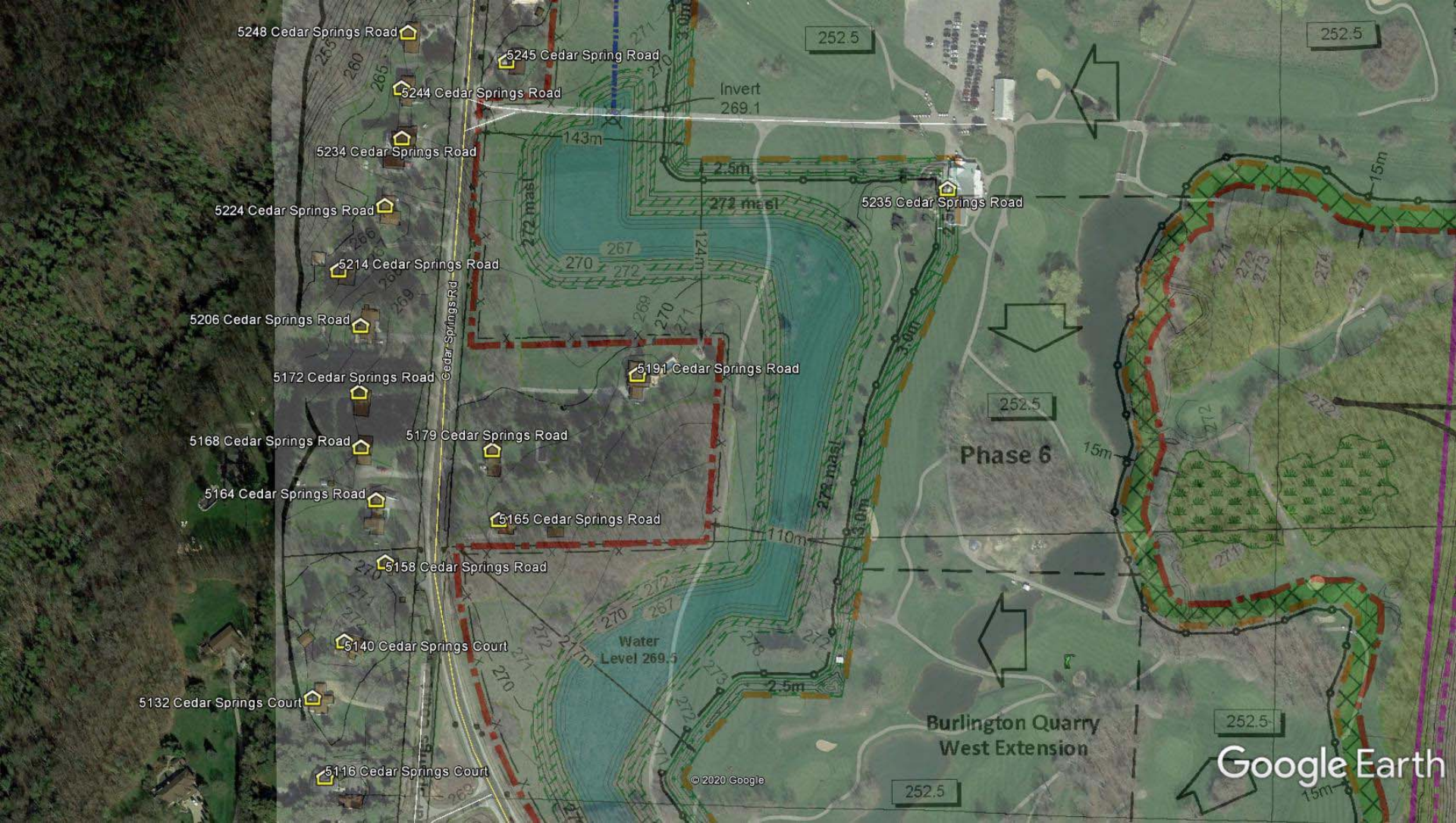
5248 Cedar Springs Road
5245 Cedar Spring Road
5244 Cedar Springs Road
5234 Cedar Springs Road
5224 Cedar Springs Road
5214 Cedar Springs Road
5206 Cedar Springs Road
5172 Cedar Springs Road
5168 Cedar Springs Road
5164 Cedar Springs Road
5158 Cedar Springs Road
5140 Cedar Springs Court
5132 Cedar Springs Court
5116 Cedar Springs Court
5235 Cedar Springs Road
5191 Cedar Springs Road
5179 Cedar Springs Road
5165 Cedar Springs Road
Cedar Springs Rd
Invert
269.1
143m
272 masl
124m
110m
217m
Water
Level 269.5
Phase 6
Burlington Quarry
West Extension
252.5
15m
2.5m
3.0m
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5380 Cedar Spring Road
5353 Cedar Spring Road
5360 Cedar Spring Road
5352 Cedar Spring Road
℄ of diversion pipe shall remain a minimum 7.0m from Sun-Canadian Pipe Line easement
2129 Colling Road
2139 Colling Ro
Existing Control S
269.5
5336 Cedar Spring Road
Colling Road
Colling-Rd
5318 Cedar Springs Road
3.0m
30m
3.5m
Invert
269.1
5300 Cedar Springs Road
252.5
5268 Cedar Springs Road
98m
5264 Cedar Springs Road
Diversion Pipe
Burlington Quarry
West Extension
5258 Cedar Springs Road
Phase 5
5254 Cedar Springs Road
5255 Cedar Spring Road
96m
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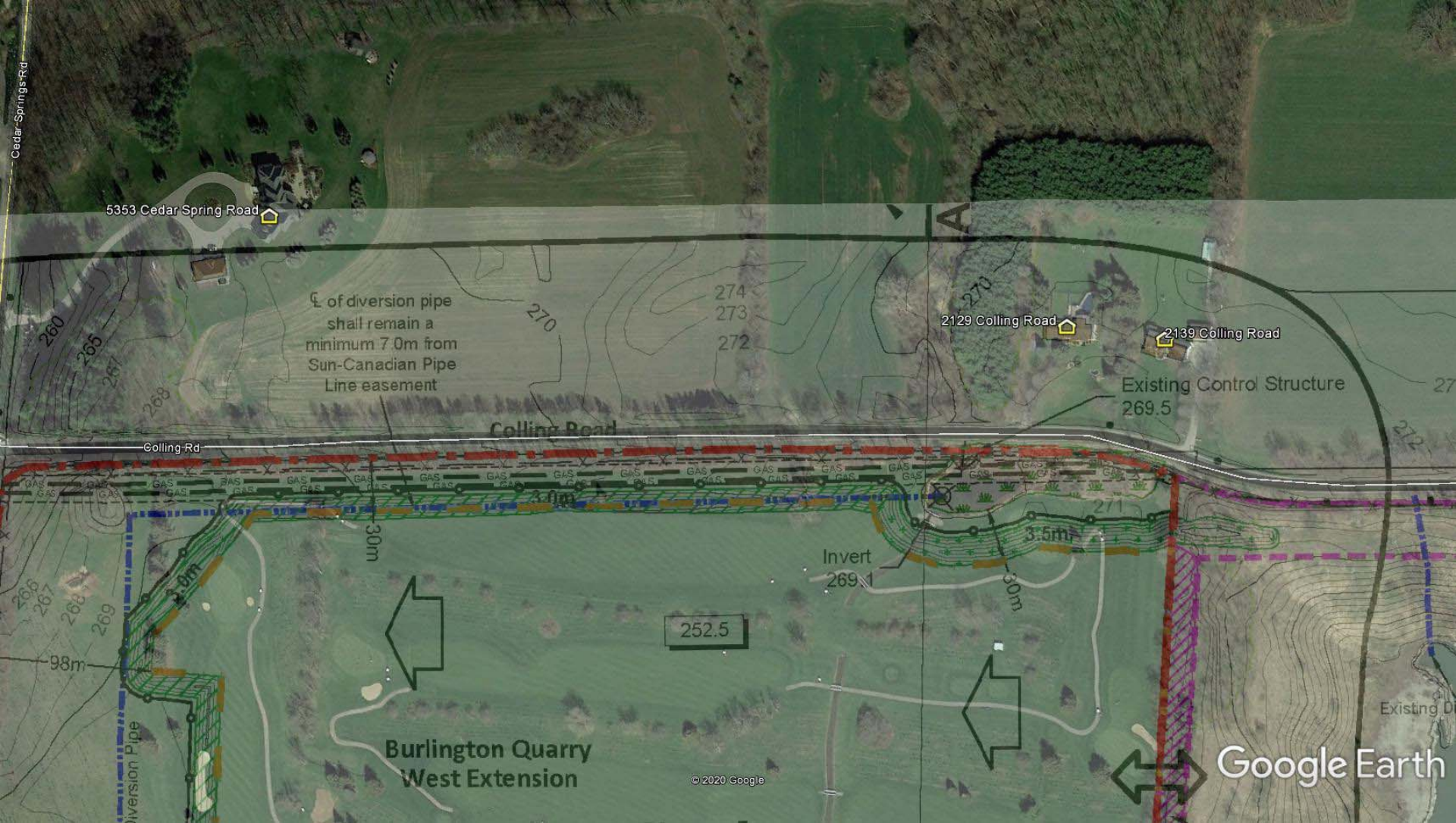
Cedar Springs Rd
5353 Cedar Spring Road
℄ of diversion pipe shall remain a minimum 7.0m from Sun-Canadian Pipe Line easement
2129 Colling Road
2139 Colling Road
Existing Control Structure
269.5
Colling Road
Colling Rd
3.0m
30m
3.5m
Invert
269.1
252.5
98m
Burlington Quarry West Extension
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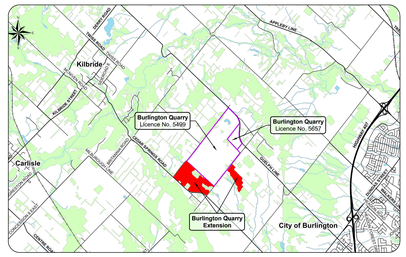
Seismograph Location Overview
Seismograph Location for Blasting Operations (2014-2019)
Colling Road and Blind Line
Gas Line
Southwest Corner of Quarry Property
2479 No 2 Side Road
2450 No 2 Side Road
2470 No 2 Side Road
2582 No 2 Side Road
Google Earth

Key Map
(N.T.S.)



A. General

1. This site plan is prepared under the Aggregate Resources Act (ARA) for a Class 'A' Licence, Category 2.
2. Area Calculations:
   i. Licence Area (total) **78.4 ha**
   - South Extension 18.3 ha
   - West Extension 60.1 ha

B. References

1. Contours were obtained from the City of Burlington's Open Data Catalogue based on 2017 data and are displayed in one metre intervals. Elevations shown are in metres above sea level (masl).
2. Topographic information was obtained from numerous sources including Ontario GeoHub (Land Information Ontario), City of Burlington's Open Data Catalogue, Google Earth Pro aerial photography captured on May 7, 2018 and field investigations for technical reports.
3. All topographic features and structures are shown to scale in Universal Transverse Mercator (UTM) with North American Datum 1983 (NAD83), Zone 17 (metre), Central Meridian 81 degrees west coordinate system.
4. The licence boundaries were established using Municipal Property Assessment Corporation (MPAC) parcel fabric data. Distances are approximate and for reference purposes only.
5. Land use designations on and within 120 metres of the licences are from the Niagara Escarpment Plan, Map 3 - Regional Municipality of Halton, approved June 1, 2017. The Burlington Quarry Extension lands are designated Escarpment Rural Area.
6. Land use information and structures identified on or within 120 metres of the licence boundaries were determined using Google Earth Pro aerial photography captured on May 7, 2018.

C. Drainage

1. Surface drainage on and within 120 metres of the licence boundaries are by overland flow in the directions shown by arrows on the plan view, or by infiltration.

D. Groundwater

1. The established groundwater table varies between 264 masl to 273 masl in the South Extension and 263 masl to 265 masl in the West Extension (EarthFX 2020).

E. Site Access and Fencing

1. There are four existing site accesses on Side Road No. 2 and a single existing site access on Cedar Springs Road.
2. Post and wire fencing (unless noted otherwise) exists in the locations shown on the plan view.

F. Aggregate Related Site Features

1. There are no existing aggregate operations or features on either Extension such as internal haul roads, processing, stockpiles, scrap, fuel storage, berms or excavation faces.

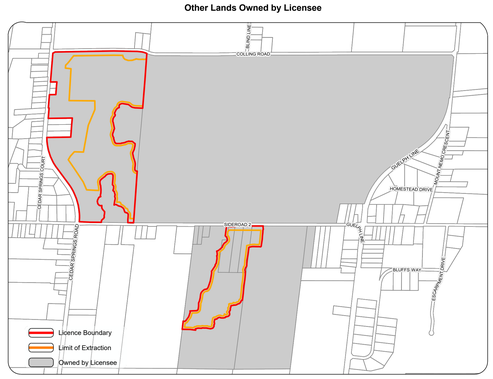
G. Cross Sections

1. See drawing 4 of 4.

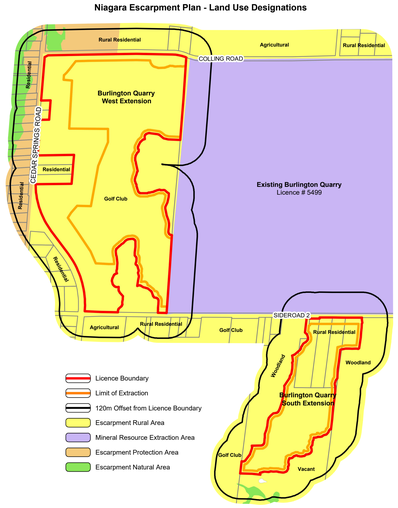
H. Technical Reports - References

1. Adaptive Management Plan, Proposed Burlington Quarry Extension, EarthFX Inc., Savanta, and Tatham Engineering, April 2020.
2. Agricultural Impact Assessment, Nelson Aggregate Co. Burlington Quarry Expansion, April 2020.
3. Air Quality Study for Nelson Aggregate Co., Burlington Quarry Extension, BCX Environmental Consulting, March 2020.
4. Archaeological Assessment (Stages 1, 2 & 3), Nelson Aggregates Quarry Expansion, Archaeologix Inc., August 2003.
5. Archaeological Assessment (Stage 4), Nelson Aggregates Quarry Expansion, Archaeologix Inc., August 2004.
6. Stage 1-2 Archaeological Assessment, Proposed West Extension of the Burlington Quarry, Golder Associates, September 2020.
7. Blast Impact Analysis, Burlington Quarry Extension, Explotech Engineering Ltd, April 23, 2020.
8. Cultural Heritage Impact Assessment Report, Burlington Quarry Extension, MacNaughton Hermsen Britton Clarkson Planning Limited (MHBC), April 2020.
9. Financial Impact Study, Proposed Burlington Quarry Extension, Nelson Aggregates Co., April, 2020.
10. Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, Proposed Burlington Quarry Extension, EarthFX Incorporated, April 2020.
11. Level 1 and 2 Natural Environment Technical Report, Proposed Burlington Quarry Extension, Savanta, April 2020.
12. Noise Impact Assessment, Nelson Aggregate Quarry Extension, Howe Gastmeier Chapnik Limited, April 22, 2020.
13. Nelson Aggregate Company, Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.
14. Surface Water Assessment, Burlington Quarry Extension, Tatham Engineering, April 2020.
15. Visual Impact Assessment Report, Proposed Extension of the Burlington Quarry, MacNaughton Hermsen Britton Clarkson Planning Limited (MHBC), April 2020.

Other Lands Owned by Licensee



Niagara Escarpment Plan - Land Use Designations



Legal Description

Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

Legend

- Licence Boundary
- Limit of Extraction
- Contours with Elevation (Metres above sea level (MASL))
- Public Road
- Fence (1.2m post & wire fence unless otherwise noted)
- Water Feature
- Irrigation Pond
- Significant Woodlands
- Woodlands
- Wooded Feature
- Wetland (Savanta)
- Wetland (MNRF - Provincially Significant)
- Wetland (MNRF - Unevaluated)
- 120m Offset From Licence Boundary
- Existing Licence (Existing Licenced Boundary (solid line) Existing Limit of Extraction (dashed line))
- Parcel Fabric
- Diversion or Discharge Pipe (Existing - Single Dash)
- Discharge Location
- Jefferson Salamander Regulatory Boundary
- Fish Habitat (Direct - solid Indirect - dash)
- Sun-Canadian Pipe Line (Pipe line location and easement)
- Entrance / Exit (Existing)
- Direction of Surface Drainage
- Building/Structure
- Cross Sections (A1)

Significant Wildlife Habitat

- Amphibian Breeding (Woodland)
- Bat Maternity Colony
- Rare Vegetation Community

Species of Conservation Concern

- Unicorn Clubtail
- Eastern Wood-pewee
- Large Toothwort Community

Species at Risk

- Butternut Category 1
- Butternut Category 2
- BP18 Bobolink
- BSNO C Barn Swallow Nest Observation
- Bat Habitat (Little Brown Myotis and Tri-coloured Bat)

Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licencing)

No.	Date	Description	By
1.	September 2020	Update date of Archaeological Assessment Report in Section H.	CAP
2.	April 2021	Included MNRF wetlands for South Extension. Added Significant Wildlife Habitat, Species of Conservation Concern and Species at Risk. Update legend.	CAP

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
113 COLLIER STREET, BARRIE, ON. L4M 1H2 | P: 705.728.0045 F: 705.728.2010 | WWW.MHBCPLAN.COM

MNRF Approval Stamp

MHBC Stamp

DRAFT

Applicant

NELSON AGGREGATE CO.
2433 No. 2 Sideroad
P.O.Box 1070 Burlington Ont. L7R 4L8
phone: (905) 335-5250

Project

Burlington Quarry Extension

MNRF Licence Reference No. 626477	**Pre-approval review:**
Plan Scale: 1:3000 (Arch E) 0 100 200 Meters	**Date** April 2021
	Drawn By C.P.
	Checked By B.Z.
	File No. 9135D

File Name

Existing Features

Drawing No.

1 of 4

File Path N:\Brian\9135D- Nelson - Project Sideways\Drawings\ARA Site Plans\Extension Site Plan\CAD\9135D - Site Plan - Blacklined - April 19 2021.dwg

A. General

1. Area Calculations:
   - i. Licence Area (total) **78.4 ha**
     - South Extension 18.3 ha
     - West Extension 60.1 ha
   - ii. Limit of Extraction (total) **50.2 ha**
     - South Extension 14.5 ha
     - West Extension 35.7 ha
2. The maximum annual tonnage is 2,000,000.
3. The existing golf course use in the West Extension may continue to operate until site preparation for that Extension commences.

B. Hours of Operation

1. Hours of operation are Monday to Friday from 7:00am to 7:00pm excluding statutory holidays.
2. Blasting is permitted Monday to Friday between 8:00am to 6:00pm excluding statutory holidays. Blasting will typically occur once per week but may occur more often based on operational needs.

C. Site Access and Fencing

1. Prior to extraction within the South or West Extension, post and wire fencing (at least 1.2 metres in height) shall be erected and maintained (for the life of that extension) along the licence or property boundary. Portions of the West Extension licence boundary shall be exempt from this requirement (see Section O. Variations from Provincial Standards). Where the licence boundary is not fenced, it will be delineated with marker posts every 30 metres.
2. A new operational entrance/exit for the South Extension shall be established in the location shown on the plan view (see Section N. Report Recommendations for additional details under Traffic). Material being transferred from the South Extension to existing Licence # 5499 (see Section O. Variations from Provincial Standards) shall occur through an at grade roadway crossing on Side Road No. 2 in this location.
3. A gate shall be installed at the operational entrance/exit of the South Extension on Side Road No. 2, kept closed during hours of non-operation, and maintained throughout the life of that Extension.
4. A gate shall not be required for the field/property access located at 2280 and 2015 Side Road No. 2 (see Section O. Variations from Provincial Standards).
5. The West Extension shall be accessed through the common licence boundary with existing Licence #5499 in Phases 3 and 5. The locations shown on the plan view are approximate only.

D. Drainage and Siltation Control

1. Drainage of undisturbed areas will continue in the directions shown on drawing 1 of 4.
2. Prior to site preparation, an Erosion and Sedimentation Control (ESC) Plan shall be prepared and implemented to minimize the potential for erosion and sedimentation from the operation of the quarry (see Section N. Report Recommendations - Natural Environment note "a").
3. Prior to extraction in the West Extension, the infiltration pond located in the west setback (including the diversion/discharge pipe and bottom draw outlet) shall be constructed. The pond shall be excavated to an elevation of ±267 masl into bedrock. For the portions of the pond located above bedrock, 3:1 slopes shall be established. The purpose of the diversion pipe is to convey water from the weir pond to the infiltration pond in the west setback and to provide the diffuse discharge in the northwest corner of the site.
4. Within the West Extension, the diversion and discharge pipes shall be placed in the locations shown on the plan view (see Section N. Report Recommendations -Natural Environment note "h" for timing to install the diversion pipe within the weir pond). The centreline of the diversion pipe along the north boundary of Phase 5 shall remain a minimum of 7.0 metres from the Sun-Canadian Pipe Line easement and be installed prior to constructing the berm in this vicinity.
5. Prior to removal of the irrigation ponds and irrigation channel in the West Extension, the downstream end of the golf course channel shall be blocked to isolate surface water. If water is to be pumped from the feature to facilitate site preparation, it shall be directed to the existing sump for discharge in accordance with MECP, ECA and PTTW requirements.

E. Site Preparation

1. All existing structures within the South Extension (excluding the house and barn located at 2280 Side Road No. 2) and West Extension (excluding the house and barn located at 2015 Side Road No. 2) shall be demolished prior to extraction in each Extension, in accordance with all applicable regulations (see Section N. Report Recommendations - Natural Environment note "o" regarding removal of three structures within the West Extension that contain Barn Swallow habitat).
2. No new buildings are proposed for either Extension.
3. Timber resources (if any) will be salvaged for use as saw logs, fence posts and fuel wood where appropriate. Stumps, trees, shrubs and brush cleared will be used for rehabilitation of this site and License #5499 to provide coarse and fine wood debris to enhance soils and create habitats during site rehabilitation.
4. Topsoil and overburden shall be stripped and stored separately wherever feasible (see Section O. Variations from Provincial Standards).
5. Topsoil and overburden shall be placed in perimeter acoustic/visual berms, pond construction or used immediately for progressive rehabilitation in either Extension or existing Licence #5499 (see Section O. Variations from Provincial Standards).
6. Excess topsoil and overburden not required for immediate use in berms or rehabilitation may be temporarily stockpiled on the quarry floor. Topsoil and overburden stockpiles shall be located within the limit of extraction and remain a minimum of 30 metres from the licence boundary (except where the West Extension licence boundary abuts existing Licence #5499) and 90 metres from a property with a residential use (see Section O. Variations from Provincial Standards).
7. Temporary topsoil and overburden stockpiles which remain for more than one year shall have their slopes vegetated to control erosion.

F. Berms and Screening

1. Acoustic and visual berms shall be constructed to the heights or elevations specified in the locations shown on the plan view. See Section N. Report Recommendations - Visual Impact Assessment notes and the Typical Acoustic & Visual Berm detail on this drawing for additional information.
2. Berm side slopes shall not exceed the following maximums:
   - i. South Extension
     - Northwest, north and northeast setback = 1.5:1
     - Southwest setback = 2:1
   - ii. West Extension
     - North and west setback = 2:1
     - Southeast setback = 1.5:1
3. Berms in the South Extension shall be constructed prior to extraction in that extension.
4. Berms in the West Extension shall be constructed prior to extraction in that extension.
5. The north toe of the perimeter berm in the West Extension shall not be located within 1 metre of the Sun-Canadian Pipe Line easement.
6. Berms shall be vegetated with a native mix of wildflowers and grasses to stabilize slopes and minimize mowing and maintenance. The vegetation on the berms shall be maintained until the berms are removed for rehabilitation.
7. Existing vegetation within the setbacks shall be maintained except where acoustic berms, visual berms, ponds or diversion/discharge pipes are required (see Section O. Variations from Provincial Standards). Setbacks disturbed will be vegetated with a native mix of wildflowers and grasses to restore areas and minimize mowing and maintenance. A portion of the setback areas, as shown on the operations schematic, will also be forested in accordance with Section N. Report Recommendations - Natural Environment note "k".
8. Setbacks identified as forested setbacks on the plan view shall be forested (see Section N. Report Recommendations - Natural Environment notes "d" and "f" for additional information).

G. Site Dewatering

1. During the initial stages of extraction within the South Extension, a temporary settling pond will be constructed within the extraction area (eg. Phase 2). Once sufficient extraction has occurred in Phase 2, the sump and settling pond will be constructed on the quarry floor. See Adaptive Management Plan for additional details.
2. The discharge location for the South Quarry Extension shall be constructed in accordance with Section N. Report Recommendations - Natural Environment note "e".
3. For the West Extension, the water will be diverted to existing Licence #5499 and discharged from the existing sumps and discharge locations.
4. The licensee shall operate in accordance with Environmental Compliance Approval (ECA) and Permit to Take Water (PTTW) requirements.

H. Extraction Sequence

1. Phase 1
   - a. Prepare Phase 1 (South Extension) for extraction and ensure all requirements pertaining to this Extension in Sections C through G of this drawing are met.
   - b. Strip Phase 1 and construct perimeter berms. Should there be insufficient topsoil and overburden in Phase 1 to construct berms, only the amount of material required to complete the perimeter berms and the temporary settling pond may be stripped from Phase 2.
   - c. Create sinking cut.
   - d. Commence extraction in a southerly direction and complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors.
   - e. Phase 1A may be extracted to a maximum depth of 271 masl.
   - f. Phase 1B may be extracted to a maximum depth of 270 masl.
   - g. Prepare Phase 2 for extraction.
2. Phase 2
   - a. Strip Phase 2 in sequence as extraction progresses in a southerly direction.
   - b. Extract Phase 2 in a southerly direction from Phase 1 and complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors.
   - c. Phase 2 may be extracted to a maximum depth of 252.5 masl.
   - d. As extraction advances, complete progressive rehabilitation of Phase 2.
   - e. Prepare Phase 3 (West Extension) for extraction and ensure all requirements pertaining to this Extension in Sections C through G and Archaeology note "a", under Section N. Report Recommendations, of this drawing are met.
   - f. Remove wooded features in Phase 3 (see Section N. Report Recommendations - Natural Environment note "m").
3. Phase 3
   - a. Strip Phase 3 and a portion of Phase 4 (if required) to construct perimeter berms in West Extension.
   - b. Extract Phase 3 by commencing at the common boundary with existing Licence #5499 and proceeding westerly before heading in a northwesterly direction. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors.
   - c. Phase 3 may be extracted to a maximum depth of 252.5 masl.
   - d. Complete progressive and final rehabilitation in Phases 1 and 2.
   - e. Prepare Phase 4 for extraction.
4. Phase 4
   - a. Strip Phase 4 and use the material for progressive rehabilitation in Phase 3 and existing Licence #5499.
   - b. Extract Phase 4 in a westerly and southwesterly direction from Phase 3. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors.
   - c. Phase 4 may be extracted to a maximum depth of 252.5 masl.
   - d. Prepare Phase 5 for extraction.
5. Phase 5
   - a. Strip Phase 5 and use the material for progressive rehabilitation in Phase 5 and existing Licence #5499.
   - b. Continue progressive rehabilitation in Phases 3 and 4.
   - c. Extract Phase 5 by commencing at the common boundary with existing Licence #5499 and proceeding in a westerly direction. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors.
   - d. Refer to Section N. Report Recommendations - Blasting for additional requirements regarding the Sun-Canadian Pipe Line easement.
   - e. Phase 5 may be extracted to a maximum depth of 252.5 masl.
   - f. Prepare Phase 6 for extraction.
   - g. Remove wooded feature in Phase 6 (see Section N. Report Recommendations - Natural Environment note "l").
6. Phase 6
   - a. Strip Phase 6 and use the material for progressive rehabilitation in Phases 4, 5 and existing Licence #5499.
   - b. Prior to extraction commencing in Phase 6, side sloping within Phase 3 shall be completed.
   - c. Extract Phase 6 in a southerly direction from Phase 5. At the commencement of extraction, complete a noise audit to ensure the site is meeting NPC 300 Noise Guidelines at the nearest sensitive receptors.
   - d. Phase 6 may be extracted to a maximum depth of 252.5 masl.
   - e. Complete progressive and final rehabilitation of the West Extension.

I. Extraction Details

1. The maximum height of a lift shall be 25 metres.
2. The maximum depth of extraction for the South Extension is 29.5 metres. Phase 1 shall be extracted in one lift and Phase 2 shall be extracted in a maximum of two lifts.
3. The maximum depth of extraction for the West Extension is 23.5 metres and the maximum number of lifts is two.
4. Extraction shall be permitted in two Phases simultaneously to allow for transition between Phases.
5. Internal haul road locations will vary as extraction progresses and will be located on the quarry floor with the exception of the at grade roadway crossing between the South Extension and existing Licence #5499.
6. Blasted aggregate will be transported back to existing Licence #5499 for processing and shipping.
7. Berms that encroach within the limit of extraction shall be removed, and the underlying aggregate may be extracted, as part of final extraction for each Extension.

J. Equipment and Processing

1. Equipment used for site preparation, extraction, pond construction, and site rehabilitation includes drills, front-end loaders, graders, bulldozers, backhoes, conveyors, water trucks, fuel trucks and haul trucks. See Section N. Report Recommendations for additional details on the equipment regarding equipment.
2. No processing shall occur in the South or West Extension. Aggregate extracted in the South and West Extension shall be hauled to existing Licence #5499 for processing.

K. Fuel Storage

1. No fuel shall be stored in the South or West Extension.
2. Fuel trucks will be used to transfer fuel to on-site equipment in accordance with the Liquid Fuels Handling Code.
3. A Spills Contingency Program will be developed prior to site preparation.

L. Dust

1. Dust shall be mitigated on-site.
2. Water or another provincially approved dust suppressant shall be applied to internal haul roads as often as required to mitigate dust.
3. The licensee shall implement all air quality recommendations outlined in Section N. Report Recommendations.

M. Scrap and Recycling

1. No scrap shall be stored in the South and West Extension.
2. No recycling shall occur in the South and West Extension.

N. Report Recommendations

1. Air Quality

a. The Licensee shall implement their Best Management Practices Plan (BMPP) for the Control of Fugitive Dust dated March 2020, as may be amended from time to time to reflect current best management practices.

b. The Licensee shall construct the acoustic berms as shown on the operational plan. See Section F for additional detail.

2. Blasting

a. All blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments - one installed in front of the blast and one installed behind the blast.

b. In order to safeguard the structural integrity of the structures located at 2280 No 2 Side Road, ground vibrations shall be maintained below 50mm/s (>40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s.

c. All blasts within 60m of the adjacent Sun-Canadian High Pressure Oil Pipeline will be designed and monitored by a registered engineer, licensed in the province of Ontario or any distance specified in later revisions of the Sun-Canadian guidelines or when vibration calculations suggest vibrations in excess of 35mm/s at the pipeline.

d. To protect adjacent fish habitat, the Department of Fisheries and Oceans (DFO) has established limits for water overpressure and ground vibrations. Water overpressures are to be limited to 100kPa (year round), and in the presence of active spawning beds (March 15 - July 15), ground vibrations at the bed are to be limited to 13mm/s. Fish habitat and assumed spawning beds are present in the Unnamed Tributary of Willoughby Creek, the Unnamed Tributary of Lake Medad and the East and West Arms of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The utilization of shallower blast holes, decks, smaller hole diameters and/or changes in blasting patterns, along with hydrophone sensor monitoring, are necessary when blasting adjacent to fish habitat at any time of year. These mitigation measures, in addition to vibration monitoring, would also apply, when adjacent to spawning beds from March 15 - July 15.

e. The guideline limits for vibration and overpressure shall adhere to standards as outlined in the MECP Model Municipal Noise Control By-law publication NPC 119 (1978) or any such document, regulation or guideline which supersedes this standard.

f. In the event of an exceedance of NPC 119 limits or any such document, regulation or guideline which supersedes this standard, blast designs and protocol shall be reviewed prior to any subsequent blasts and revised accordingly in order to return the operations to compliant levels.

g. Orientation of the aggregate extraction operation will be designed and maintained so that the direction of the overpressure propagation will be away from structures as much as possible.

h. Blast designs shall be continually reviewed with respect to fragmentation, ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with current applicable guidelines and regulations.

i. Blasting procedures such as drilling and loading shall be reviewed on a yearly basis and modified as required to ensure compliance with industry standards.

j. Detailed blast records shall be maintained in accordance with current industry best practices.

3. Noise

a. Site preparation, pond construction, rehabilitation, drilling, extraction activities, and transporting material to the existing quarry for processing and shipping may only occur Monday to Friday during daytime hours (7:00 - 19:00).

b. Prior to extraction in the South Extension, all berms in this Extension shall be constructed to the heights specified in the locations shown on the plan view. Berms shall not be required in the West Extension until prior to extraction in that Extension.

c. Prior to extraction in the West Extension, all berms in this Extension shall be constructed to the heights specified in the locations shown on the plan view.

d. Equipment used on-site shall operate within the sound power levels specified below:

- drills - 110 dBA
- front-end loaders - 101 dBA
- haul trucks - 114 dBA

e. Up to three haul trucks will be used to transport material from this site to the processing area in License #5499, with a posted speed limit of 35 km/hr along this route.

f. Equipment used for site preparation, pond construction and rehabilitation shall satisfy the noise emission levels of MOE - 115, "Noise Construction Equipment".

4. Visual Impact Assessment

a. For both Extension areas, existing vegetation located along the site perimeter and within the setback area will be retained where possible. Berms will be laid out in a way that favours the retention of existing vegetation where possible.

b. Visual and acoustic berms are to be installed in the location shown on the plan view and berm elevation details (on drawing 4 of 4) and to the requirements outlined below.

c. Where berms are deemed to be required, they are to only be constructed where shown on the plan view. Berms are to be constructed in a smooth, rolling manner with varying highpoints (respecting minimum height requirements), and variations along the berm frontage to create a more natural appearance. Berms should be seeded with a native mix of wildflowers and grasses to stabilize slopes and minimize mowing and maintenance.

d. The existing deciduous trees and shrubs located within 15 metres of No. 2 Side Road and in front of the proposed southern noise berm in the West Extension are to be retained.

e. Visual berms proposed for the South Extension are to be planted with trees (see plan view for berm locations). Trees will be planted at a spacing of 5 to 10 m on centre, depending on species. Plantings are to be randomly spaced and staggered up on the berm up to one third of its maximum height to appear more natural, where possible. All vegetation is to be selected for wind and salt tolerance hardiness. Native species that complement the existing surroundings are to be utilized wherever possible.

f. For the visual berm adjacent to Side Road No. 2, deciduous trees of minimum 40mm caliper, coniferous trees of minimum 1.2m height, and shrub species of minimum 40cm height shall be planted.

g. For the visual berm in the southwest corner of the South Extension, deciduous tree whips of minimum 1.2m height, coniferous trees of minimum 0.6m height, and shrub species of minimum 20cm height (or bare root stock when in season) shall be planted.

h. Plant species for the visual berm planting referenced in note 4e, f, and g may include, but are not limited to the following trees (White Pine, Common Hackberry, Chokecherry, White Spruce, Paper Birch, Pin Oak Sugar / Silver Maple, Trembling Aspen, Basswood, White Pine, White Spruce or White Cedar) and shrubs (Nannyberry, Common Ninebark, American Elder, Dogwood, or Highbush Cranberry).

i. To ensure survival and positive growth rate, the vegetative screening is to be maintained and managed appropriately so that it remains an effective visual screen over time. Allowance of natural succession to occur is encouraged, in keeping with restoration objectives.

j. During the first year of quarry operations, the planted trees will be watered and monitored until established. After the first year, the trees will be inspected twice each year. Once in spring after leaf break, and once in fall prior to leaf drop, to ensure any trees which are in poor condition at the time, are fertilized, watered and monitored, as needed, to improve their health and vigor.

k. If any of the planted trees die, they will be replaced yearly, and will be planted in spring or late summer. With annual maintenance and monitoring, the trees will have the best chance of survival, and overall, it is anticipated that the need for tree replacements during the life of the operation will be reduced.

5. Traffic

a. The northbound and southbound approaches to Side Road No. 2 shall be controlled by stop sign control.

b. The new roadway crossing will be located on the crest on Side Road No. 2 (in the location shown on the plan view) with a clear sight distance of at least 215 metres in each direction along Side Road No. 2 for both the northbound and southbound approaches.

c. The roadway geometry and road bed structure will be designed to accommodate the rock trucks that the licensee plans to operate.

d. Prior to extraction commencing in the South Extension, the licensee will be responsible to upgrade the crossing on Side Road No. 2 to municipal standards. During operations in the South Extension, the licensee will be responsible for maintaining this crossing. The licensee is responsible for all costs associated with the crossing, including any signage at the crossing. (Financial Report)

6. Water Resources and Natural Environment

a. The licensee is required to operate in accordance with the Adaptive Management Plan, prepared by EarthFX Inc., Tatham Engineering and Savanta dated April 2020, as may be amended from time to time with approval from MNRF, in consultation with NEC, Region of Halton, City of Burlington and Conservation Halton.

7. Water Resources

a. Based on current approvals for the existing quarry, the water discharge pumping at both locations will cease once extraction is complete, which would have a negative impact on flow and associated fish habitat in both watercourses (Savanta, 2020). The proposed revised rehabilitation plan would stipulate that dewatering and pumping will continue at the same locations and in the same manner to ensure there are no negative impacts to any of the hydrological features that rely on this water input. This will result in long-term enhancements to downstream fish habitat compared to the existing approved post-extraction water management plan.

b. Post rehabilitation, the West Extension is to be maintained in a dewatered state using the main discharge points to the north and south from Quarry Sump 0100 and 0200 in licence #5499 in accordance with the conditions of the PTTW and ECA to provide public water management benefits.

c. Prior to extraction commencing in each of the South and West Extensions, the licensee shall complete a residential well survey for properties within one kilometre of the extraction area.

d. If a water well complaint is received by the licensee the following actions will be taken:

d.a. The licensee will notify MNRF and MECP of the complaint.

d.b. The licensee will contact a well contractor in the event of a well malfunction and residents will be provided a temporary water supply within 24 hours, if the issue cannot be easily determined and rectified.

d.c. The well contractor will contact the resident with the supply issue and rectify the problem as expediently as possible, provided the landowner gives authorization for the work. If the issue raised by the landowner is related to loss of water supply, the licensee will have a consultant/contractor determine the likely causes of the loss of water supply, which can result from a number of factors, including pump failure (owner's expense), extended overuse of the well (owner's expense) or lowering of the water level in the well potentially caused by quarry interference (licensee expense). This assessment process would be carried out at the expense of the licensee and the results provided to the homeowner.

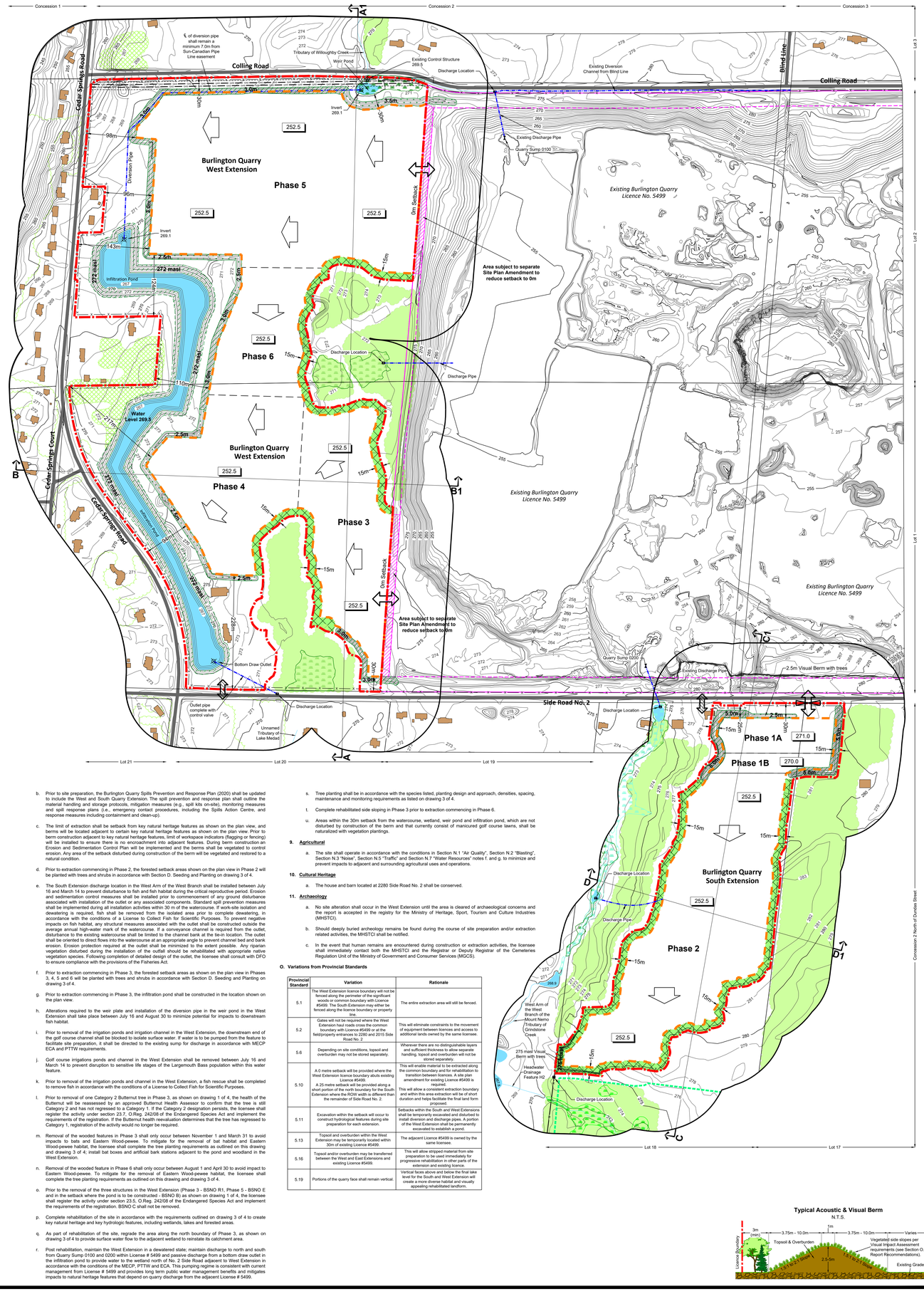
d.d. If it has been determined that the quarry caused the water supply interference, the quarry shall continue to supply water at the licensee's expense until the problem is rectified. The following mitigation measures shall be considered and the appropriate measure(s) implemented at the expense of the licensee:

- adjust pump pressure;
- lowering of the pump to take advantage of existing water storage within the well;
- deepening of the well to increase the available water column;
- widening of the well to increase the available storage of water;
- relocation of the well to another area on the property;
- drilling multiple wells; and
- only at the request of a landowner would a cistern be installed.

e. If the issue raised by the land owner is related to water quality, the licensee will have a consultant/contractor determine the likely causes of the change in water quality, and review monitoring results at the quarry and background monitoring results from the baseline well survey to determine if there is any potential correlation with the quarry. If it has been determined that the quarry caused a water quality issue, the quarry shall continue to supply water at the licensee's expense until the problem is rectified. The licensee shall be responsible for restoring the water supply by replacing the well or providing a water treatment system. Only at the request of a landowner would a cistern be supplied. The licensee is responsible for the expense to restore the water supply.

8. Natural Environment

a. Prior to site preparation an Erosion and Sedimentation Control (ESC) Plan will be prepared and implemented to minimize the potential for erosion and sedimentation from the operation of the quarry. Basic elements of the plan should include consideration of: Construction and operation phasing to minimize the amount of time soils are barren and therefore, more susceptible to erosion; Requirements and timing for rehabilitation of disturbed areas; Stormwater management strategies during construction; Grading and removal of golf course surface water features during periods when the features are not flowing, to minimize potential for adverse effects on downstream water quality; Erosion prevention measures (e.g., hydroseeding, sodding, erosion control matting, tarping of stockpiles); Sedimentation control measures (e.g., silt fences); and Inspection and performance monitoring requirements and adaptive management.

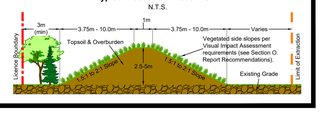


O. Variations from Provincial Standards

Provincial Standard	Variation	Rationale
5.1	The West Extension licence boundary will not be fenced along the perimeter of the significant woods or common boundary with Licence #5499. The South Extension may either be fenced along the licence boundary or property line.	The entire extraction area will still be fenced.
5.2	Gates will not be required where the West Extension haul roads cross the common boundary with Licence #5499 or at the field/property entrance to 2280 and 2015 Side Road No. 2	This will eliminate constraints to the movement of equipment between licences and access to additional land owned by the same licensee.
5.6	Depending on site conditions, topsoil and overburden may not be stored separately.	Wherever there are no distinguishable layers and sufficient thickness to allow separate handling, topsoil and overburden will not be stored separately.
5.10	A 0 metre setback will be provided where the West Extension licence boundary abuts existing Licence #5499. A 25 metre setback will be provided along a short portion of the north boundary for the South Extension where the ROW located at 2280 is different than the remainder of Side Road No. 2.	This will enable material to be extracted along the common boundary and for rehabilitation to transition between licences. A site plan amendment for existing Licence #5499 is required. This will allow a consistent extraction boundary and within this area extraction will be of short duration and helps facilitate the final land form proposed.
5.11	Excavation within the setback will occur to construct hydrological features during site preparation for each extension.	Setbacks within the South and West Extensions shall be temporarily excavated and disturbed to install diversion and discharge pipes. A portion of the West Extension shall be permanently excavated to establish a pond.
5.13	Topsoil and overburden within the West Extension may be temporarily located within 30m of existing Licence #5499.	The adjacent Licence #5499 is owned by the same licensee.
5.16	Topsoil and/or overburden may be transferred between the West and East Extensions and existing Licence #5499.	This will allow stripped material from site preparation to be used immediately for progressive rehabilitation in other parts of the extension and existing licence.
5.19	Portions of the quarry face shall remain vertical.	Vertical faces above and below the final lake level for the South and West Extension will create a more diverse habitat and visually appealing rehabilitated landform.

Typical Acoustic & Visual Berm

N.T.S.



- o. Tree planting shall be in accordance with the species listed, planting design and approach, densities, spacing, maintenance and monitoring requirements as listed on drawing 3 of 4.
- t. Complete rehabilitated side sloping in Phase 3 prior to extraction commencing in Phase 6.
- u. Areas within the 30m setback from the watercourse, wetland, weir pond and infiltration pond, which are not disturbed by construction of the berm and that currently consist of manicured golf course lawns, shall be naturalized with vegetation plantings.

9. Agricultural

a. The site shall operate in accordance with the conditions in Section N.1 "Air Quality", Section N.2 "Blasting", Section N.3 "Noise", Section N.5 "Traffic" and Section N.7 "Water Resources" notes f. and g. to minimize and prevent impacts to adjacent and surrounding agricultural uses and operations.

10. Cultural Heritage

a. The house and barn located at 2280 Side Road No. 2 shall be conserved.

11. Archaeology

a. No site alteration shall occur in the West Extension until the area is cleared of archaeological concerns and the report is accepted in the registry for the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI).

b. Should deeply buried archeology remains be found during the course of site preparation and/or extraction related activities, the MHSTCI shall be notified.

c. In the event that human remains are encountered during construction or extraction activities, the licensee shall immediately contact both the MHSTCI and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Government and Consumer Services (MGCS).

Legal Description

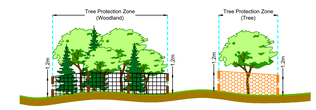
Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

Legend

- Licence Boundary
- Limit of Extraction
- Contours with Elevation (Metres above sea level (MASL))
- Public Road
- Fence (1.2m post & wire fence unless otherwise noted)
- Jefferson Salamander Regulatory Boundary
- Water Feature
- Significant Woodlands
- Woodlands
- Wooded Feature
- Wetland (Savanta)
- Wetland (MNRF - Provincially Significant)
- Wetland (MNRF - Unevaluated)
- Forested Setbacks
- 120m Offset From Licence Boundary
- Existing Licence (Existing Licenced Boundary (solid line) Existing Limit of Extraction (dashed line))
- Parcel Fabric
- Diversion or Discharge Pipe (Existing - Single Dash, Proposed - Double Dash)
- Discharge Location
- Sun-Canadian Pipe Line (Pipe line location and easement)
- Entrance / Exit (Operational - hollow, Field / Property - hatch)
- Gate
- General Direction of Excavation & Boundary
- Berm - Acoustic
- Berm - Hydrologic
- Berm - Visual
- Building/Structure
- Quarry Floor (Metres above sea level (MASL))
- Cross Sections

Tree Protection Plan Detail

Not to Scale



1. The Tree Protection Zone (TPZ) for woodlands extends the length of the woodland dripline of significant woodlands.
2. Prior to site preparation in each Phase, liner fencing shall be erected along the licence boundary. The area between the licence boundary and the drip line of the significant woodland is the TPZ. The TPZ is to prevent damage and soil compaction within the TPZ.
3. Fencing material shall consist of orange plastic web snow fencing and/or page wire fencing with reflective tape.
4. Fencing material shall be installed a minimum 1.2 metres in height above grade.
5. Signage shall be posted in visible locations along the perimeter of each TPZ fence and be a minimum 25 cm x 36 cm. Each sign shall clearly state the text provided to the right.
6. The TPZ must remain fully intact and shall not be used for temporary storage of fill, topsoil, building materials, equipment storage, washing of equipment, or dumping of any construction materials.
7. Where encroachment into the TPZ is necessary to facilitate construction of the discharge pipe, tree removal shall be kept to a minimum and the disturbed soil shall be restored with wood chips. In this location a trail will be maintained to provide access to the discharge location.

Legend

- Woodland / Tree Dripline
- Orange Plastic Web Snow Fencing
- Page Wire Fencing with Reflective Tape

Tree Protection Zone
No grade change, storage of materials, storage of equipment, washing of equipment, or dumping of any debris is permitted within this area.

Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licencing)

No.	Date	Description	By
1.	September 2020	Adjust pond adjacent to dwelling in the southwest corner of the West Extension.	CAP
2.	April 2021	Updated notes per MNRF feedback. Added discharge locations/pipe to plan view. Updated legend and added Tree Preservation Plan detail. Included MNRF wetlands for South Extension.	CAP

No.	Date	Description	By

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
113 COLLIER STREET, BARRIE, ON. L4M 1H2 | P: 705.728.0045 F: 705.728.2010 | WWW.MHBCPLAN.COM

MNRF Approval Stamp

MHBC Stamp

DRAFT

Applicant

NELSON AGGREGATE CO.
2433 No. 2 Sideroad
P.O.Box 1010 Burlington Ont. L7R 4L8
phone: (905) 335-5250

Project

Burlington Quarry Extension

MNRF Licence Reference No.
626477

Pre-approval review:

Plan Scale: 1:3000 (Arch E)

0 100 200 Meters

Date April 2021

Drawn By C.P. **File No.** 9135D

Checked By B.Z.

File Name

Operational Plan

Drawing No.

2 of 4

File Path N:\Brian\9135D- Nelson - Project Sideways\Drawings\ARA Site Plan\ExtExtension Site Plan\CAD\9135D - Site Plan - Blacklined - April 19 2021.dwg

Progressive Rehabilitation

A. General

1. Area Calculations:

   i. To be extracted (total) **50.2 ha**
   - South Extension 14.5 ha
   - West Extension 35.7 ha

   ii. To be rehabilitated (total) **50.2 ha**
   - South Extension 14.5 ha
   - West Extension 35.7 ha

B. Phasing

1. As excavation reaches the limit of extraction or maximum depth, progressive rehabilitation shall commence.
2. Progressive rehabilitation shall follow the direction and sequence of extraction identified on the plan view and described in the notes on drawing 2 of 4.
3. Prior to extraction commencing in Phase 6, side sloping within Phase 3 shall be completed.

C. Slopes and Grading

1. Progressive rehabilitation will utilize a variety of rehabilitation techniques including:

   i. Backfilling extraction faces and quarry floors;
   ii. Partially backfilling extraction faces to create a cliff with talus slope; or
   iii. Leaving extraction faces vertical

2. Excess soil, in accordance with MECP "Excess Soil Regulation (O. Reg 406/19), as may be amended from time to time, may be imported to facilitate the establishment of 3:1 and 2:1 (horizontal: vertical) slopes on the quary faces and/or applied to the quary floors to achieve the final contour elevations shown on the plan view. The licensee must ensure that the material is tested at the source, before it is deposited on-site, to ensure that the material meets the MECP's criteria under Table 1 of MECP's Soils, Ground Water and Sediment Standards for use under Part XV.1 of the *Environmental Protection Act*. Sampling results will be provided to the MNRF upon request.
3. Notwithstanding Condition 1, where the imported material is not being placed within 1.5 metres of the surface, the criteria under Table 1 for sodium absorption ratio and electrical conductivity do not have to be met.
4. The final rehabilitated landforms established in the South and/or West Extension using the rehabilitation techniques will consist of lakes, islands, shoreline wetlands, vernal pools, beach, pond, woodlands, gradually sloping grades, 2:1 and 3:1 side slopes, cliff with talus slopes, and vertical faces as shown on the plan view.
5. Beach sand may be imported to establish the beach area in the South Extension.
6. As part of rehabilitation of the site, regrade the area along the north boundary of Phase 3, as shown on this drawing to provide surface water flow to the adjacent wetland to reinstate its catchment area.

D. Seeding and Planting

1. The side slopes and backfilled portions of the quarry floor will be seeded with the Ministry of Transportation's (MTO) Ontario Roadside Seed Mix (Creeping Red Fescue, Kentucky Bluegrass, Perennial Ryegrass and White Clover) or equivalent.
2. Ponds, wetlands, and tree planting areas identified in the plan view shall be planted in accordance with Table 1: Rehabilitation Plant List Recommendations on this drawing.
3. The planting design and approach will be guided by the Conservation Halton Landscaping and Tree Preservation Guidelines (2010).
4. Planting densities shall be determined based on the restoration objectives and presence/absence of existing natural features. For example, planting densities will be highest where the objective is to restore/establish a woodland, and meet the definition of woodland under the Forestry Act, but may be reduced if/when objective is to establish a buffer adjacent to a naturalized area. The type of species planted will also be dependent on adjacent habitat (e.g., greater reliance on shrub plantings when restoration occurs adjacent to a meadow, and tree plantings when planting next to woodland).
5. Where the restoration objective is the establishment of a woodland, trees will be planted at a minimum density of 10 trees per 100 m², in order to account for competition, stress or wildlife damage and to meet the definition of woodland under the Forestry Act. Within this area, the shrub to tree ratio will be 5:1, with trees planted no closer than 2.5 m on centre and shrubs planted between 0.75 m and 1.5 m apart.
6. Where the restoration objective is the establishment of a setback adjacent to a natural feature, planting densities will be dependent on the features they abut (e.g., densities will be higher when planting next to an existing forest relative to the densities when planting next to an anthropogenic or cultural feature). The planting design of a proposed setback adjacent to a natural feature will follow a 3-band approach, where woody planting densities will be highest within Band 1 (closest to the existing adjacent feature) and reduced in Band 2. No woody species will be planted in Band 3, which will be seeded with a soil and moisture-appropriate native seed mix. Where trees will be planted, the following planting densities will be applied: Band 1 - five trees per 100 m². Where shrubs are also being proposed, these will be planted at a shrub to tree ratio of 5:1; Band 2 - three trees per 100 m². Where shrubs are also being proposed, these will be planted at a shrub to tree ratio of 5:1.
7. Competing herbaceous vegetation will be controlled by placing mulch around each planted tree or shrub (50 cm radius of mulch around each planting). Rodent protection will be installed as necessary. Where access permits, planting will be watered during periods of drought (defined as a 30 day period between May and September with less than 25mm of precipitation) until establishment has occurred.
8. For planting in areas not extracted, plantings shall be monitored at least annually until "free-to-grow" conditions have been achieved. "Free-to-grow" is a condition in which the plantings are considered established based on a minimum stocking standard, a minimum height and freedom from competition that could impede growth. At the "free-to-grow condition", the survival (stocking standard) of planted trees shall be a minimum of 1000 trees per hectare. If survival is less than 1000 "free-to-grow" condition trees per hectare, additional planting will take place.
9. For plantings in areas extracted, plantings shall be monitored at least annually until "free-to-grow" conditions have been achieved. "Free-to-grow" is considered established based on a minimum stocking standard, a minimum height and freedom from competition that could impede growth. At the "free-to-grow" condition, the survival (stocking standard) of planted trees shall be a minimum of 1000 trees per hectare. If survival is less than 1000 "free-to-grow" condition trees per hectare, additional planting will take place.

E. Drainage

1. Final surface drainage will follow the rehabilitated contours and directional arrows shown on the plan view.
2. Once the South Extension is depleted, pumping will cease and portions of the site below the ground water table will fill with water.
3. Runoff within the South Extension will drain into the lake.
4. Construct overflow outlet in the southwest corner of the South Extension.
5. Once the West Extension is depleted, the West Extension will remain in a dewatered state. Runoff within the West Extension will either drain north towards the lake or southeast into existing Licence #5499.
6. During rehabilitation the licensee shall maintain discharge to fish habitat to the north and south from Quarry Sump 0100 and 0200 within License #5499 and passive discharge from a bottom draw outlet in the infiltration pond to provide water to the wetland north of No. 2 Side Road adjacent to West Extension.
7. During rehabilitation the licensee shall operate in accordance with the conditions of the MECP, PTTW and ECA for the ongoing dewatering of the site. This pumping regime is consistent with current management from License #5499 and provides long term public water management benefits and mitigates impacts to natural heritage features that depend on quarry discharge from the adjacent License #5499.
8. The licensee has committed to: conveying the site into public ownership and to maintain the West Extension in a dewatered state by maintaining the pumping regime from License #5499 to provide long-term public water management benefits and mitigate impacts on natural heritage features which depend on quarry discharge from the adjacent License #5499.

F. Adaptive Management Plan

1. During progressive rehabilitation, until surrendering the licence, the licensee is required to operate in accordance with the Adaptive Management Plan, prepared by EarthFX Inc., Savanta and Tatham Engineering, dated April 2020, as may be amended from the time to time with approval from MNRF, in consultation with NEC, Region of Halton, City of Burlington and Conservation Halton.

Final Rehabilitation

A. General

1. All equipment shall be removed from the South and West Extension.
2. No internal haul roads shall remain in either Extension.
3. The residence and barn at 2280 Side Road No. 2 in the South Extension shall remain.
4. The residence and barn located at 2015 Side Road No. 2 in the southwest corner of the West Extension shall remain.
5. A field/property access entrance shall remain to access the residence and barn located at 2280 and 2015 Side Road No. 2.
6. The groundwater table post rehabilitation varies between 263.5 masl to 271 masl in the South Extension and 255.5 masl to 265 masl in the West Extension (EarthFX 2020) or ±269 masl if the West Extension is not maintained in a dewatered state.
7. The licensee, prior to the surrender of the licence, shall complete a Record of Site Condition for the Extensions in accordance with the Environmental Protection Act.
8. Prior to the surrender of the Aggregate Resource Act Licence, the licensee shall define the transition of the site to another party and the pre-requisite for license surrender to the satisfaction of the MNRF.

Table 1: Rehabilitation Plant List Recommendations

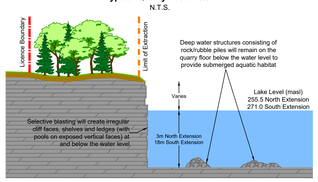
Pond/Wetland (PW)
Grassland and Existing Trees (GL)
Gradual Grade/Side Slope with Trees (GG)
Forested Setback During Operation (FSO)
Forested Setback Post Berm (FSB)
Restored to Existing Grade and Forested (REG)

Location	LATIN NAME	COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	OWES WETLAND SPECIES	PROVINCIAL STATUS (S-RANK)	LOCAL STATUS HALTON (Varga 2005)
FSB, REG	*Sambucus racemosa ssp. pubens*	Red Elderberry	5	3		S5	X
FSB, REG	*Cornus alternifolia*	Alternate-Leaved Dogwood	6	3		S5	X
FSB, REG	*Cornus racemosa*	Grey Dogwood	2	0	T	S5	X
PW, FSB, REG	*Cornus sericea*	Red-Osier Dogwood	2	-3	I*	S5	X
FSB, REG	*Ribes cynosbati*	Eastern Prickly Gooseberry	4	3		S5	X
FSB, REG	*Prunus virginiana var. virginiana*	Chokecherry	2	3		S5	X
FSB, REG	*Rubus allegheniensis*	Alleghany Blackberry	2	3		S5	X
FSB, REG	*Rubus occidentalis*	Black Raspberry	2	5		S5	X
PW	*Salix discolor*	Pussy Willow	3	-3	I	S5	X
PW, FSB, REG	*Salix eriocephala*	Cottony Willow	4	-3	T	S5	X
PW, FSB, REG	*Salix interior*	Sandbar Willow	1	-3	T	S5	U
PW	*Salix petiolaris*	Meadow Willow	3	-3	I	S5	X
GG, FSB, REG	*Betula alleghaniensis*	Yellow Birch	6	0	T	S5	X
GG, FSO, FSB, REG	*Betula papyrifera*	Paper Birch	2	3	T	S5	X
GG, FSB, REG	*Carpinus caroliniana ssp. virginiana*	Blue-Beech	6	0	T	S5	X
GL, GG, FSO, FSB, REG	*Ostrya virginiana*	Eastern Hop-Hornbeam	4	3		S5	X
GL, GG, FSO, FSB, REG	*Fagus grandifolia*	American Beech	6	3		S4	X
GL, GG, FSO, FSB, REG	*Quercus macrocarpa*	Burr Oak	5	3	T	S5	X
GL, GG, FSO, FSB, REG	*Quercus rubra*	Northern Red Oak	6	3		S5	X
GL, GG, FSB, REG	*Carya cordiformis*	Bitternut Hickory	6	0		S5	X
GL, GG, FSO, FSB, REG	*Tilia americana*	Basswood	4	3		S5	X
GL, GG, FSO, FSB, REG	*Prunus serotina var. serotina*	Black Cherry	3	3		S5	X
GG, FSB, REG	*Populus balsamifera*	Balsam Poplar	4	-3	T	S5	X
GL, GG, FSO, FSB, REG	*Populus deltoides ssp. deltoides*	Eastern Cottonwood	4	0	T	S5	U
GL, GG, FSO, FSB, REG	*Populus tremuloides*	Trembling Aspen	2	0	T	S5	X
PW, GG, FSB, REG	*Salix amygdaloides*	Peach-Leaved Willow	6	-3	T	S5	U
GL, GG, FSO, FSB, REG	*Acer nigrum*	Black Maple	7	3		S4?	X
GG, FSB, REG	*Acer saccharinum*	Silver Maple	5	-3	I	S5	X
GL, GG, FSO, FSB, REG	*Acer saccharum*	Sugar Maple	4	3		S5	X
GG, FSB, REG	*Thuja occidentalis*	Eastern White Cedar	4	-3	T	S5	X
GG, FSB, REG	*Abies balsamea*	Balsam Fir	5	-3	T	S5	U
GL, GG, FSO, FSB, REG	*Picea glauca*	White Spruce	6	3	T	S5	X
GL, GG, FSO, FSB, REG	*Pinus strobus*	Eastern White Pine	4	3	T	S5	X
GL, GG, FSO, FSB, REG	*Tsuga canadensis*	Eastern Hemlock	7	3	T	S5	X

Herbaceous seed mixes will be applied where appropriate (e.g. if soil seedbank is deemed unsuitable). Potential mixes could include Upland Dry Meadow Mix, Early Succession/Riparian Mix, and Meadow Marsh Mix, following Conservation Halton guidelines.

A nurse crop will be applied to exposed soil, the species of which will depend on season of application but will follow Conservation Halton guidelines.

Typical Quarry Face Detail
N.T.S.



Typical Cliff and Talus Slope Detail
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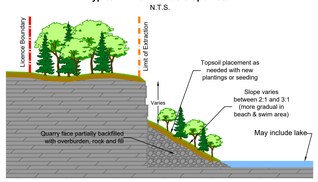
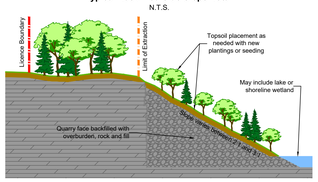
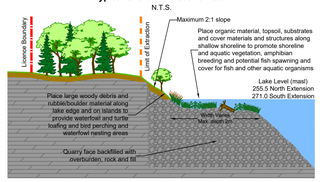


Typical Backfilled Side Slope Detail
N.T.S.



Typical Shoreline Wetland Detail
N.T.S.



Legal Description

Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

Legend

- Licence Boundary
- Limit of Extraction
- Contours with Elevation — Metres above sea level (MASL)
- Public Road
- Fence — 1.2m post & wire fence unless otherwise noted
- Water Feature
- Lake / Pond Licence # 5499
- Significant Woodlands
- Woodlands
- Wooded Feature
- Wetland — Savanta
- Wetland — MNRF - Provincially Significant
- Wetland — MNRF - Unevaluated
- 120m Offset From Licence Boundary
- Existing Licence — Existing Licenced Boundary (solid line) / Existing Limit of Extraction (dashed line)
- Parcel Fabric
- Diversion or Discharge Pipe — Existing - Single Dash / Proposed - Double Dash
- Discharge Location
- Sun-Canadian Pipe Line — Pipe line location and easement
- Jefferson Salamander Regulatory Boundary
- Entrance / Exit — Field / Property
- Gate
- Building/Structure
- Proposed Final Grade and Slope
- Final Elevation of Land and Lake (MASL)
- Cross Sections

Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licencing)

No.	Date	Description	By
1.	September 2020	Adjust pond adjacent to dwelling in the southwest corner of the West Extension.	CAP
2.	April 2021	Included MNRF wetlands for South Extension. Updated notes per MNRF feedback. Updated legend.	CAP

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
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MNRF Approval Stamp

MHBC Stamp

DRAFT

Applicant

NELSON AGGREGATE CO.
2433 No. 2 Sideroad
P.O.Box 1070 Burlington Ont. L7R 4L8
phone: (905) 335-5250

Project

Burlington Quarry Extension

MNRF Licence Reference No. 626477

Pre-approval review:

Plan Scale: 1:3000 (Arch E)

0 100 200 Meters

Date April 2021

Drawn By C.P. | **Checked By** B.Z. | **File No.** 9135D

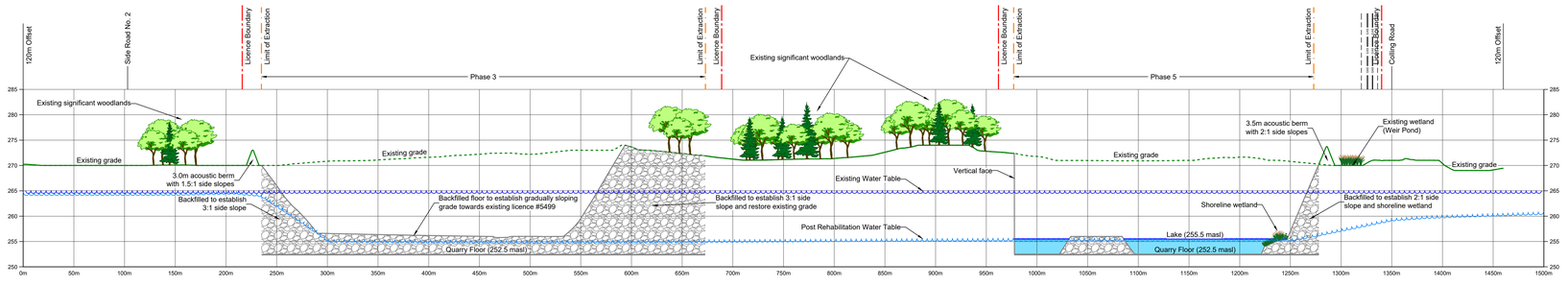
File Name

Rehabilitation Plan

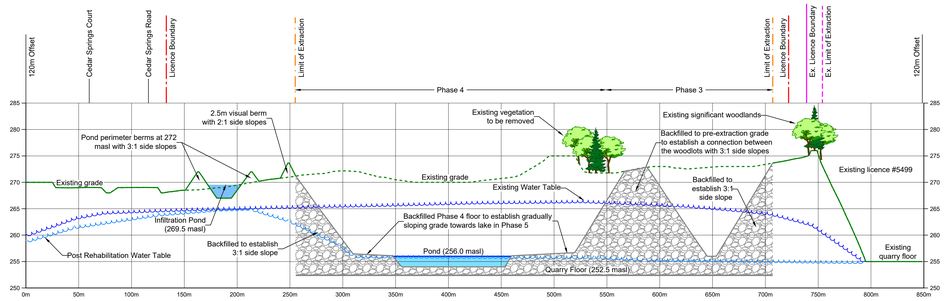
Drawing No.

3 of 4

File Path N:\Brian\9135D- Nelson - Project Sideways\Drawings\ARA Site Plans\Extension Site Plan\CAD\9135D - Site Plan - Blacklined - April 19 2021.dwg



Cross Section A-A1



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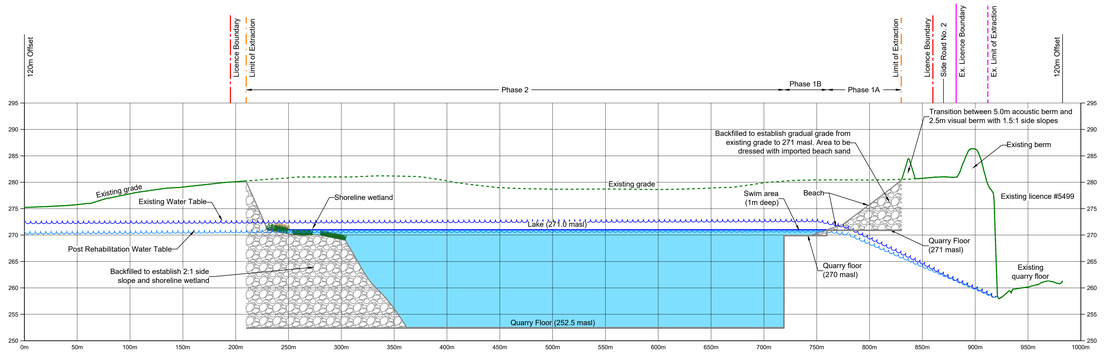
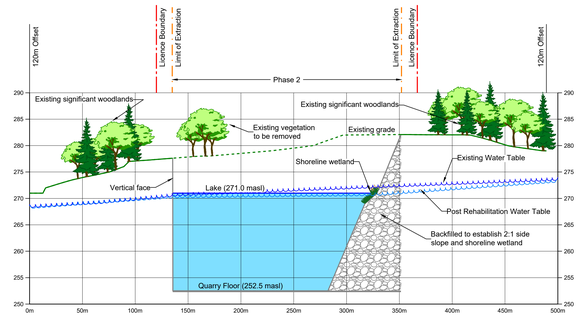


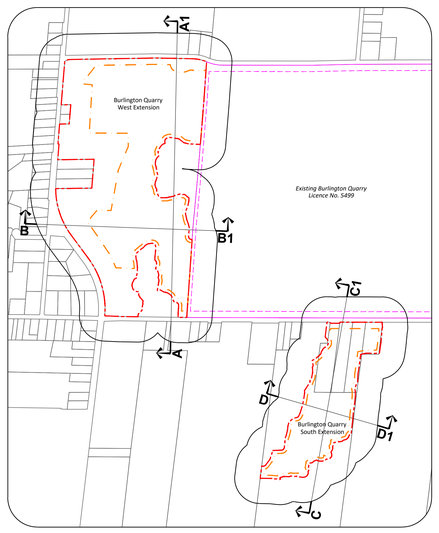
Cross Section C-C1



Cross Section D-D1

Key Map

Cross Sections



Legal Description

Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

Legend

- Licence Boundary
- Limit of Extraction
- Existing Licence
- Existing Limit of Extraction
- 120m Offset From Licence Boundary
- Existing Grade - Removed / Altered
- Existing Grade - Undisturbed
- Quarry Floor / Face
- Berm
- Existing Water Table
- Post Rehabilitation Water Table
- Backfilled
- Lake or Pond

Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licencing)

No.	Date	Description	By
1.	April 2021	Added additional cross section labels for clarity	CAP

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MNRF Approval Stamp

DRAFT

MHBC Stamp

Applicant

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P.O.Box 1070 Burlington Ont. L7R 4L8
phone: (905) 335-5250

Project

Burlington Quarry Extension

MNRF Licence Reference No. 626477	**Pre-approval review:**
Plan Scale: Horizontal 1:2000, Vertical 1:400	**Date** April 2021
	Drawn By C.P.
	Checked By B.Z.
	File No. 9135D

File Name

Cross Sections

Drawing No.

4 of 4

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Appendix B

Burlington Quarry Extension

PREVAILING METEOROLOGICAL CONDITIONS

Medians provided by Environment Canada
Canadian Climate Normals 1981-2010
Hamilton – Municipal Airport

Date	Wind Direction	Wind Velocity Km/h	Temperature (Deg Celsius)
January	SW	19.5	-5.5
February	W	18.6	-4.6
March	W	18.5	-0.1
April	NE	15.9	6.7
May	NE	14.0	12.8
June	SW	14.0	18.3
July	W	12.6	20.9
August	SW	11.8	20.0
September	SW	13.1	15.8
October	SW	15.6	9.3
November	W	17.4	3.7
December	SW	18.7	-2.3

Appendix C

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone 905-567-4444
Fax 905-567-6561

REPORT ON

BLASTING IMPACT ASSESSMENT
PROPOSED NELSON AGGREGATE
NELSON QUARRY EXTENSION

Submitted to:

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ont. L7R 4L8

DISTRIBUTION:

20 Copies - Nelson Aggregate Co.
2 Copies - Golder Associates Ltd.

April 2006

021-1238

EXECUTIVE SUMMARY

Blasting operations within the proposed extension of the Nelson quarry may be readily carried out in compliance with existing provincial environmental guideline limits with respect to ground and air vibrations. These effects are subject to recommended limits of 12.5 mm/s and 128 dBL respectively, as established by the Ontario Ministry of the Environment and outlined in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, for operations where monitoring of these effects is carried out as a matter of routine.

Ground and air vibration attenuation characteristics were monitored and assessed from a number of routine production blasts within the existing Nelson quarry. The results indicate that the majority of the proposed extension may be excavated using the blast parameters currently being used in the existing quarry. These would include reducing the borehole diameter, reducing the bench height and reducing the explosive weight per delay period. The Nelson quarry would continue monitoring all blasts during extraction within the proposed extension area. The blasting operations within the proposed extension would have no impact on the integrity of adjacent water wells.

By ensuring that the ground and air vibration levels produced during blasting operations at the Nelson quarry continue to remain within the recommended provincial guideline limits, there would not be any noticeable cumulative effect on adjacent structures associated with the blasting operations within the proposed extension.

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1.0 INTRODUCTION

Golder Associates was retained by Nelson Aggregate Co. to carry out an impact assessment of the environmental effects from future blasting operations within the proposed extension of the existing licensed area of the Nelson Quarry Company quarry. The proposed extension would be located immediately south of No. 2 Sideroad on Part Lots 17 and 18, Concession 2 in the City of Burlington. The impact assessment specifically addresses whether the applicable Ontario Ministry of Environment guidelines with respect to ground and air vibration effects could be met at the residential properties closest to the proposed extension.

The investigation included monitoring a number of regularly scheduled production blasts at various receptor points around the blast site to assess site-specific ground and air vibration decay characteristics.

This report addresses the following topics:

- reviews existing provincial and federal guidelines for the assessment of environmental impacts from blasting,
- provides recommendations for the continued control of ground and air vibration effects,
- evaluates the potential impact of the blasting operations on bedrock strata and adjacent water wells,
- evaluates the long term impact of the blasting operations on surrounding structures.

2.0 EXISTING CONDITIONS

2.1 Site Description

The existing licensed Nelson Quarry Co. quarry (Nelson) is situated immediately north of No. 2 Sideroad and south of Colling Road between Guelph Line and Cedar Springs Road in the City of Burlington, Ontario in the Region of Halton (see Figure 1). The proposed extension area would encompass an area of approximately 82.3 Hectares immediately south of the existing quarry and No. 2 Sideroad, as seen in Figure 2.

As shown in Figures 2 and 4, the closest residential properties to the proposed extension consist of those residences to the east and west on the south side of No. 2 Sideroad. Compared to the existing quarry location, the proposed extension is relatively remote from the existing neighbouring properties. The closest residential receptors have been identified as the residences along No. 2 Sideroad (see Appendix B). The topography of the area generally consists of gently rolling hills.

2.2 Quarry Blasting Operations

The Nelson quarry currently operates a single bench which varies in height from approximately 19 to 26 m. Typical blast design details for the existing quarry are given in Table 1 while common quarry blasting terms and procedures are illustrated in Figure 3.

All blasting at the Nelson quarry is monitored for ground and air vibration effects. Monitoring is routinely being carried out at three locations along the south side of No. 2 Sideroad and occasionally within Mount Nemo Court, east of Guelph Line.

Blasting procedures within the proposed extension would be carried out in a manner similar to those currently being carried out for the existing Nelson quarry, as shown in Table 1.

3.0 PROPOSED EXTRACTION OF EXTENSION AREA

The proposed sequence of extraction for the extension is illustrated in Figure 4. Extraction within the proposed extension area would commence with the crossing of No. 2 Sideroad west of the existing office. Extraction of Phase 1 would see an approximately 100 m wide working face advanced in a westerly direction along the north side of the proposed extension, as shown in Figure 4. Phases 2 and 3 would see the entire west side of the extension extracted in a southerly direction before proceeding east along the south boundary.

Extraction of Phase 4 would be carried out in a northerly direction which would complete extraction of the west half of the proposed extension. Phases 5a and 5b would be carried out in an easterly direction in the southeast corner of the extension while the remainder of the property would be extracted as Phase 6 in a northerly direction, as seen in Figure 4.

4.0 IMPACT IDENTIFICATION

The environmental effects most often associated with blasting operations are ground vibrations and air concussion.

The intensity of ground vibrations, which is an elastic effect measured in units of peak particle velocity, is defined as the speed of excitation of particles within the ground resulting from vibratory motion. For the purposes of this report, peak particle velocity is measured in mm/s.

While ground vibration is an elastic effect, one must also consider the plastic or non-elastic effect produced locally by each detonation when assessing the effects on the bedrock strata and local water wells. The detonation of an explosive produces a very rapid and dramatic increase in volume due to the conversion of the explosive from a solid to a gaseous state. When this occurs within the confines of a borehole it has the following effect:

- The bedrock in the area immediately adjacent to the explosive product is crushed.
- As the energy from the detonation radiates outward from the borehole, the bedrock between the borehole and quarried face becomes fragmented and is displaced while the bedrock behind the borehole is fractured.
- Energy not used in the fracturing and displacement of the bedrock dissipates in the form of ground vibrations, sound and airblast. This energy attenuates rapidly from the blast site due to geometric spreading and natural damping.

Air concussion, or air vibrations, is a pressure wave traveling through the air produced by the direct action of the explosive on air or the indirect action of a confining material subjected to explosive loading. Air vibrations from surface blasting operations consist primarily of acoustic energy below 20 Hz, where human hearing is less acute (Siskind et al., 1980), while noise is that portion of the spectrum of the air vibration lying within the audible range from 20 to 2000 Hz. It is the lower frequency component (below 20 Hz) of air concussion, that which is less audible, that is of interest as it is often the source of secondary rattling and shaking within a structure. For the purposes of this report, air vibration is measured as decibels in the Linear or Unweighted mode (dBL). This differs from noise (above 20 Hz) which is measured in dBA.

Both ground and air vibration effects produced at private structures adjacent to surface or underground mining operations are subject to guidelines contained in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, dated August, 1978, published by the Ontario Ministry of Environment. Under conditions where monitoring of the blasting operations is routinely carried out, as it is at the Nelson Quarry, the recommended ground and air vibration limitations at the nearest private structure would be 12.5 mm/s and 128 dBL respectively. A copy of Publication NPC 119 is reproduced in Appendix A.

5.0 QUARRY BLAST MONITORING

As part of this study, peak ground and air vibration levels were monitored during several typical quarry production blasts in the existing quarry at progressively increasing distances from the blast site. The blasts occurred both on the south and east faces of the quarry. Instrumentation consisted of Instantel DS-077 Minimates, Minimate Pluses and DS-477 Blastmates. These instruments measure and record ground vibration velocities in each of three orthogonal directions, as well as simultaneously recording air vibration levels. Instrumentation was generally set up in a line at distances ranging from about 100 to 600 m from the blast site. Specific instrument and blast locations were established using a Garmin GPS electronic navigation aid (NAVAID) to determine accurate distances between the blast and receptors.

5.1 Attenuation Characteristics

The rate at which ground vibrations attenuate or decrease with increased distance from a blast source depends on a variety of conditions, including the type and condition of the bedrock being blasted, depth and composition of the earth covering deposits (soil), and the general topography. Air vibration effects are less affected by these factors, being more influenced by the prevailing weather conditions at the time of the blast.

The following relationships were established from the blast monitoring results.

5.1.1 Ground Vibrations

The ground vibration attenuation characteristics established for the Nelson Quarry is presented in Figure 5 as a plot of the peak particle velocity against the Scaled Distance. Scaled Distance is defined as:

$$\text{Scaled Distance (SD)} = D/\sqrt{W}$$

where D = distance (m) between the blast and receptor
W = maximum weight of explosive (kg) detonated per delay period

As seen in Figure 5 the collection of points defining the rate of decay for the ground vibrations exhibits a degree of scatter that is inherent in all Scaled Distance plots. Factors responsible for these variations include the geologic conditions of the bedrock (type and structure), different wave types, errors in blast initiation timing, differences between types of explosives, degree of confinement, and differences in blast efficiencies.

The equation for the 95% regression line developed in Figure 5 can be expressed as:

$$PPV = 896(SD)^{-1.32}$$

where PPV = Peak Particle Velocity (mm/s)

SD = Scaled Distance ($m/(kg^{0.5})$)

The calculated Scaled Distance for a peak ground vibration level of 12.5 mm/s would equal 25.5 $m/(kg^{0.5})$. The purpose of this equation is not so much to predict what a given vibration level would be at a particular location for a given blast, but to indicate the probability that the peak vibration would fall below the level indicated by the equation for a given distance and maximum explosive weight. The equation is therefore a useful blast design tool in establishing maximum explosive charge weights per delay for various distances from a blast site for a given maximum ground vibration level.

5.1.2 Air Vibrations

Cube root scaling was used in establishing the air vibration decay characteristics as given in the following relationship:

Scaled Distance (SD) = $D/\sqrt[3]{W}$, where D and W are defined as previously described.

Figure 6 shows the Scaled Distance air vibration plot, which exhibits considerably more scatter and has a typically poorer correlation than that seen with the ground vibration results. This is primarily due to variable weather conditions during each blast, which are entirely independent of the blasting operations. Other factors influencing air vibration distribution from a blast include the length of collar and type of stemming material used, differences in explosive types and variations in burden distance.

The 95% regression curve given in Figure 6 can be expressed as:

$$APL = 181(SD)^{-0.0867}$$

where SD = as defined above

APL = air pressure level (dBL)

The calculated Scaled Distance for a peak air vibration level of 128 dBL would equal 53.0 $m/(kg^{0.33})$. The variability in the plot suggests that it is less reliable as a tool for guiding blast design.

Site specific Scaled Distance plots are commonly used as a blast design tool since peak vibration levels can be reasonably predicted at specified distances from a blast site. Based on the 95%

regression equations given in Figures 5 and 6, Table 2 shows the maximum suggested explosive loads for various distances from the blast site based on the provincial guideline limits of 12.5 mm/s and 128 dBL discussed previously. It can be seen that the ground vibration limit of 12.5 mm/s becomes the more restrictive guideline when determining maximum explosive loads beyond a distance of about 225 m for the quarry's blasting operations.

6.0 IMPACT ASSESSMENT

6.1 Compliance with NPC 119

It is evident from the regression equations discussed in Section 5 that the distance between the blast and the receptor and the amount of explosive detonated per delay period are the principal parameters in controlling ground and air vibration effects. The maximum explosive loads given in Table 2 for limiting peak ground and air vibration levels to 12.5 mm/s and 128 dBL respectively, indicate that the provincial guidelines may be complied with for all blasting beyond a distance of about 200 m from adjacent private residential properties. This represents a majority of the proposed extension and is based on a maximum explosive weight per delay of about 60 kg. When blasting approaches to within about 200 m of adjacent private residences, it may become necessary to reduce the maximum explosive weight detonated per delay period within the blast. Any one or combination of the following operations would achieve this:

1. Reducing the borehole diameter with a corresponding reduction in the drill pattern.
2. Introduce additional decked charges within each borehole, as illustrated on Figure 3.
3. Reduce the borehole length (depth) by reducing the bench height.

For example, a reduction in the borehole diameter from 127 mm to 76 mm would effectively reduce the explosive column weight per hole by about 65%. Decking the explosive column could further reduce the explosive column weight by an additional 50%. Additional decking and reductions in bench heights, as identified above, could achieve further reductions in maximum explosive weights.

As it is the intention of the Nelson quarry to continue monitoring all blasting operations, the attenuation curves discussed previously would be used in conjunction with the monitoring data collected at adjacent properties to dictate when changes to the blast procedure become necessary within the proposed extension. Although a reduction in the maximum instantaneous explosive load is anticipated as blasting approaches the residences to the east and west, the ground and air vibration guideline limits contained within NPC 119 would continue to be maintained.

6.2 Repeated Vibration Effects on Structures

Blast vibrations characteristically produce temporary transient strains within the various materials that makeup a residential structure. These strains would typically have durations of no more than one or two seconds for each blast as the vibration passed the structure. In additional to these temporary strains, Table 3 shows the strain levels produced in a household by changes in temperature and humidity (environmental changes), as well as those produced by regular household activities (Dowding, 1985), which occur on a recurring and often frequent basis. These strain levels are compared to equivalent levels of ground vibration produced from blasting

operations. It is evident from Table 3 that routine household activities and environmental changes can at times produce strains within a structure that are well in excess of those produced by blasting.

Several studies have also been carried out to look at the long-term effects of repeated blasting on structures (Stagg et al, 1984, Siskind et al, 1980). These studies concluded that repeated blasting over several decades, producing peak vibration levels well in excess of the provincial guideline limit, were required to cause cosmetic threshold cracking to occur. By ensuring that blasting continues to remain within the provincial guideline limits, there would not be any noticeable cumulative effect associated with the blasting operations within the extension area.

6.3 Effects on Bedrock and Water Wells

As discussed previously, under typical blasting conditions stresses introduced into the bedrock by the explosive detonation and the accompanying gas pressures create and extend fractures within the bedrock around each borehole. Fracture development is usually limited to the equivalent distance of about 20 times the borehole diameter. In the case of the blast procedures expected for the proposed extension, this would equate to about two to three metres for a 114 mm diameter hole. The gas pressures within the hole may extend micro-cracks or existing natural discontinuities within the bedrock, such as joints or bedding planes, beyond this distance.

Studies on crack development within bedrock from blast detonations (Keil et al., 1977) indicate that peak ground vibration levels of 300 to 600 mm/s are required to create micro-cracks or open existing discontinuities. Our own experience within the limestone of Southern Ontario indicates that such values would not be anticipated beyond a distance of about 10 to 20 m from the blast site, depending on such parameters as drill hole diameter and the type of explosive product. It is evident therefore that the creation or extension of fractures within the bedrock would remain confined to an area immediately around the blast site.

Several studies have been carried out to investigate the effects of blasting on ground water wells (Froedge, 1983). These studies have concluded that:

1. When blast induced ground vibrations are less than about 25 mm/s maximum resultant particle velocity, the response of the well is limited to a slight temporary variation in water level on the order of 3 to 6 cm either up or down. The specific capacity of the water well is unchanged based on drawdown tests.

2. Vibration measurements made at the surface and at the bottom of the observation wells indicate the vibration levels are always lower at the bottom of the well.

3. All of the data collected indicates that a ground vibration limit of 50 mm/s peak particle velocity is adequate to protect the wells from any significant damage. There is a possibility that temporary turbidity may be caused at lower levels periodically, although not at any constant threshold level.

The research consistently indicates that blast vibrations below 25 mm/s should have no adverse effects on nearby wells. As the maximum provincial guideline vibration limitation at the nearest residence is only half of this value, at 12.5 mm/s, the ground vibrations produced from the quarry's blasting operations within the proposed extension area would have no effect on the integrity of neighbouring water wells.

7.0 CONCLUSIONS

Based on the foregoing considerations, it is our opinion that blasting operations may be readily performed within the limits of the proposed extension of Nelson Quarry Company quarry in compliance with the current quarry blasting guidelines published by the Ministry of Environment. All blasting and blast monitoring would occur in accordance with the Aggregate Resources Act prescribed conditions in order to ensure compliance with the provincial guidelines.

GOLDER ASSOCIATES LTD.

Marcus V. van Bers, P. Eng.
Associate

MVVB/AC/ms/co

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Froedge, D. T. , *Blasting Effects on Water Wells*, Proc. Ninth Conf. on Explosives and Blasting Technique, Int. Soc. of Explosives Engineers, 1983.

Keil, L. D., Burgess, A. S., Nielson, N. M., Koropatrick, A., *Blast Vibration Monitoring of Rock Excavation*, Canadian Geotechnical Journal, Volume 14, 1977.

Ministry of Environment, Model Municipal Noise Control By-Law, Final Report, August, 1978.

Siskind, D. E., Stagg, M. S., Kopp, J. W., Dowding, C. H., *Structure Response and Damage Produced by Ground Vibration From Surface Mine Blasting*, U.S.B.M. Report RI8507, 1980.

Stagg, M. S., Siskind, D. E., Stevens, M. G., Dowding, C. H., *Effects of Repeated Blasting on a Wood-Frame House*, U.S.B.M. Report RI8896, 1984.

TABLES

TABLE 1

Existing Blast Details for Nelson Quarry Company

PARAMETER	NELSON QUARRY
Bench (face) height (m)	19 - 26
Drill hole pattern (m)	2.4 x 2.4 – 4.3 x 4.3
Drill hole diameter (mm)	76 – 114
Sub-drill depth (m)	0.6
Collar length (m)	1.7 – 3.0
Holes per blast	7 – 40
Explosive product(s) used	Emulsion/ANFO blend
Initiation system	Electric, Electronic
Delay timing (ms)	25ms (electric), 13ms (electronic)
Maximum explosive weight per delay period (kg)	30 – 279

Note: See Figure 3 for a description of blasting terms.

TABLE 2

Maximum Explosive Loads vs Distance
for 12.5 mm/s and 128 dBL

Distance (m)	PPV = 12.5 mm/s SD = 25.5 kg/m$^{0.5}$	INL = 128 dBL SD = 53.0 kg/m$^{0.33}$
100	15	7
150	35	23
200	61	54
250	96	105
300	138	181
400	246	429
500	384	838
600	553	1449

Note: See Section 5 of accompanying report.

TABLE 3

Strain Levels Induced by Household Activities, Environmental Changes and Blasting

Loading Phenomena	Site[a]	Microstrain Induced by Phenomena (μin.in.)	Corresponding Blast Vibration Level[b] (mm/s)
Daily environmental changes	K_1	149	30.0
	K_2	385	76.0
Household activities:			
1. Walking	S_2	9.1	0.8
2. Heel drops	S_2	16.0	0.8
3. Jumping	S_2	37.3	7.1
4. Door slams	S_1	48.8	12.7
5. Pounding nails	S_{12}	88.7	22.4

[a] K_1 and K_2 were placed across a taped joint between two sheets of gypsum wallboard.

[b] Blast equivalent based on envelope line of strain vs ground vibration.

Source: Dowding (1985)

FIGURES

KEY LOCATION PLAN
NELSON QUARRY

FIGURE 1

REFERENCE:
THIS FIGURE WAS CREATED FROM A MAPART MAP TITLED "HAMILTON" 2003 EDITION.

Date: SEPTEMBER 2004

Project: 021-1238

Drawn: RJ

Chkd:

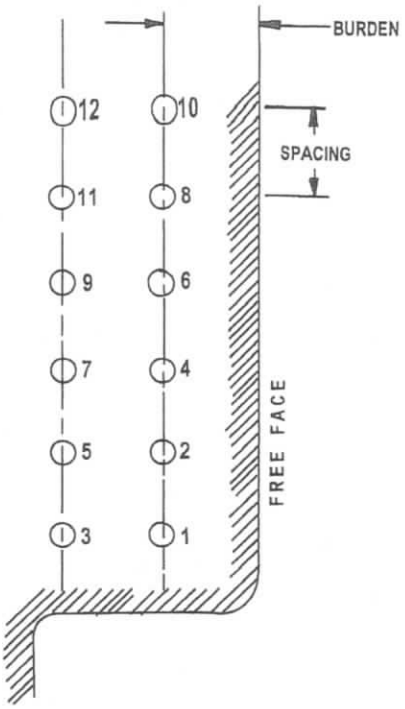
Golder Associates

0211238FIG01.cdr

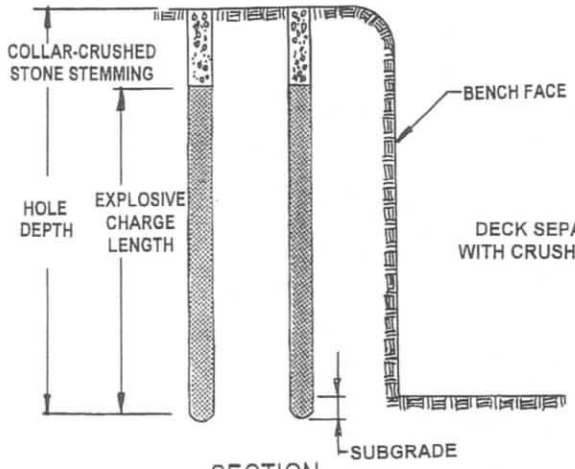
DESCRIPTION OF BLASTING TERMS

FIGURE 3

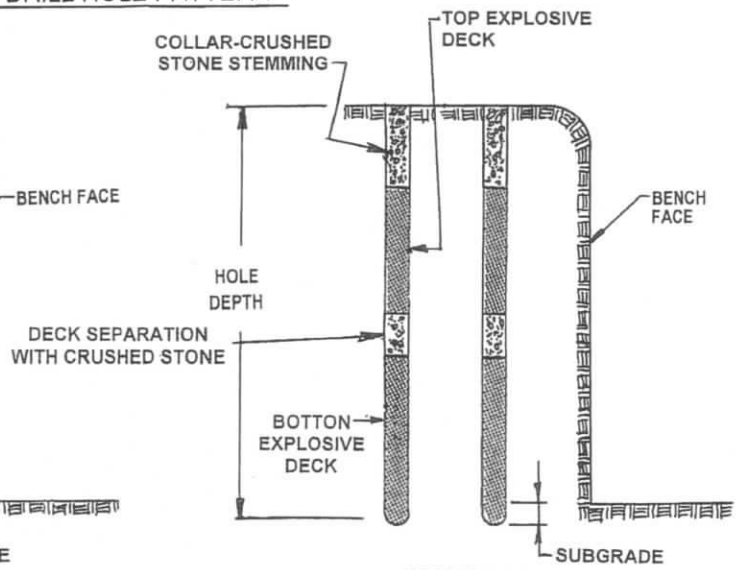
NUMBERS SHOW SHORT PERIOD DELAY	EXAMPLE OF FIRING TIMES (MILLISECONDS)
PERIOD 1	25
PERIOD 2	50
PERIOD 3	75
PERIOD 4	100
PERIOD 5	125



PLAN OF DRILL HOLE PATTERN



SECTION
FULL COLUMN EXPLOSIVE LOAD



SECTION
DECKED EXPLOSIVE LOAD

0211238FIG03.cdr

Date: SEPTEMBER 2004

Project: 021-1238

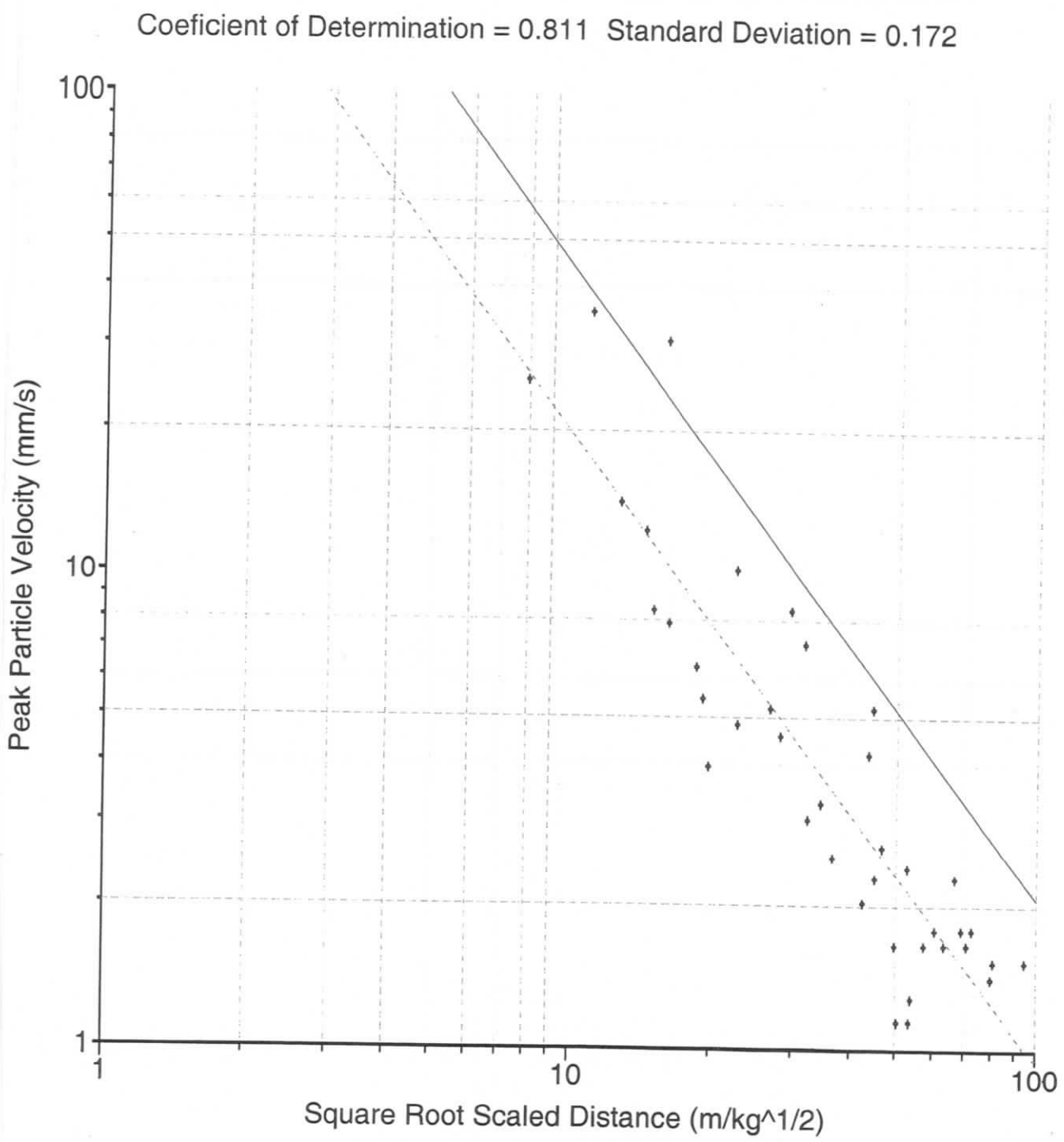
Golder Associates

Drawn: RJ

Chkd:

NELSON QUARRY GROUND VIBRATION ATTENUATION CURVE

FIGURE 5



Date.....Aug 29/04.....

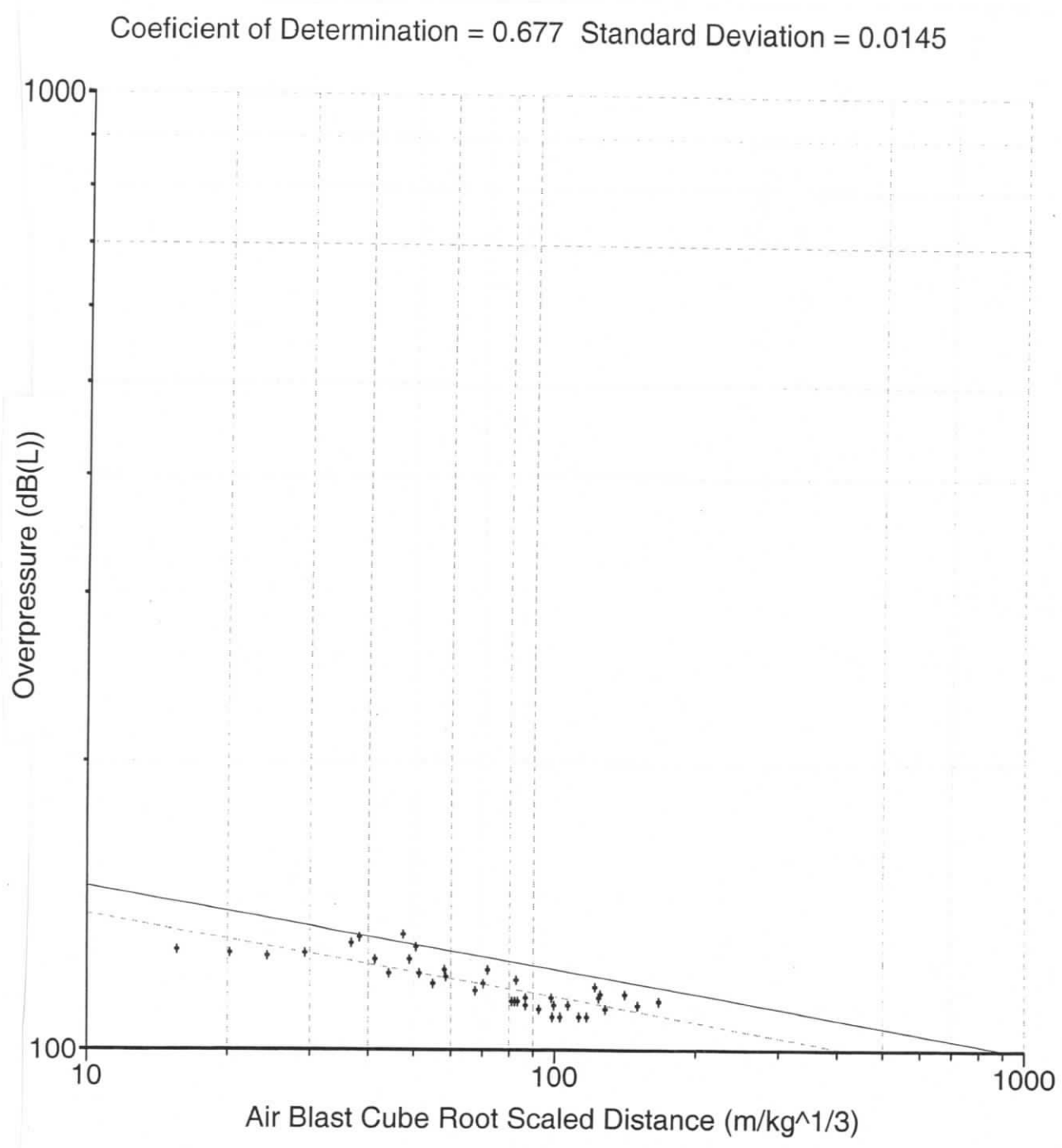
Project...021-1238.....

Drawn.....MB.....

Chkd.....MB.....

NELSON QUARRY AIR VIBRATION ATTENUATION CURVE

FIGURE 6



Date.....Aug 29/04.....

Project...021-1238.....

Drawn.....

Chkd.....

APPENDIX A
PUBLICATION NPC 119

PUBLICATION NPC-119

Blasting

Scope

This Publication refers to limits on sound (concussion) and vibration due to blasting operations.

Technical Definitions

The technical terms used in this Publication are defined in Publication NPC-101 – Technical Definitions.

Measurement Procedures

All measurements of peak pressure level and vibration velocity shall be made in accordance with the "Procedure for Measurement of Sound and Vibration due to Blasting Operations" set out in Publication NPC-103 – Procedures, section 5.

Concussion – Cautionary Limit

Subject to section 5 the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 120 dB.

Concussion – Peak Pressure Level Limit

If the person in charge of a blasting operation carries out routine monitoring of the peak pressure level, the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 128 dB.

Vibration – Cautionary Limit

Subject to section 7, the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.00 cm/s.

Vibration – Peak Particle Velocity Limit

If the person in charge of a blasting operation carries out routine monitoring of the vibration the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.25 cm/s.

APPENDIX B
NEW RESIDENCE RECEPTOR LOCATION

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone 905-567-4444
Fax 905-567-6561

December 13, 2004

021-1238

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ontario
L7R 4L8

Attention: Mr. Tom Palko
Property Manager

RE: BLASTING IMPACT ASSESSMENT PROPOSED NELSON AGGREGATE NELSON QUARRY EXTENSION NEW RESIDENCE RECEPTOR LOCATION

Dear Mr. Palko:

Further to our report entitled "Blasting Impact Assessment Proposed Nelson Aggregate Nelson Quarry Extension" dated September, 2004, it is our understanding that the closest residential receptor to the proposed Nelson Aggregate Nelson quarry extension has now been identified as the residence at 2416 No. 2 Sideroad, located in the northeast corner of the proposed extraction area. The residence and ancillary buildings at 2416 No. 2 Sideroad are located a minimum of 290 m from the Phase 1 extraction area and 370 m from the Phase 5B extraction area.

As stated in Section 6.0 Impact Assessment of the report identified above, the recommended Ontario provincial ground and air vibration guideline limits of 12.5 mm/s and 128 dBL respectively, may be complied with for all blasting beyond a distance of about 200 m. This indicates that the extraction of Phases 1 through 5B and part of Phase 6 may be carried out without any changes to the quarry's existing blasting procedures.

It is our opinion that blasting operations may be carried out within the proposed extension area in compliance with the current quarry blasting guidelines while the residence at 2416 No. 2 Sideroad is occupied. If you have any additional questions please do not hesitate to contact me.

Yours truly,

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED BY

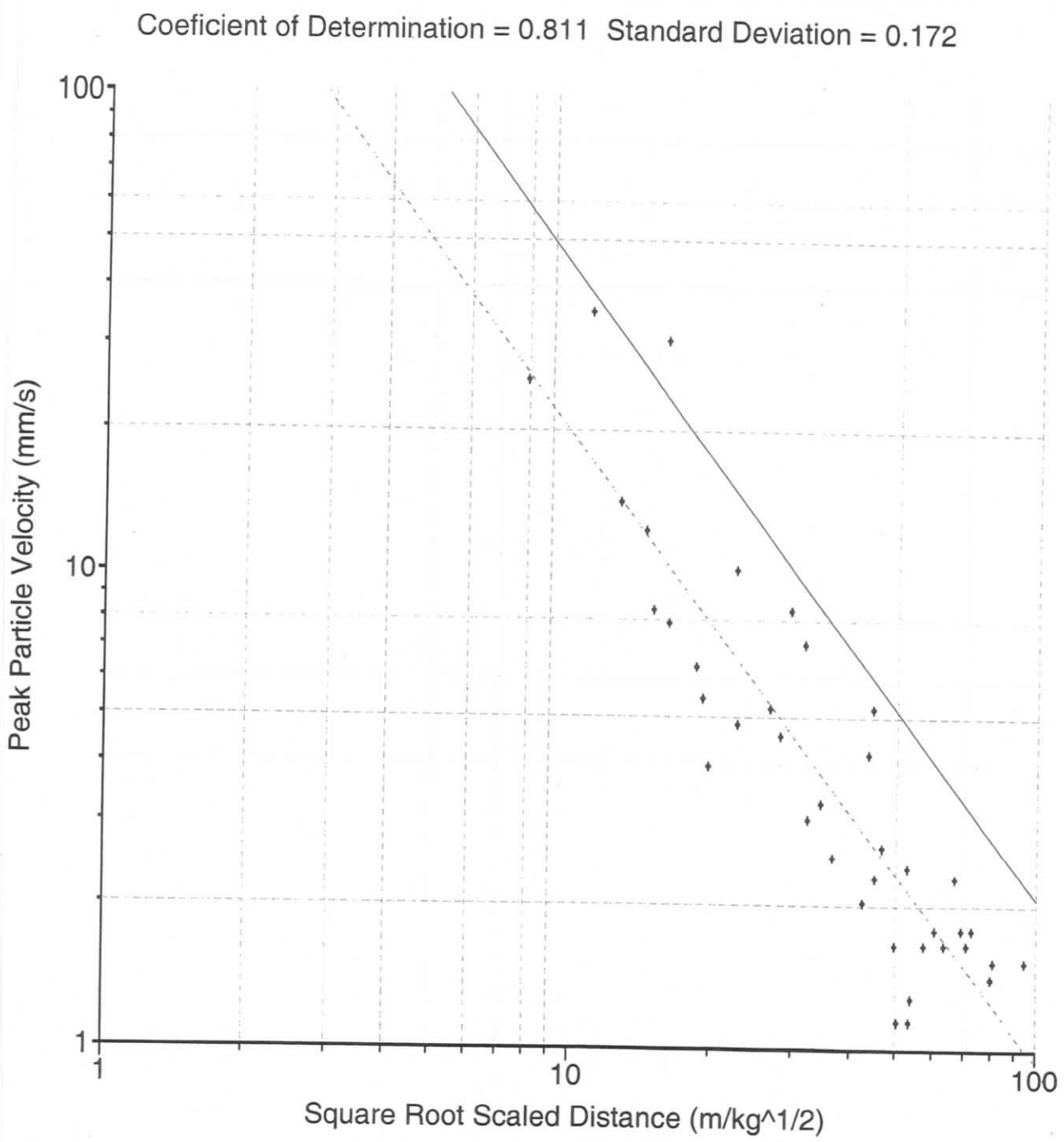
Marcus V. van Bers, P.Eng.
Associate

MVB/co
cc: Mr. Brian Zeman, MHBC Planning

n:\active\2002\1200\021-1238 - nelson aggreg-extension-burlington\reports\021-1238 ltr 04dec13 blasting impact assess-amendment.doc

NELSON QUARRY GROUND VIBRATION ATTENUATION CURVE

FIGURE 5



Date.....Aug 29/04.....

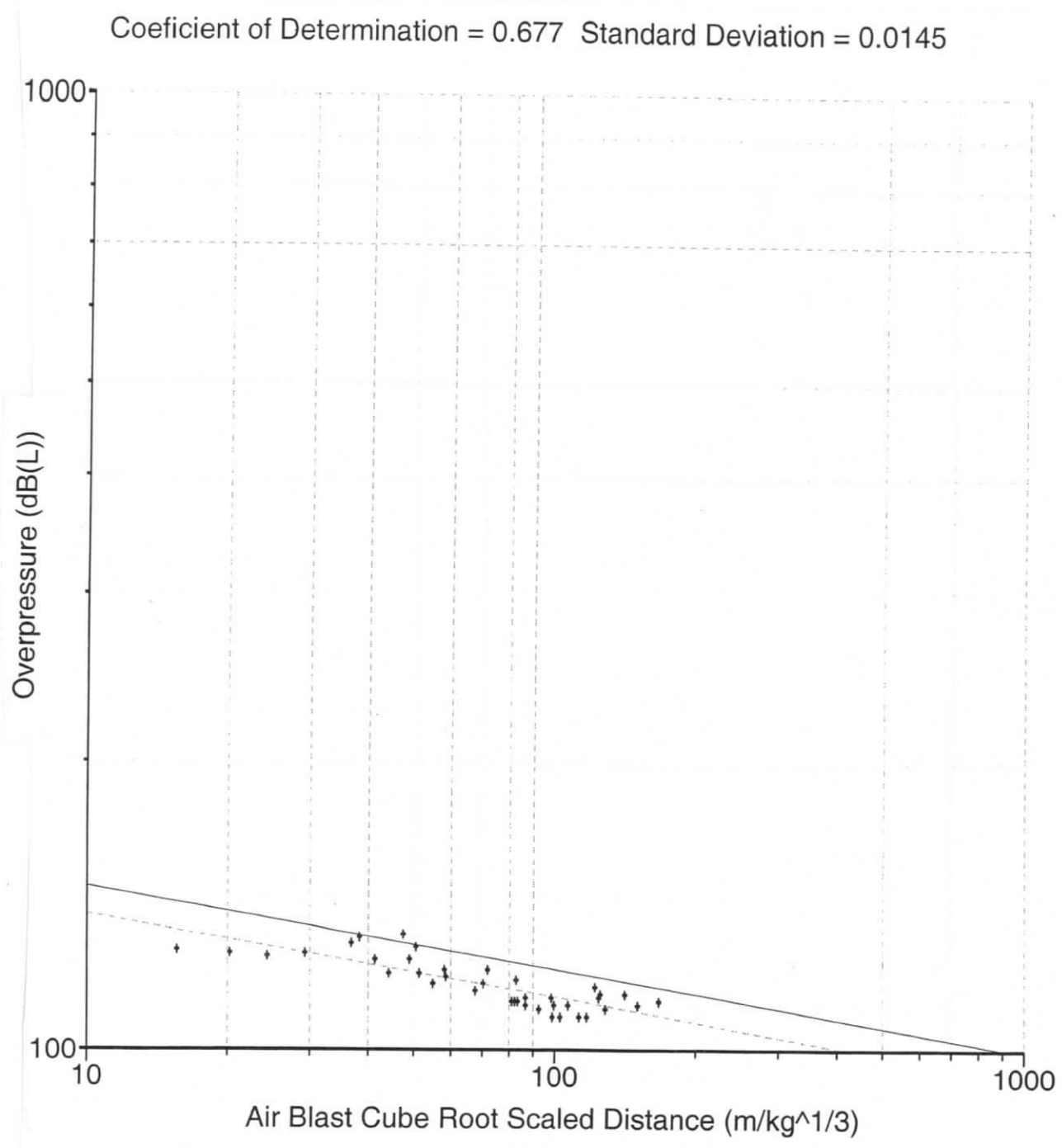
Project...021-1238.....

Drawn.....MB.....

Chkd.....MB.....

NELSON QUARRY AIR VIBRATION ATTENUATION CURVE

FIGURE 6



Date.....Aug 29/04.....

Project...021-1238.....

Drawn.....

Chkd.....

NELSON AGGREGATES

SEISMIC REPORT

Date: APRIL 11/17 OVERCAST Time: 11:56AM Shot # 01-17

Weather: 20°C Terrain: UNEVEN Wind From: SW Wind Velocity: 20KPH

Location of Blast: BULDGE, #2 SIDE RD.

Seismic Setup By: B. WHITE, NELSON Max. Kg/Delay: 92.15

Detonator System: [ ] Electric [ ] Non-Electric [✓] Electronic

Toe Load Product: CENTRA GOLD Column Load Product: CENTRA GOLD

Hole Dia. 4 in. Pattern: Spacing 11 ft. x Burden 11 ft.

# of Decks 2 # of Rows 6 # of Holes 46

Time Between: Decks 13 ms., Holes 26 ms., Rows 136 ms.

Subdrill 2 ft. Ave. Water 50.33ft Ave. Hole Depth 58.25 ft Total Tons 26417.9

Max. Vibration = 12.5 mm/sec, Max Airblast = 128.0 dbl

Monitor 1

Location: 2450 #2 SIDE RD.

Vibration: 2.53 mm/s Airblast: 111.5 dbl.

Monitor 2

Location: COLLING RD, BLIND LINE INTERSECTION, NELSON PROPERTY

Vibration: N/R mm/s Airblast: N/R. dbl.

Monitor 3

Location: SOUTH WEST CORNER, CAMISLE

Vibration: 15.6 mm/s Airblast: 113.1 dbl.

Monitor 4

Location: NOT USED

Vibration: _____ mm/s Airblast: _____ dbl.

Prepared by: M. Nelson

NELSON AGGREGATES

SEISMIC REPORT

Date: APRIL 18/17 Time: 11:53 AM Shot # 02-17

Weather: CLEAR 10° Terrain: FLAT, Wind From: EAST Wind Velocity: 15KPH

Location of Blast: HIGH WALL OLD SUB STATION

Seismic Setup By: B. WHITE, NELSON Max. Kg/Delay: 222.95

Detonator System: [ ] Electric [ ] Non-Electric [✓] Electronic

Toe Load Product: CENTRA GOLD Column Load Product: CENTRA GOLD

Hole Dia. 4 In. Pattern: Spacing 10½ ft. x Burden 11½ ft.

# of Decks 1 # of Rows 3 # of Holes 27

Time Between: Decks 0 ms., Holes 13 ms., Rows 58 ms.

Subdrill 2 ft. Ave. Water 72.82 ft Ave. Hole Depth 80.5 ft Total Tons 21384.4

Max. Vibration = 12.5 mm/sec, Max Airblast = 128.0 dbl

Monitor 1

Location: NOT USED

Vibration: _____ mm/s Airblast: _____ dbl

Monitor 2

Location: SOUTH WEST CORNER, CAMISLE

Vibration: 0.176 mm/s Airblast: 124.1 dbl.

Monitor 3

Location: 2450 #2 SIDE ROAD

Vibration: 3.56 mm/s Airblast: 125.0 dbl.

Monitor 4

Location: NOT USED

Vibration: _____ mm/s Airblast: _____ dbl.

Prepared by: M. Nelson.

NELSON AGGREGATES

SEISMIC REPORT

Date: APRIL 21/17 Time: 11:53 AM Shot # 03-17

Weather: RAIN, 10°C Terrain: FLAT Wind From: WEST Wind Velocity: 22 KPH

Location of Blast: LOW BENCH

Seismic Setup By: B. WHITE, NELSON Max. Kg/Delay: 173.13

Detonator System: [ ] Electric [ ] Non-Electric [✓] Electronic

Toe Load Product: CENTRA GOLD Column Load Product: CENTRA GOLD

Hole Dia. 5" & 4½" in. Pattern: Spacing 10½ ft. x Burden 11½ ft.

# of Decks 1 # of Rows 3 # of Holes 50
ROW 1 & 2 19 MS

Time Between: Decks 0 ms., Holes 17 ms., Rows _____ ms. ROW 2 & 3 91 MS

Subdrill 2 ft. Ave. Water 39.38 ft Ave. Hole Depth 44.76 ft Total Tons 21133.9

Max. Vibration = 12.5 mm/sec, Max Airblast = 128.0 dbl

Monitor 1

Location: COLLINGWOOD BLINDLINE INTERSECTION, NELSON PROPERTY

Vibration N/R mm/s Airblast: N/R dbl.

Monitor 2

Location: 2450 2 SIDE ROAD

Vibration: 3.56 mm/s Airblast: 122.9 dbl

Monitor 3

Location: SOUTH WEST CORNER, CAMISLE

Vibration: 1.02 mm/s Airblast: 116.7 dbl.

Monitor 4

Location: NOT USED

Vibration: _____ mm/s Airblast: _____ dbl.

Prepared by: M. Nelson

Blast Report

Customer: Nelson | Quarry: Burlington | Blast Number: 17-004
P.O. #: | Orica Order #: 2179557
Blast Date: 2017-05-01 | Blast Time: 11:51 AM

page 1 | Blaster-in-charge: Kevin Topllis (Print Name)

Blast Location: South Wall (Bench / Face)
GPS Coordinates: 43.39784 °N Latitude (Centre of Blast) | 79.88487 °W Longitude (Centre of Blast)

Wind from the: E at 15 kph | Temperature: 6 to 10 °C

Clear:		Rain:	x	Overcast:		Ceiling:	185 m
Partly Cloudy:		Snow:		Inversion:			

tonnes Blasted:	17,585 te	6,763 m^3	Rate Code
Total tonnes per day:	te		
Total Holes Loaded:	32 holes		
... including:	Dead Holes		
... and:	Helper Holes		
Helper Hole Collar:	ft avg		
# Rows Blasted:	3 rows		

- Pattern (Front Row)-

Burden:	10.5 ft avg
Spacing:	10.5 ft avg
# Holes:	10 front row

- Drilling Information -

			Angle from Vertical		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes: 32	= 2,230.4 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:	= 0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:	= 0.0 ft (" diam)

Burden:	10.5 ft avg
Spacing:	10.5 ft avg
# Holes:	22
Bench Height:	67.7 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	69.7 ft avg

- Stone Decking -

Front Row:	4.0 ft avg
Main Body:	4.0 ft avg
# Stone Decks:	31 per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75 clear

- Charge Length -

Front Row:	58.7 ft avg
Main Body:	58.7 ft avg

- Charge Weight -

Front Row:	171.2 kg/hole
Main Body:	171.2 kg/hole
Max. per delay:	128.0 kg/delay
SD () Equation:	622.8 kg/delay
Total kg Loaded:	6,152 kg
Rock Density:	2.60 g/cc = te/m^3

Theoretical PF: (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

- Powder Factor -

1.533 lb/yd^3	Yield PF:	0.350 kg/te (actual)
1.365 lb/yd^3	Front row:	0.311 kg/te (theoretical)
1.365 lb/yd^3	Main Body:	0.311 kg/te (theoretical)
0.000 lb/yd^3	"KPI" PF:	0.000 kg/te (theoretical)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,020	20,900	6,120

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	95	32.3

total explosives weight in Blast (kg): 6,152
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 15M			31
UNITRONIC 600 30M			63

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	25
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)		1
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	Line Item (Fee per Blast)		1
3D LASER PROFILE	Enter "1" if 3D Profiled		
BORETRACK	Enter "1" if Boretraked		
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		16.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

There is no video for this blast

All holes got 88kg on the bottom and then adjusted loads for the tops. A1 was only toe to 50ft.

16 hours split between 1 blaster and 2 helper

ORICA
The Blasting Professionals™

Customer: **Nelson**

Blast Design

Quarry:	Burlington	Blast Number:	17-004
P.O. #:		Orica Order #:	2179557
Blast Date:	2017-05-01	Blast Time:	11:51 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39783	79.88548	0.757435	1.394265
Front Row Corner	43.39795	79.88469	0.757437	1.394251
Back Row Corner	43.39775	79.88443	0.757434	1.394246
Average (Centre of Blast)	43.39784	79.88487	0.757435	1.394254

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40246	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40246	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	748.7	m		
Post Blast Data: ppV:	2.6	mm/s	Trigger set at: 2.0	mm/s
frequency:	41.0	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
air overpressure:	121.0	dB	Trigger set at: 115	dB

2nd concession (orica monitor)

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043

Distance (2nd Seis. From Centre of Blast	0.0	m		
Post Blast Data: ppV:	3.1	mm/s	Trigger set at: 2.0	mm/s
frequency:	43.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	108.0	dB	Trigger set at: 115	dB

2450 2nd concession (Nelson monitor)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:		mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:		dB	Trigger set at: 115	dB

Enter description of seismograph location

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting.

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(748.7)^2}{30^2} \text{ kg}$$

$$= \frac{560{,}552}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 623 kg

Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate

ORICA The Blasting Professionals

Customer: **Nelsons**

Blast Report

Quarry: **Burlington** | P.O. #: **NA** | Blast Date: **2017-05-15**

Blast Number: **17-005** | Orica Order #: **2185675** | Blast Time: **12:35PM**

Blaster-in-charge: **Mitch Ossington** (Print Name)

Blast Location: **South face** (Bench / Face)

GPS Coordinates: **43.39788** °N Latitude (Centre of Blast) **79.88447** °W Longitude (Centre of Blast)

Wind from the: **NW** at **10** kph

Temperature: **16 to 20** °C

Clear: **X** | Rain: | Overcast:

Partly Cloudy: | Snow: | Inversion: | Ceiling: 30000ft m

tonnes Blasted: **21,062** te | **8,101** m^3

Total tonnes per day: **21,062** te TBA Rate Code

Total Holes Loaded: **34** holes

... including: **0** Dead Holes

... and: **0** Helper Holes

Helper Hole Collar: **0.0** ft avg

Rows Blasted: **3** rows

- Pattern (Front Row) -

Burden: **10.5** ft avg

Spacing: **11.5** ft avg

Holes: **11** front row

- Drilling Information -

		Angle from Vertical			Nominal Bit Diameter:	
Primary Bit diam:	**101.6** mm	**0** °	# Holes: **34**	=	2,516.0 ft (4 " diam)	
Secondary Bit diam:	mm	**0** °	# Holes:	=	0.0 ft (" diam)	
Tertiary Bit diam:	mm	°	# Holes:	=	0.0 ft (" diam)	

Burden: **10.0** ft avg

Spacing: **11.5** ft avg

Holes: 23

Bench Height: **72.0** ft avg

Sub-drill: **2.0** ft avg

Hole Depth: 74.0 ft avg

- Stone Decking -

Front Row: **4.0** ft avg

Main Body: **4.0** ft avg

 # Stone Decks: **33** per blast

- Collar Stemming -

Front Row: **7.0** ft avg

Main Body: **7.0** ft avg

Material used: **1/2" crush**

- Charge Length -

Front Row: 63.0 ft avg

Main Body: 63.0 ft avg

- Charge Weight -

Front Row: 183.7 kg/hole

Main Body: 183.7 kg/hole

Max. per delay: **110.0** kg/delay

SD () Equation: kg/delay

Total kg Loaded: 7,155 kg

Rock Density: **2.60** g/cc = te/m^3

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	**27,020**	**19,900**	7,120

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	**103**	35.0

total explosives weight in Blast (kg): 7,155

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 15M			**34**
UNITRONIC 600 20M			**32**
UNITRONIC 600 30M			**37**

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	**1**
STEMMING PLUG MINI	units	**12**
	units	

- Powder Factor -

1.489 lb/yd^3	Yield PF:	0.340 kg/te (actual)
1 258 lb/yd^3	Front row:	0 287 kg/te (theoretical)
1 321 lb/yd^3	Main Body:	0 301 kg/te (theoretical)
###### lb/yd^3	"KPI" PF:	#DIV/0! kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)	**1**
# of Blasters (this Blast)	**1**
# of Helpers (this Blast)	**1**
# of MMU's (this Blast)	**1**

Services:

GPS LAYOUT	Line Item (Hourly Rate)		**1**
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Enter "1" if 3D Profiled		
BORETRACK	Enter "1" If Boretraked		
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Blt , B, S, Expl or IS from previous Blast:

3D laser profile = 0.5hrs

Blaster hours = 6.5hrs

Helper hours = 6

All Nelsons seismographs used.

Salesman will have to provide a rate code.

ORICA
The Blasting Professionals

Customer: **Nelsons**

Blast Design

Quarry:	Burlington	Blast Number:	17-005
P.O. #:	NA	Orica Order #:	2185675
Blast Date:	2017-05-15	Blast Time:	12:35PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39805	79.88465	0.757439	1.394248
Front Row Corner	43.39790	79.88446	0.757436	1.394247
Back Row Corner	43.39770	79.88439	0.757433	1.394246
Average (Centre of Blast)	43.39788	79.88447	0.757436	1.394247

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	0.1	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L T	(Vertical, Transverse or Longitudinal)
air overpressure:	88.0	dB	Trigger set at: 115	dB

Colling Rd

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	3.8	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L ?	(Vertical, Transverse or Longitudinal)
air overpressure:	111.5	dB	Trigger set at: 115	dB

2450 #2 sideroad

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	3.3	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L ?	(Vertical, Transverse or Longitudinal)
air overpressure:	95.9	dB	Trigger set at: 115	dB

Camisle

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: [ ]

$$W = \frac{D^2}{2}$$

$$= \frac{(0)^2}{2} \text{ kg}$$

$$= \frac{0}{0} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = [ ] kg

Orica
Blaster-in-charge: *Mitch Ossington*

Signature required, indicating that Blast Report is Complete & Accurate

Blast Report

Customer: Nelson

Quarry: Burlington
P.O. #:
Blast Date: 2017-05-17

Blast Number: 17-006
Orica Order #: 2187001
Blast Time: 11:53 AM

page 1

Blaster-in-charge: Kevin Topllis (Print Name)

Blast Location: Lower middle bench (Bench / Face)
GPS Coordinates: 43.40414 °N Latitude (Centre of Blast) 79.88442 °W Longitude (Centre of Blast)

Wind from the: SW at 40 kph
Temperature: 26 to 30 °C

Clear:		Rain:	Overcast:	x
Partly Cloudy:	x	Snow:	Inversion:	

Ceiling: 9,144 m

tonnes Blasted:	15,010 te / 5,773 m³
Total tonnes per day:	15,010 te
Total Holes Loaded:	42 holes
... including:	Dead Holes
... and:	Helper Holes
Helper Hole Collar:	ft avg
# Rows Blasted:	2 rows
- Pattern (Front Row)-	
Burden:	10.5 ft avg
Spacing:	11.5 ft avg
# Holes:	22 front row

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes: 41	=	1,689.2 ft (4 " diam)
Secondary Bit diam:	114.3	mm	°	# Holes: 1	=	41.2 ft (4 1/2 " diam)
Tertiary Bit diam:		mm	°	# Holes:	=	0.0 ft (" diam)

Burden:	10.5 ft avg
Spacing:	11.5 ft avg
# Holes:	20
Bench Height:	40.2 ft avg
Sub-drill:	1.0 ft avg
Hole Depth:	41.2 ft avg
- Stone Decking -	
Front Row:	ft avg
Main Body:	ft avg
# Stone Decks:	0 per blast
- Collar Stemming -	
Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75 clear
- Charge Length -	
Front Row:	34.2 ft avg
Main Body:	34.2 ft avg
- Charge Weight -	
Front Row:	99.7 kg/hole
Main Body:	99.7 kg/hole
Max. per delay:	140.0 kg/delay
SD () Equation:	325.6 kg/delay
Total kg Loaded:	4,889 kg
Rock Density:	2.60 g/cc = te/m³

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,060	22,200	4,860

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	84	28.6

total explosives weight in Blast (kg): 4,889
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			41
UNITRONIC 600 15M			43

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	3
	units	

1.427 lb/yd³	Yield PF: 0.326 kg/te (actual)
1.223 lb/yd³	Front row: 0.279 kg/te (theoretical)
1.223 lb/yd³	Main Body: 0.279 kg/te (theoretical)
0.000 lb/yd³	"KPI" PF: 0.000 kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=2,000kg	<5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		16.0

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Hole B2 is a 4 1/2"

Hole B1 slumped to 18ft, a 15m uni was used instead of a 6m uni. The hole was plugg 10ft.

Hole collars adjusted: A22 10ft, A21-19 10ft, A18-14 8ft.

There was no Orica seismograph used.

Labour hours is 16 split between 1 blaster and 2 helpers

ORICA The Blasting Professionals	Customer: Nelson	Quarry:	Burlington	Blast Number:	17-006
	Blast Design	P.O. #:		Orica Order #:	2187001
		Blast Date:	2017-05-17	Blast Time:	11:53 AM

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Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40414	79.88444	0.757545	1.394246
Front Row Corner	43.40388	79.88413	0.757541	1.394241
Back Row Corner	43.40440	79.88469	0.757550	1.394251
Average (Centre of Blast)	43.40414	79.88442	0.757545	1.394246

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40246	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40246	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	541.3	m		
	Post Blast Data: ppV:	DID	mm/s	Trigger set at: 2.0	mm/s
	frequency:	NOT	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure:	TRIGGER	dB	Trigger set at: 115	dB
	2nd concession (Nelson monitor)				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.71939	80.38847	0.763047	1.403043
	2nd Reading				
	Average	43.71939	80.38847	0.763047	1.403043
	Distance (2nd Seis. From Centre of Blast	0.0	m		
	Post Blast Data: ppV:	1.1	mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:	111.8	dB	Trigger set at: 115	dB
	2450 2nd concession (Nelson monitor)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	0.0	m		
	Post Blast Data: ppV:		mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:		dB	Trigger set at: 115	dB
	Enter description of seismograph location				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(541.3)^2}{30^2} \text{ kg}$$

$$= \frac{293{,}006}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 326 kg

Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate

ORICA The Blasting Professionals

Customer: **Nelsons**

Blast Report

Quarry: **Burlington** | P.O. #: **NA** | Blast Date: **2017-05-29**

Blast Number: **17-007** | Orica Order #: **2191786** | Blast Time: **12:00PM**

page 1

Blaster-in-charge: **Mitch Ossington** (Print Name)

Blast Location: **South face** (Bench / Face)

GPS Coordinates: **43.39805** °N Latitude (Centre of Blast) **79.88433** °W Longitude (Centre of Blast)

Wind from the: **SE** at **5** kph | Temperature: **21 to 25** °C

Clear:	x	Rain:		Overcast:	
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 30000ft m

tonnes Blasted:	20,898 te	7,886 m^3	Rate Code
Total tonnes per day:	**20,898** te	TBA	
Total Holes Loaded:	**30** holes		
... including:	**0** Dead Holes		
... and:	**0** Helper Holes		
Helper Hole Collar:	**0.0** ft avg		
# Rows Blasted:	**3** rows		

- Pattern (Front Row) -

Burden:	**10.5** ft avg
Spacing:	**11.5** ft avg
# Holes:	**10** front row

- Drilling Information -

Angle from Vertical

Primary Bit diam:	**101.6** mm	**0** °	# Holes:	**30**	=	2,442.0 ft	(4	" diam)
Secondary Bit diam:	mm	**0** °	# Holes:		=	0.0 ft	(	" diam)
Tertiary Bit diam:	mm	°	# Holes:		=	0.0 ft	(	" diam)

Nominal Bit Diameter:

Burden:	**10.0** ft avg
Spacing:	**11.5** ft avg
# Holes:	20
Bench Height:	**79.4** ft avg
Sub-drill:	**2.0** ft avg
Hole Depth:	81.4 ft avg

- Stone Decking -

Front Row:	**4.0** ft avg
Main Body:	**4.0** ft avg
# Stone Decks:	**29** per blast

- Collar Stemming -

Front Row:	**10.0** ft avg
Main Body:	**7.0** ft avg

Material used: **1/2" crush**

- Charge Length -

Front Row:	67.4 ft avg
Main Body:	70.4 ft avg

- Charge Weight -

Front Row:	196.5 kg/hole
Main Body:	205.3 kg/hole
Max. per delay:	**130.0** kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	6,860 kg
Rock Density:	**2.65** g/cc = te/m^3

- Powder Factor -

1.466 lb/yd^3	Yield PF:	0.328 kg/te	(actual)
1 220 lb/yd^3	Front row:	0 273 kg/te	(theoretical)
1 338 lb/yd^3	Main Body:	0.300 kg/te	(theoretical)
###### lb/yd^3	"KPI" PF:	#DIV/0! kg/te	(theoretical)

(Theoretical PF (based on a single hole) / Based on Total Powder & Rock Mass)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	**33,530**	**26,710**	6,820

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	**118**	40.1

total explosives weight in Blast (kg):	6,860
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			**29**
UNITRONIC 600 20M			**29**
UNITRONIC 600 30M			**60**

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	**1**
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		**1**
# of Blasters (this Blast)		**1**
# of Helpers (this Blast)	Note Exception	**2**
# of MMU's (this Blast)		**1**

Services:

GPS LAYOUT	Line Item (Hourly Rate)		**1**
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		**0**
3D LASER PROFILE	Line Item (Hourly Rate)		**1**
BORETRACK	Enter "1" if Boretraked		**0**
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

saleman will provide a rate code.

Blaster Hours= 6hrs

Helper Hours= 10hrs

ORICA The Blasting Professionals	Customer: **Nelsons** Blast Design	Quarry: **Burlington** P.O. #: **NA** Blast Date: **2017-05-29**	Blast Number: **17-007** Orica Order #: **2191786** Blast Time: **12:00PM**

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Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.39814**	**79.88442**	0.757440	1.394246
Front Row Corner	**43.39803**	**79.88434**	0.757439	1.394245
Back Row Corner	**43.39798**	**79.88423**	0.757438	1.394243
Average (Centre of Blast)	43.39805	79.88433	0.757439	1.394245

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	**0.0** m			
Post Blast Data: ppV:	**DNT**	mm/s	Trigger set at: **2.0** mm/s	
frequency:	**DNT**	Hz	V / T / L **T** (Vertical, Transverse or Longitudinal)	
air overpressure:	**DNT**	dB	Trigger set at **115** dB	
Colling Rd				

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (2nd Seis. From Centre of Blast)	**0.0** m			
Post Blast Data: ppV:	**3.3**	mm/s	Trigger set at: **2.0** mm/s	
frequency:		Hz	V / T / L : **?** (Vertical, Transverse or Longitudinal)	
air overpressure:	**94.0**	dB	Trigger set at: **115** dB	
2450 #2 sideroad				

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	**0.0** m			
Post Blast Data: ppV:	**2.4**	mm/s	Trigger set at **2.0** mm/s	
frequency:		Hz	V / T / L **?** (Vertical, Transverse or Longitudinal)	
air overpressure:	**88.0**	dB	Trigger set at: **115** dB	
Camisle				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

Orica
Blaster-in-charge: Mitch Ossington

Signature required, indicating that
Blast Report is Complete & Accurate

ORICA

Customer: **Nelson**

Blast Report

Quarry: Burlington
P.O. #: n/a
Blast Date: 2017-06-01

Blast Number: 17-008
Orica Order #: 2194148
Blast Time: 2:38 PM

page 1

Blaster-in-charge: Ken George

Blast Location: East Middle
GPS Coordinates: 0 00000 °N Latitude 0 00000 °W Longitude

Wind from the: SW at 25 kph Temperature: -16 to -20 °C

Clear: X Rain: Overcast:
Partly Cloudy: Snow: Inversion: Ceiling: m

					Nominal Bit Diameter:		
Primary Bit diam:	**101.6** mm	**0**	# Holes:	**86**	=	3,382.0 ft (4	" diam)
Secondary Bit diam:	mm	**0**	# Holes:		=	0.0 ft (	" diam)
Tertiary Bit diam:	mm	°	# Holes:		=	0.0 ft (	" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	**26,860**	**17,350**	9,510

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0 34	**174**	59.2

total explosives weight in Blast (kg): 9,569
Pkgd Prod (0 kg) % of Total kg: 0 0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			**84**
UNITRONIC 600 15M			**90**

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

	1
	1
	2
	1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	**1**
BULK TRUCK CHARGE	>/=5,000kg <10,000kg	**1**
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Line Item (Hourly Rate)	1

tonnes Blasted:	29,085 te	10,976 m^3	Rate Code
Total tonnes per day:	te		
Total Holes Loaded:	**86** holes		
Including:	**0** Dead Holes		
and:	**0** Helper Holes		
Helper Hole Collar:	**0.0** ft avg		
# Rows Blasted:	**4** rows		
Burden:	**10.5** ft avg		
Spacing:	**11.5** ft avg		
# Holes:	**27**		
Burden:	**10.5** ft avg		
Spacing:	**11.5** ft avg		
Bench Height:	**37.3** ft avg		
Sub-drill:	**2.0** ft avg		
Hole Depth:	39.3 ft avg		
Front Row:	**0.0** ft avg		
Main Body:	**0.0** ft avg		
# Stone Decks:	**0** per blast		
Front Row:	**9.0** ft avg		
Main Body:	**7.0** ft avg		
Material used:	3/4 Clear		
Front Row:	30.3 ft avg		
Main Body:	32.3 ft avg		
Front Row:	88.4 kg/hole		
Main Body:	94.3 kg/hole		
Max. per delay:	**130.0** kg/delay		
SD () Equation:	kg/delay		
Total kg Loaded:	9,569 kg		
Rock Density:	**2.65** g/cc	= te/m^3	
1.470 lb/yd^3	Yield PF:	0.329 kg/te	(actual)
##### lb/yd^3	"KPI" PF:	#DIV/0! kg/te	(theoretical)

3 Angled holes drill underneath concrete tunnel

MMU ran out of ammonium nitrate,100% emulsion blend used to load last 9 holes

ORICA
The Blasting Professionals

Customer: **Nelson**

Blast Design

Quarry:	Burlington	Blast Number:	17-008
P.O #:	n/a	Orica Order #:	2194148
Blast Date:	2017-06-01	Blast Time:	2:38 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast				
Front Row Corner				
Back Row Corner				
Average (Centre of Blast)	0.00000	0.00000	0.000000	0.000000

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (1st Seis From Centre of Blast)		m		
Post Blast Data: ppV:	5.8	mm/s	2.0	
frequency:		Hz	T	
air overpressure:	101.0	dB	115	

2450 #2 Side Rd

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance **(2nd Seis. From Centre of Blast**		m		
Post Blast Data: ppV:	3.8	mm/s	2.0	
frequency:		Hz	?	
air overpressure:	91.5	dB	115	

Northwest

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis From Centre of Blast)		m		
Post Blast Data: ppV:	1.5	mm/s	2.0	
frequency:		Hz	?	
air overpressure:	88.0	dB	115	

Southwest

Scaling Factor denotes the degree of Blast confinement
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: [ ]

$$W = \frac{D^2}{2}$$

$$= \frac{(0)^2}{2} \text{ kg}$$

$$= \frac{0}{0} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = [ ] kg

Orica
Blaster-in-charge: Ken George

ORICA The Blasting Professionals

Customer: **Nelsons**

Blast Report

Quarry: Burlington | Blast Number: 17-009
P.O. #: NA | Orica Order #: 2191786
Blast Date: 2017-06-08 | Blast Time: 12:00PM

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Blaster-in-charge: Mitch Ossington (Print Name)

Blast Location: South face (Bench / Face)

GPS Coordinates: 43.39805 °N Latitude (Centre of Blast) | 79.88433 °W Longitude (Centre of Blast)

Wind from the: SE at 5 kph | Temperature: 21 to 25 °C

Clear:	x	Rain:	x	Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 30000ft m

tonnes Blasted:	20,898 te	7,886 m³
Total tonnes per day:	20,898 te	TBA (Rate Code)
Total Holes Loaded:	30 holes	
... including:	0 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row) -		
Burden:	10.5 ft avg	
Spacing:	11.5 ft avg	
# Holes:	10 front row	

- Drilling Information -

		mm	Angle from Vertical		# Holes:		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes:	30	=	2,442.0 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	"	# Holes:		=	0.0 ft (" diam)

Burden:	10.0 ft avg
Spacing:	11.5 ft avg
# Holes:	20
Bench Height:	79.4 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	81.4 ft avg
- Stone Decking -	
Front Row:	4.0 ft avg
Main Body:	4.0 ft avg
# Stone Decks:	29 per blast
- Collar Stemming -	
Front Row:	10.0 ft avg
Main Body:	7.0 ft avg
Material used:	1/2" crush
- Charge Length -	
Front Row:	67.4 ft avg
Main Body:	70.4 ft avg
- Charge Weight -	
Front Row:	196.5 kg/hole
Main Body:	205.3 kg/hole
Max. per delay:	130.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	6,860 kg
Rock Density:	2.65 g/cc = te/m³

Theoretical PF (based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

- Powder Factor -

1.466 lb/yd³	Yield PF:	0.328 kg/te (actual)
1.220 lb/yd³	Front row:	0.273 kg/te (theoretical)
1.338 lb/yd³	Main Body:	0.300 kg/te (theoretical)
###### lb/yd³	"KPI" PF:	#DIV/0! kg/te (theoretical)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,530	26,710	6,820

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	118	40.1

total explosives weight in Blast (kg): 6,860

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			29
UNITRONIC 600 20M			29
UNITRONIC 600 30M			60

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

saleman will provide a rate code.

Blaster Hours= 6hrs

Helper Hours= 10hrs

ORICA
The Blasting Professionals

Customer: **Nelsons**

Blast Design

Quarry:	Burlington	Blast Number:	17-009
P.O. #:	NA	Orica Order #:	2191786
Blast Date:	2017-06-08	Blast Time:	12:00PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39814	79.88442	0.757440	1.394246
Front Row Corner	43.39803	79.88434	0.757439	1.394245
Back Row Corner	43.39798	79.88423	0.757438	1.394243
Average (Centre of Blast)	43.39805	79.88433	0.757439	1.394245

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (1st Seis. From Centre of Blast): 0.0 m

Post Blast Data:

ppV:	DNT	mm/s	Trigger set at: 2.0	mm/s
frequency:	DNT	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
air overpressure:	DNT	dB	Trigger set at: 115	dB

Colling Rd

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (2nd Seis. From Centre of Blast): 0.0 m

Post Blast Data:

ppV:	3.3	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	94.0	dB	Trigger set at: 115	dB

2450 #2 sideroad

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast): 0.0 m

Post Blast Data:

ppV:	2.4	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	88.0	dB	Trigger set at: 115	dB

Camisle

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting.

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

Orica
Blaster-in-charge: Mitch Ossington

Signature required, indicating that
Blast Report is Complete & Accurate

ORICA
The Blasting Professionals

Customer: **Nelsons**

Blast Report

Quarry: Burlington
P.O. #: NA
Blast Date: 2017-06-21

Blast Number: 17-010
Orica Order #: 2202619
Blast Time: 12:35PM

page 1

Blaster-in-charge: Mitch Ossington

Blast Location: Lower Middle
GPS Coordinates: 43.40406 °N Latitude 79.88412 °W Longitude

Wind from the: W at 10 kph
Temperature: 21 to 25 °C

Clear:
Partly Cloudy: x
Rain:
Snow:
Overcast:
Inversion:
Ceiling: 30000ft m

		Nominal Bit Diameter:				
Primary Bit diam:	101.6 mm	0 °	# Holes: 78	=	3,162.4 ft (4 " diam)	
Secondary Bit diam:	114.3 mm	0 °	# Holes: 6	=	244.8 ft (4 1/2 " diam)	
Tertiary Bit diam:	mm	°	# Holes:	=	0.0 ft (" diam)	

tonnes Blasted:	25,680 te	9,690 m^3	
Total tonnes per day:	25,680 te	TBA	Rate Code
Total Holes Loaded:	84 holes		
... including:	0 Dead Holes		
... and:	0 Helper Holes		
Helper Hole Collar:	0.0 ft avg		
# Rows Blasted:	3 rows		
Burden:	12.0 ft avg		
Spacing:	10.5 ft avg		
# Holes:	28		
Burden:	9.0 ft avg		
Spacing:	10.5 ft avg		
Bench Height:	38.8 ft avg		
Sub-drill:	2.0 ft avg		
Hole Depth:	40.8 ft avg		
Front Row:	10.0 ft avg		
Main Body:	0.0 ft avg		
# Stone Decks:	1 per blast		
Front Row:	8.0 ft avg		
Main Body:	7.0 ft avg		
Material used:	1/2" crush		
Front Row:	22.8 ft avg		
Main Body:	33.8 ft avg		
Front Row:	66.5 kg/hole		
Main Body:	98.6 kg/hole		
Max. per delay:	117.0 kg/delay		
SD () Equation:	0.0 kg/delay		
Total kg Loaded:	8,482 kg		
Rock Density:	2.65 g/cc	= te/m^3	

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,170	18,720	8,450

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	95	32.3

total explosives weight in Blast (kg):	8,482
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 15M			91
UNITRONIC 600 6M			4

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	5
	units	

1.475 lb/yd^3	Yield PF: 0.330 kg/te (actual)
###### lb/yd^3	"KPI" PF: #DIV/0! kg/te (theoretical)

Customer wants to try higher collars in back row to try to break the top better on the middle bench

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>/=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	

Blaster Hours= 6.5
Helper Hours= 12

ORICA
The Blasting Professionals

Customer: **Nelsons**

Blast Design

Quarry: Burlington
P.O. #: NA
Blast Date: 2017-06-21

Blast Number: 17-010
Orica Order #: 2202619
Blast Time: 12:35PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40401	79.88408	0.757543	1.394240
Front Row Corner	43.40370	79.88380	0.757537	1.394235
Back Row Corner	43.40447	79.88447	0.757551	1.394247
Average (Centre of Blast)	43.40406	79.88412	0.757544	1.394241

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Sels. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	DNT	mm/s		
frequency:	DNT	Hz		
air overpressure:	DNT	dB		
Colling Rd				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (2nd Sels. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	DNT	mm/s		
frequency:		Hz		
air overpressure:	DNt	dB		
2450 #2 sideroad				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Sels. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	DNT	mm/s		
frequency:		Hz		
air overpressure:	DNT	dB		
Camisle				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

Orica
Blaster-in-charge: Mitch Ossington

ORICA The Blasting Professionals

Customer: **Nelsons**

Blast Report

Quarry: Burlington | Blast Number: 17-011
P.O. #: NA | Orica Order #: 2201920
Blast Date: 2017-06-20 | Blast Time: 12:02PM

page 1

Blaster-in-charge: Mitch Ossington (Print Name)

Blast Location: South Wall (Bench / Face)
GPS Coordinates: 43.39816 °N Latitude (Centre of Blast) 79.88425 °W Longitude (Centre of Blast)

Wind from the: SW at 10 kph | Temperature: 21 to 25 °C

Clear:		Rain:		Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 2540ft m

tonnes Blasted:	23,583 te	8,899 m³
Total tonnes per day:	23,583 te	TBA (Rate Code)
Total Holes Loaded:	36 holes	
... including:	0 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row) -

Burden:	18.0 ft avg
Spacing:	6.0 ft avg
# Holes:	16 front row

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 36	=	3,027.6 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:	=	0.0 ft (" diam)

Burden:	10.0 ft avg
Spacing:	10.5 ft avg
# Holes	20
Bench Height:	82.1 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	84.1 ft avg

- Stone Decking -

Front Row:	4.0 ft avg
Main Body:	4.0 ft avg
# Stone Decks:	35 per blast

- Collar Stemming -

Front Row:	8.0 ft avg
Main Body:	7.0 ft avg
Material used:	1/2" crush

- Charge Length -

Front Row:	72.1 ft avg
Main Body:	73.1 ft avg

- Charge Weight -

Front Row:	210.2 kg/hole
Main Body:	213.2 kg/hole
Max. per delay:	150.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	8,379 kg
Rock Density:	2.65 g/cc = te/m³

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

- Powder Factor -

1.587 lb/yd³	Yield PF:	0.355 kg/te (actual)
1.411 lb/yd³	Front row	0.316 kg/te (theoretical)
1.472 lb/yd³	Main Body:	0.330 kg/te (theoretical)
###### lb/yd³	"KPI" PF:	#DIV/0! kg/te (theoretical)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	30,240	21,910	8,330

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	143	48.6

total explosives weight in Blast (kg):	8,379
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 9M			35
UNITRONIC 600 15M			36
UNITRONIC 600 30M			72

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

Hole A8 bottom dets would not pull so a 15m unitronic was used as a safety.

Hole A4 collapsed at collar, no top deck.

Blaster Hours= 6.5

Helper Hours= 11

ORICA The Blasting Professionals

Customer: **Nelsons**

Blast Design

Quarry:	Burlington	Blast Number:	17-011
P.O. #:	NA	Orica Order #:	2201920
Blast Date:	2017-06-20	Blast Time:	12:02PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39823	79.88432	0.757442	1.394244
Front Row Corner	43.39816	79.88428	0.757441	1.394244
Back Row Corner	43.39810	79.88415	0.757440	1.394241
Average (Centre of Blast)	43.39816	79.88425	0.757441	1.394243

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	DNT	mm/s	Trigger set at: 2.0 mm/s	
frequency:	DNT	Hz	V / T / L : T (Vertical, Transverse or Longitudinal)	
air overpressure:	DNT	dB	Trigger set at: 115 dB	
Colling Rd				

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	2.0	mm/s	Trigger set at: 2.0 mm/s	
frequency:		Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
air overpressure:	108.4	dB	Trigger set at: 115 dB	
2450 #2 sideroad				

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	2.4	mm/s	Trigger set at: 2.0 mm/s	
frequency:		Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
air overpressure:	101.9	dB	Trigger set at: 115 dB	
Camisle				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

Orica
Blaster-in-charge: Mitch Ossington

ORICA The Blasting Professionals™

Customer: Nelsons

Blast Design

Quarry: Burlington
P.O. #: NA
Design Date: 2017-06-20

Blast Number: 17-011
Orica Order #:

page 1

Blaster-in-charge: Mitch Ossington (Print Name)

Blast Location: South Face (Bench / Face)
GPS Coordinates: 43.39805 °N Latitude (Centre of Blast) 79.88433 °W Longitude (Centre of Blast)

Design te Blasted:	23,583	te
Total Holes Loaded:	36	holes
... including:	0	Dead Holes
... and:	0	Helper Holes
Helper Hole Collar:	0.0	ft avg
# Rows Blasted:	3	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 36	=	3,027.6 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

12:02 pm
22°c P. Cloudy
7km/h SW
2540'

- Design Pattern (Front Row) -

Burden:	18.0	ft avg
Spacing:	6.0	ft avg
# Holes:	16	front row

- Design Pattern (Main Body) -

Burden:	10.0	ft avg
Spacing:	10.5	ft avg
# Holes	20	main body
Bench Height:	82.1	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	84.1	ft avg

- Design Stone Decking -

Front Row:	4.0	ft avg
Main Body:	4.0	ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	1/2" crush	

- Design Charge Length -

Front Row:	73.1	ft avg
Main Body:	73.1	ft avg

- Design Charge Weight -

Front Row:	213.2	kg/hole
Main Body:	213.2	kg/hole
Max Chge Wt / delay:	~~130.0~~ 150	kg/delay
Required kg Loaded:	8,565	kg
Rock Density:	2.65	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.363	kg/te (actual)
1 431 lb/yd³	Front row:	0 320	kg/te (theoretical)
1 472 lb/yd³	Main Body:	0 330	kg/te (theoretical)
1.458 lb/yd³	"KPI" PF:	0.326	kg/te (theoretical)

Bulk Explosives Req'd:

		kg
CENTRA GOLD 70	ChargeWt.exe	8,500

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 16 (OR EQUIVALENT)	0.45	144	65.4

total explosives weight in Blast (kg):	8,565
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 30M		72
UNITRONIC 600 ~~15M~~ 20m		36
UNITRONIC 600 9M		36

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Fee per Blast)		1
BORETRACK	Enter "1" if Boretraked		
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Hole A8 bottom dets would not pull, put in a 15m qs safety.

Hole A4 collapsed at collar, no top deck.

ORICA
The Blasting Professionals™

Customer: **Nelsons**

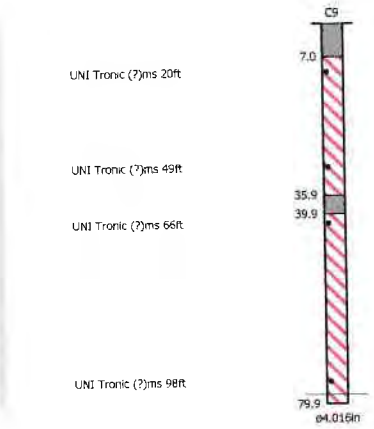
Blast Design

Quarry: Burlington
P.O. #:
Blast Date: ~~2017-06-20~~ 2017/06/20

Blast Number: ~~17-007~~ 17-011
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Mitch Ossington

#
Quarry Manager:

Signature required, indicating sign off on Blast Design

JUN. 19. 2017 1:22PM

COMBINATION SHORT FORM BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

BLASTER MITCH
HELP KEITH
BRAD

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE: 700	TIME OUT / HEURE SORTIE: 1230
ORDER NUMBER / N° DE COMMANDE: 2201920	B/L NUMBER / N° DE CONNAISSEMENT: 85682632

REPRINT

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
20 Jun 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
20 Jun 2017	FOB Dest'n, Own Truck	F-73289	1500

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
196	PC	X	53	143	PENTEX BC 340 (49/CS)	4	71.540
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
60	PC	X	25	35	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
66	PC	X	30	36	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
108	PC	X	36	72	*uni tronic 600-30M C/Z SPL(100')36P	3	31.752
100	PC		100	0	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		126.998 KG
					**** TOTAL PACKAGES ****	10	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NUMÉRO CONNAISSEMENT ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ✓ NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: BRAD HUTCHINSON	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: B. HUTCHINSON	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE: 20 6 17 (D/J M/M Y/A)	SIGNATURE: B. Hutchinson	DATE: 20 6 17 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

ORIGINAL - NOT NEGOTIABLE
ORIGINAL - NON NÉGOCIABLE

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

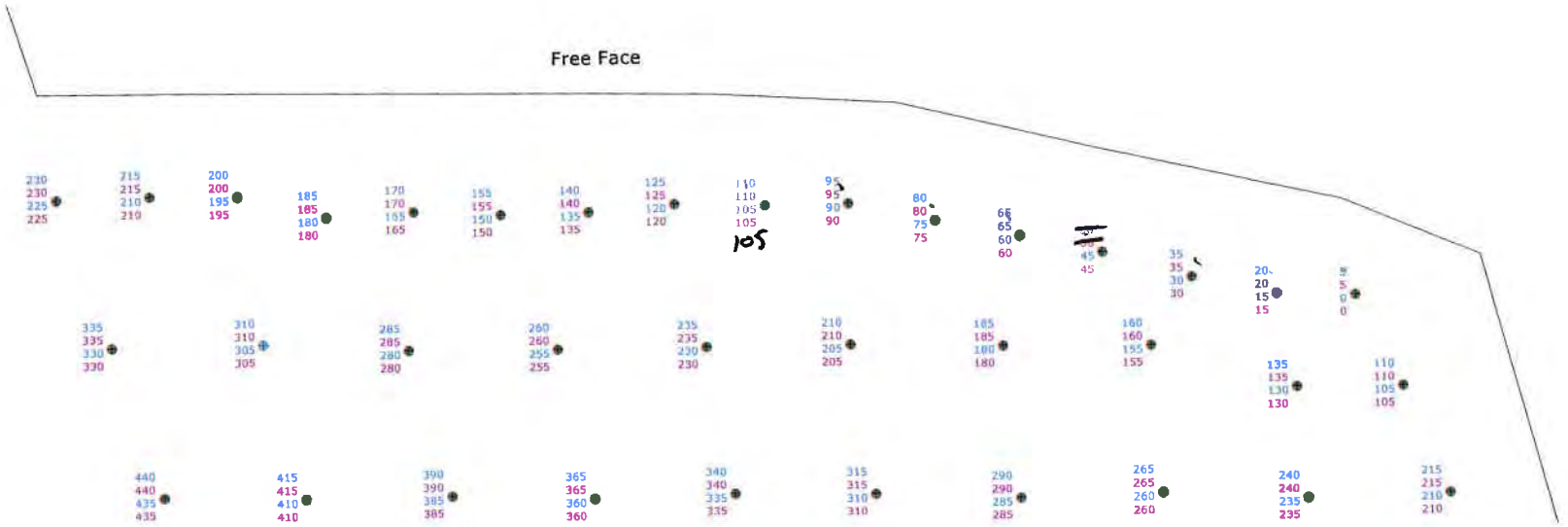
SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉES AU VERSO

D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 18.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 3030.6ft			



ORICA

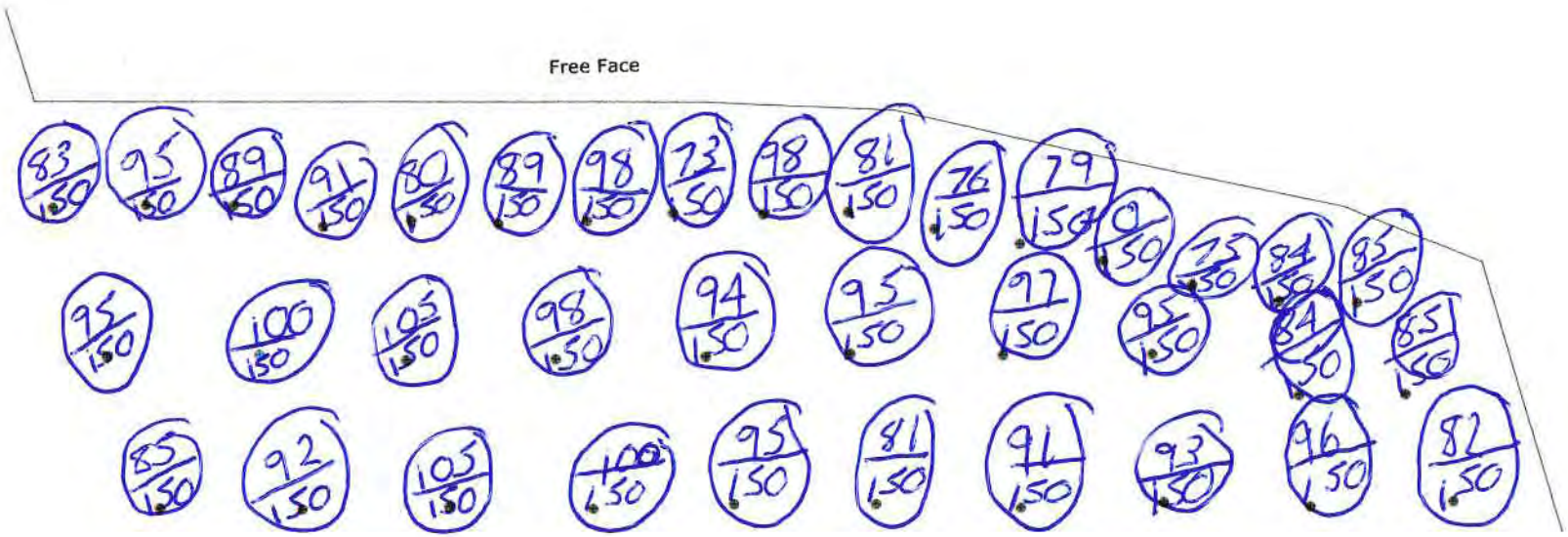
Scale 1:150

SHOTPlus 5.6.2.7	20/06/2017
Mine	
Location	
Title/author	17-011 South Face Final G. Palcso
Filename	17-011 South Face Final (2).spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 18.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 3030.6ft			



* 150 kg in all botton decks:

ORICA

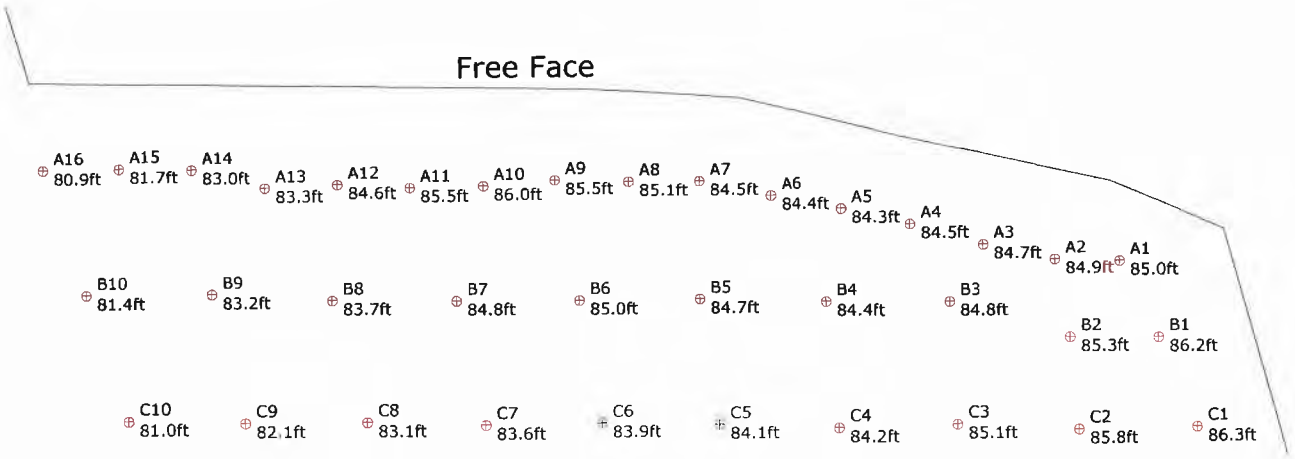
Scale 1:150

SHOTPlus 5.6.2.7	20/06/2017
Mine	
Location	
Title/author	17-011 South Face Final G. Palcso
Filename	17-011 South Face Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 18.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 3030.8ft			



17-011 South Face Final
Front Row - 18' X 6' - Body - 10' X 10.5' - 4" Bit
248.5 + .6 Sub

ORICA

Not to scale

ShotPlus5 5.2.29.0	12/06/2017
Mine	
Location	
Title/author	17-011 South Face Final G. Palcso
Filename	17-011 South Face Final.spf

ORICA

Customer: **Nelson**

Blast Report

Quarry: Burlington | Blast Number: 17-012
P.O. #: n/a | Orica Order #: 2204495
Blast Date: 2017-06-26 | Blast Time: 1:14 PM

page 1

Blaster-in-charge: Ken George

Blast Location: Floor
GPS Coordinates: 43.40250 °N Latitude 79.88614 °W Longitude

Wind from the: SW at 15 kph Temperature: 21 to 25 °C

Clear: | Rain: | Overcast:
Partly Cloudy: X | Snow: | Inversion: | Ceiling: 30 000 m

						Nominal Bit Diameter:		
Primary Bit diam:	101.6 mm	0	# Holes:	252	=	4,032.0 ft (4	" diam)	
Secondary Bit diam:	mm	0	# Holes:		=	0.0 ft (	" diam)	
Tertiary Bit diam:	mm	0	# Holes:		=	0.0 ft (	" diam)	

tonnes Blasted:	40,014 te	15,099 m^3	
Total tonnes per day:	**40,014** te		Rate Code
Total Holes Loaded:	**252** holes		
... including:	**0** Dead Holes		
... and:	**0** Helper Holes		
Helper Hole Collar:	**0.0** ft avg		
# Rows Blasted:	**12** rows		
Burden:	**11.5** ft avg		
Spacing:	**11.5** ft avg		
# Holes:	**17**		
Burden:	**11.5** ft avg		
Spacing:	**11.5** ft avg		
Bench Height:	**16.0** ft avg		
Sub-drill:	**0.0** ft avg		
Hole Depth:	16.0 ft avg		
Front Row:	**0.0** ft avg		
Main Body:	**0.0** ft avg		
# Stone Decks:	**0** per blast		
Front Row:	**7.0** ft avg		
Main Body:	**7.0** ft avg		
Material used:	3/4 Clear		
Front Row:	9.0 ft avg		
Main Body:	9.0 ft avg		
Front Row:	26.2 kg/hole		
Main Body:	26.2 kg/hole		
Max. per delay:	**45.0** kg/delay		
SD () Equation:	kg/delay		
Total kg Loaded:	6,806 kg		
Rock Density:	**2.65** g/cc = te/m^3		
0.760 lb/yd^3	Yield PF:	0.170 kg/te (actual)	
##### lb/yd^3	"KPI" PF:	#DIV/0! kg/te (theoretical)	

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,290	27,570	6,720

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	252	85.7

total explosives weight in Blast (kg):	6,806
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators:	case #'s	ms	# used
EXEL HANDIDET 12m		25/500	252
CONNECTADET 12M		42 ms	18
UNITRONIC 600 6M			1

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	
		1
		1
		2
		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>/=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Enter "1" if 3D Profiled	
BORETRACK	Enter "1" if Boretraked	

Customer: **Nelson**		Quarry:	Burlington	Blast Number:	17-012
Blast Design		P.O. #:	n/a	Orica Order #:	2204495
		Blast Date:	2017-06-26	Blast Time:	1:14 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40254	79.88612	0.757517	1.394276
Front Row Corner	43 40207	79 88607	0.757509	1.394275
Back Row Corner	43 40288	79 88623	0.757523	1 394278
Average (Centre of Blast)	43.40250	79 88614	0 757516	1.394276

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0 00000	0.000000	0.000000
Distance (1st Seis From Centre of Blast)	**0.0** m			
Post Blast Data: ppV:	6.2	mm/s	2.0	
frequency:		Hz	T	
air overpressure:	91 5	dB	115	
2450 #2 Side Rd				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0 00000	0.00000	0.000000	0.000000
Distance **(2nd Seis. From Centre of Blast**	**0.0** m			
Post Blast Data: ppV:	DNT	mm/s	2.0	
frequency:		Hz	?	
air overpressure:	DNT	dB	115	
Northwest				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0 00000	0 00000	0 000000	0 000000
Distance (3rd Seis From Centre of Blast)	**0.0** m			
Post Blast Data: ppV:	1.8	mm/s	2.0	
frequency:		Hz	?	
air overpressure:	88.0	dB	115	
Southwest				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: [ ]

$$W = \frac{D^2}{z}$$

$$= \frac{(0)^2}{2} \text{ kg}$$

$$= \frac{0}{0} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = [ ] kg

Orica
Blaster-in-charge: *Ken George*

Blast Report

Customer: **Nelson**

Quarry: Burlington | Blast Number: 17-013
P.O. #: | Orica Order #: 2210809
Blast Date: 2017-07-10 | Blast Time: 1:40 PM

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40152 °N Latitude (Centre of Blast) | 79.88959 °W Longitude (Centre of Blast)

Wind from the: SW at 10 kph | Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 2,804 m

tonnes Blasted:	58,552 te	22,095 m³
Total tonnes per day:	58,552 te	Rate Code
Total Holes Loaded:	295 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	11 rows	

- Pattern (Front Row)-

Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	28 front row

- Drilling Information -

						Nominal Bit Diameter:
		Angle from Vertical				
Primary Bit diam:	101.6 mm	0 °	# Holes:	299	=	5,980.0 ft (4 " diam)
Secondary Bit diam:	mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:	mm	°	# Holes:		=	0.0 ft (" diam)

Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	58,524
Bench Height:	20.0 ft avg
Sub-drill:	0.0 ft avg
Hole Depth:	20.0 ft avg

- Stone Decking -

Front Row:	0.0 ft avg
Main Body:	0.0 ft avg
# Stone Decks:	0 per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	3/4 Clear

- Charge Length -

Front Row:	13.0 ft avg
Main Body:	13.0 ft avg

- Charge Weight -

Front Row:	37.9 kg/hole
Main Body:	37.9 kg/hole
Max. per delay:	46.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	8,572 kg
Rock Density:	2.65 g/cc = te/m³

Theoretical PF (Based on a single hole)

- Powder Factor -

0.654 lb/yd³	Yield PF:	0.146 kg/te	(actual)
0.853 lb/yd³	Front row:	0.191 kg/te	(theoretical)
0.853 lb/yd³	Main Body:	0.191 kg/te	(theoretical)
#DIV/0! lb/yd³	"KPI" PF:	#DIV/0! kg/te	(theoretical)

Yield Powder Factor (kg Loaded / te Blaster

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,150	25,680	8,470

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	300	102.0

total explosives weight in Blast (kg): 8,572
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
EXEL HANDIDET 12m		25/500	300
CONNECTADET 12M		42 ms	21
UNITRONIC 600 6M			1

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter "1" if Layout by GPS		0
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		16.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Holes A1,2,3- B1,2- C1 where not drilled.
Holes A24, C24 where not loaded, but primed. They both where at 8ft.
Holes, K17, I15 det did not pull, a safety was used.
Holes, G28, H28 did not get loaded, do to both only being 3ft.

Blaster hours: 8.5
Helper hours: 7.5

Customer: **Nelson**	Quarry: Burlington	Blast Number: 17-013
Blast Design	P.O. #:	Orica Order #: 2210809
	Blast Date: 2017-07-10	Blast Time: 1:40 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40144	79.88941	0.757498	1.394333
Front Row Corner	43.40125	79.89002	0.757495	1.394344
Back Row Corner	43.40186	79.88933	0.757505	1.394332
Average (Centre of Blast)	43.40152	79.88959	0.757499	1.394336

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.71939	80.38847	0.763047	1.403043
	2nd Reading				
	Average	43.71939	80.38847	0.763047	1.403043
	Distance (1st Seis. From Centre of Blast)	0.0	m		
	Post Blast Data: ppV:	2.2	mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure:	91.5	dB	Trigger set at: 115	dB
	2450 #2 Side Rd (Nelson monitor)				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance **(2nd Seis. From Centre of Blast)**	0.0	m		
	Post Blast Data: ppV:	1.0	mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:	104.2	dB	Trigger set at: 115	dB
	Northwest (Nelson monitor)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	0.0	m		
	Post Blast Data: ppV:	4.2	mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:	88.0	dB	Trigger set at: 115	dB
	Southwest (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

jim bray

Orica
Blaster-in-charge: Kevin Toplis

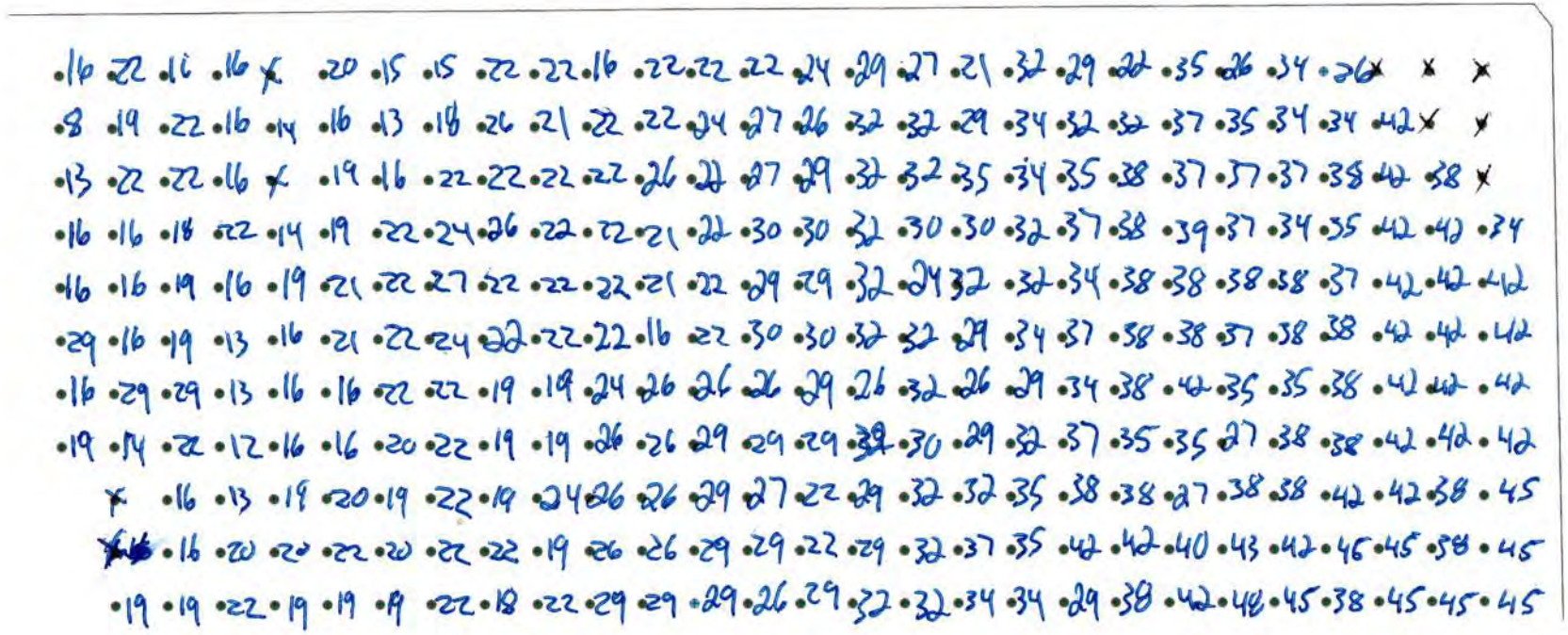
Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 7.0ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 305	Hole angle: 0.0°
Total drilled: 6100.0ft			

Free Face



17-013 Floor Blast - 11.5' X 11.5' - 4" Bit - Drill to shale

8497

ORICA

Not to scale

SHOTPlus 5.6.3.6		07/07/2017
Mine	Burlington	
Location		
Title/author	17-013 Floor Blast G. Palcso	
Filename	17-013_Floor_Blast_Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 7.0ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 305	Hole angle: 0.0°
Total drilled: 6100.0ft			

Timing

Free Face

17-013 Floor Blast - 11.5' X 11.5' - 4" Bit - Drill to shale

ORICA

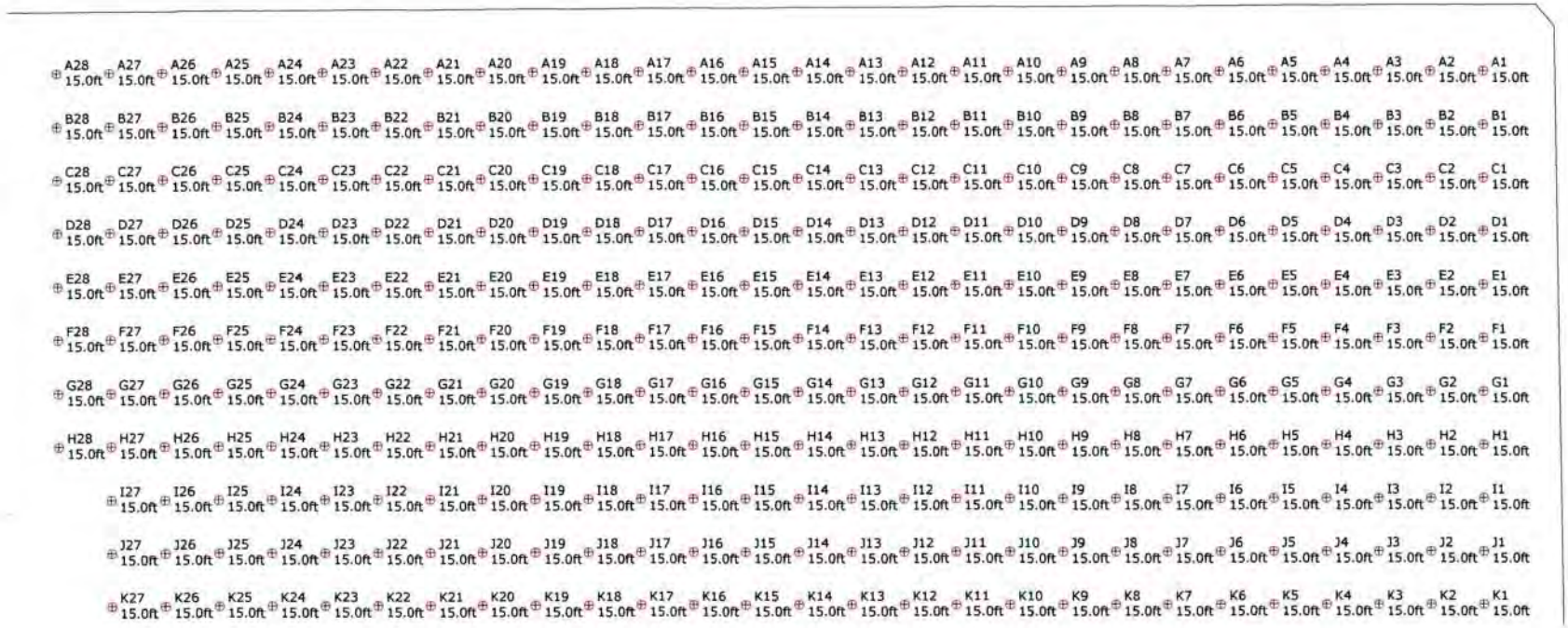
Not to scale

SHOTPlus 5.6.4.3	10/07/2017
Mine	Burlington
Location	
Title/author	17-013 Floor Blast G. Palcso
Filename	17-013_Floor_Blast_Final Timing Ope

SHOTPlus 5 Plan

Blast Summary Data			
Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 7.0ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 305	Hole angle: 0.0°
Total drilled: 4575.0ft			

Free Face



17-013 Floor Blast - 11.5' X 11.5' - 4" Bit - Drill to shale

ORICA

Not to scale

ShotPlus5 5.2.29.0		16/06/2017
Mine	Burlington	
Location		
Title/author	17-013 Floor Blast G. Palcso	
Filename	17-013 Floor Blast Final.spf	

ORICA
The Blasting Professionals

Customer: Nelson

Blast Design

Quarry: Burlington
P.O. #:
Design Date: 2017-07-07

Blast Number: 17-013
Orica Order #:

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor (Bench / Level)
GPS Coordinates: 0.00000 °N Latitude (Centre of Blast) 0.00000 °W Longitude (Centre of Blast)

Design te Blasted:	60,536 te
Total Holes Loaded:	305 holes
... including:	0 Dead Holes
... and:	0 Helper Holes
Helper Hole Collar:	0.0 ft avg
# Rows Blasted:	11 rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 305	=	6,100.0 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	28 front row

- Design Pattern (Main Body) -

Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	277 main body
Bench Height:	20.0 ft avg
Sub-drill:	0.0 ft avg
Hole Depth:	20.0 ft avg

- Design Stone Decking -

Front Row:	0.0 ft avg
Main Body:	0.0 ft avg

- Design Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	3/4 Clear

- Design Charge Length -

Front Row:	13.0 ft avg
Main Body:	13.0 ft avg

- Design Charge Weight -

Front Row:	37.9 kg/hole
Main Body:	37.9 kg/hole
Max Chge Wt / delay:	30.0 kg/delay

Required kg Loaded:	7,912 kg
Rock Density:	2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF:	0.131 kg/te	(actual)
0.853 lb/yd³ Front row:	0.191 kg/te	(theoretical)
0.853 lb/yd³ Main Body:	0.191 kg/te	(theoretical)
0.853 lb/yd³ "KPI" PF:	0.191 kg/te	(theoretical)

Bulk Explosives Req'd:

		kg
CENTRA GOLD 70	ChargeWt.exe	7,808

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	305	103.7

total explosives weight in Blast (kg):	7,912
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
EXEL HANDIDET 12m	25/500	305
CONNECTADET 12M	42 ms	11
UNITRONIC 600 6M		1

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

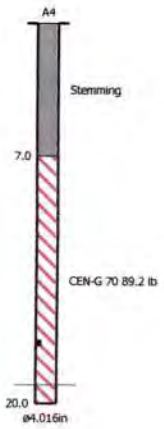
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit . B .S Expl or IS from previous Blast:

ORICA The Blasting Professionals™	Customer: **Nelson** **Blast Design**	Quarry: Burlington P.O. #: Blast Date: 2017-07-10	Blast Number: 17-013 Orica Order #:	

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Kevin Toplis

#
Quarry Manager:

Signature required, indicating sign off on Blast Design

1085980

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

GROSS / BRUT	
TARE	
NET	

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

Blaster Kevin
Help - Nelson
Keith

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
6:45	14:00
ORDER NUMBER / N° DE COMMANDE	**B/L NUMBER / N° DE CONNAISSEMENT**
2210809	85701951

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
10 Jul 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
10 Jul 2017	FOB Dest'n, Own Truck	F-73289	PT115013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
					NET EXPLOSIVES QUANTITY: 133.810 KG		
392	PC	X	92	300	PENTEX BC 340 (49/CS)	8	143.080
400	PC	X	100	300	EXEL HANDIDET 12M 25/500(40') 50/CS	8	49.200
65 ~~80~~	PC	X	65	0	EXEL Connectadet 9M 25MS (30 FT) 65/CS	2	7.760
50	PC	X	29	21	EXEL Connectadet 12M 42MS (40 FT) 50/CS	1	6
5	PC	X	4	1	*uni tronic 600-06.0M CU/ZC(20')80PC	1	0.365
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		212.245 KG
					**** TOTAL PACKAGES ****	21	

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	✓ YES / OUI ___ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE $

NETTE No. CONV / PRESSAGE / WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Keith Platt	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Keith Platt	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE: Keith Platt	DATE: 10 7 17 (D/J M/M Y/A)	SIGNATURE: Keith Platt
	DATE: 10 7 17 (D/J M/M Y/A)	SIGNATURE
		DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Blast Report

Customer: **Nelson**

Quarry: Burlington | P.O. #: | Blast Date: 2017-07-04

Blast Number: 17-014 A | Orica Order #: 2207581 | Blast Time: 12:46 PM

page 1

Blaster-in-charge: Kevin Topllis (Print Name)

Blast Location: Lower middle bench (Bench / Face)

GPS Coordinates: 43.40390 °N Latitude (Centre of Blast) | 79.88386 °W Longitude (Centre of Blast)

Wind from the: SE at 10 kph | Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 9,144 m

- Drilling Information -

			Angle from Vertical				Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes:	36	=	1,497.6 ft (4 " diam)
Secondary Bit diam:	114.3	mm	0°	# Holes:	7	=	291.2 ft (4 1/2 " diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,050	29,193	4,857

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	86	29.2

total explosives weight in Blast (kg): 4,886

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			43
UNITRONIC 600 15M			43

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	20
	units	

Resource Deployment:

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=2,000kg	<5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		14.0

tonnes Blasted:	11,970 te	4,517 m³
Total tonnes per day:	33,601 te	TBA Rate Code
Total Holes Loaded:	43 holes	
… including:	0 Dead Holes	
… and:	4 Helper Holes	
Helper Hole Collar:	10.0 ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.5 ft avg
# Holes:	12 front row

- Pattern (Main Body) -

Burden:	9.0 ft avg
Spacing:	10.5 ft avg
# Holes:	31 main body
Bench Height:	39.6 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	41.6 ft avg

- Stone Decking -

Front Row:	0.0 ft avg
Main Body:	0.0 ft avg
# Stone Decks:	0 per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75 clear

- Charge Length -

Front Row:	34.6 ft avg
Main Body:	34.6 ft avg

- Charge Weight -

Front Row:	100.9 kg/hole
Main Body:	100.9 kg/hole
Max. per delay:	125.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	4,886 kg
Rock Density:	2.65 g/cc = te/m³

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

- Powder Factor -

1.823 lb/yd³	Yield PF:	0.408 kg/te	(actual)
1.204 lb/yd³	Front row:	0.269 kg/te	(theoretical)
1.605 lb/yd³	Main Body:	0.359 kg/te	(theoretical)
1.565 lb/yd³	"KPI" PF:	0.350 kg/te	(theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

blaster hours: 7.5

helper hours: 6.5

This blast was shot with 17-014 B, with a 5 second delay

Holes A1, X1, X2 got 10ft collars. Holes B1, X3, X4, C1 got 12ft collars.

ORICA The Blasting Professionals	Customer:	**Nelson**	Quarry:	Burlington	Blast Number: 17-014 A
	Blast Design		P.O. #:		Orica Order #: 2207581
			Blast Date:	2017-07-04	Blast Time: 12:46 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40388**	**79.88387**	0.757541	1.394236
Front Row Corner	43.40375	79.88372	0.757538	1.394234
Back Row Corner	43.40406	79.88399	0.757544	1.394239
Average (Centre of Blast)	43.40390	79.88386	0.757541	1.394236

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (1st Seis. From Centre of Blast)	**0.0**	m		
	Post Blast Data: ppV:	**1.3**	mm/s	Trigger set at: **2.0**	mm/s
	frequency:		Hz	V / T / L : **T**	(Vertical, Transverse or Longitudinal)
	air overpressure:	**88.0**	dB	Trigger set at: **115**	dB
	northwest- colling rd. (Nelson monitor)				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.71939	80.38847	0.763047	1.403043
	2nd Reading				
	Average	43.71939	80.38847	0.763047	1.403043
	Distance **(2nd Seis. From Centre of Blast**	**0.0**	m		
	Post Blast Data: ppV:	**12.2**	mm/s	Trigger set at: **2.0**	mm/s
	frequency:		Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
	air overpressure:	**95.9**	dB	Trigger set at: **115**	dB
	2450 2nd concession (Nelson monitor)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	**0.0**	m		
	Post Blast Data: ppV:	**4.2**	mm/s	Trigger set at: **2.0**	mm/s
	frequency:		Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
	air overpressure:	**88.0**	dB	Trigger set at: **115**	dB
	southwest- Camisle (Nelson Monitor)				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg

jim bray

Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 43	Hole angle: 0.0°
Total drilled: 1793.4ft			

Holes A1,B1,C1, X1,X2,X3,X4 are 4.5" Diameter Marked with Green Paint

Lower Middle 17-014 Part A
12x10.5 Front Row, 9x10.5 Body
4" Hole Diameter
250m Floor Elevation + 0.6m Subdrill

ORICA

Not to scale

SHOTPlus 5.6.3.6		03/07/2017
Mine	Burlington	
Location	Lower Middle	
Title/author	Blast 17-014 Design Ken George	
Filename	Blast 17-014 Lower Middle Design.spf	

SHOTPlus 5 Plan

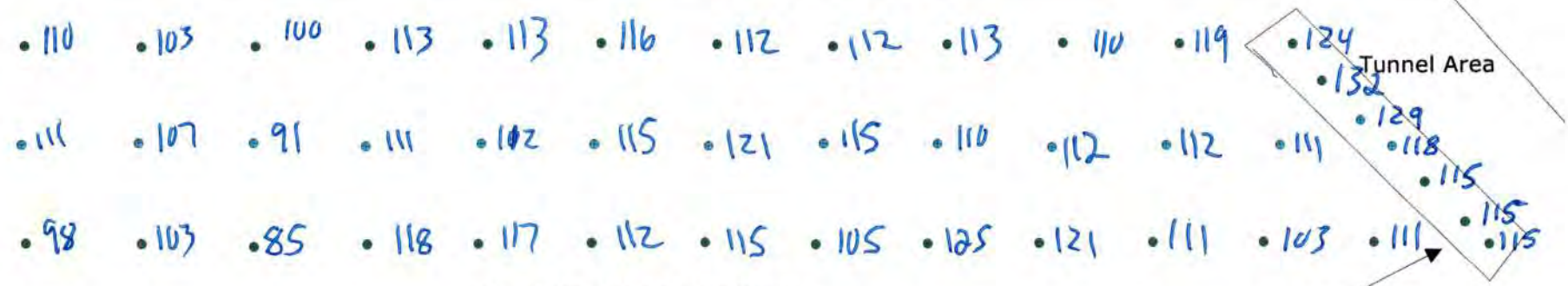
Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 43	Hole angle: 0.0°
Total drilled: 1793.4ft			

Holes A1,B1,C1, X1,X2,X3,X4 are 4.5" Diameter Marked with Green Paint

load sheet
pc counter
max load: 140kg

open face



Lower Middle 17-014 Part A
12x10.5 Front Row, 9x10.5 Body
4" Hole Diameter
250m Floor Elevation + 0.6m Subdrill

4811

ORICA

Not to scale

SHOTPlus 5.6.3.6	03/07/2017
Mine	Burlington
Location	Lower Middle
Title/author	Blast 17-014 Design Ken George
Filename	Blast 17-014 Lower Middle Design.spf

SHOTPlus 5 Plan

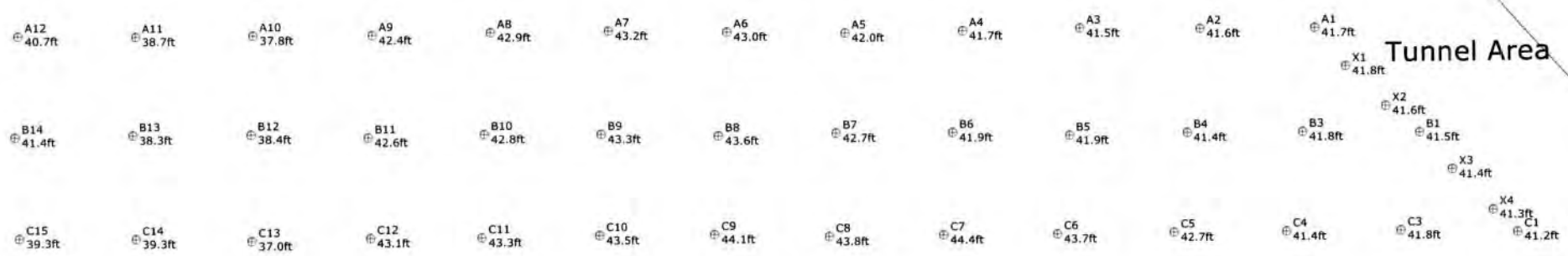
Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 43	Hole angle: 0.0°
Total drilled: 1793.4ft			

N

Holes A1,B1,C1, X1,X2,X3,X4 are 4.5" Diameter Marked with Green Paint

open face



Lower Middle 17-014 Part A
12x10.5 Front Row, 9x10.5 Body
4" Hole Diameter
250m Floor Elevation + 0.6m Subdrill

ORICA

Not to scale

SHOTPlus 5.6.4.3	22/06/2017
Mine	Burlington
Location	Lower Middle
Title/author	Blast 17-014 Design Ken George
Filename	Blast 17-014 Lower Middle Design.sp

ORICA
The Blasting Professionals™

Customer: Nelson

Blast Design

Quarry: Burlington
P.O. #:
Design Date: 2017-07-04

Blast Number: 17-014 A
Orica Order #:

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Lower middle bench (Bench / Face)
GPS Coordinates: 43.40390 °N Latitude (Centre of Blast) 79.88386 °W Longitude (Centre of Blast)

Design te Blasted:	12,949 te
Total Holes Loaded:	43 holes
... including:	0 Dead Holes
... and:	4 Helper Holes
Helper Hole Collar:	7.0 ft avg
# Rows Blasted:	3 rows

- Drilling Information -

		Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0°	# Holes:	36 =	1,497.6 ft (4 " diam)
Secondary Bit diam:	114.3 mm	0°	# Holes:	7 =	291.2 ft (4 1/2 " diam)
Tertiary Bit diam:	mm	0°	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden:	12.0 ft avg
Spacing:	10.5 ft avg
# Holes:	12 front row

- Design Pattern (Main Body) -

Burden:	9.0 ft avg
Spacing:	10.5 ft avg
# Holes:	31 main body
Bench Height:	39.6 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	41.6 ft avg

- Design Stone Decking -

Front Row:	0.0 ft avg
Main Body:	0.0 ft avg

- Design Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75 clear

- Design Charge Length -

Front Row:	34.6 ft avg
Main Body:	34.6 ft avg

- Design Charge Weight -

Front Row:	100.9 kg/hole
Main Body:	100.9 kg/hole
Max Chge Wt / delay:	140.0 kg/delay

Required kg Loaded:	4,920 kg
Rock Density:	2.60 g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.380 kg/te (actual)
1.204 lb/yd³	Front row:	0.275 kg/te (theoretical)
1.605 lb/yd³	Main Body	0.366 kg/te (theoretical)
1.471 lb/yd³	"KPI" PF:	0.336 kg/te (theoretical)

Bulk Explosives Req'd: kg

CENTRA GOLD 70	ChargeWt.exe	4,891

Pkgd Explosives Req'd: kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	86	29.2

total explosives weight in Blast (kg):	4,920
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 15M		43
UNITRONIC 600 9M		43

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

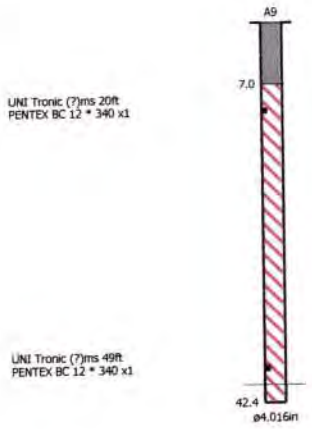
BULK TRUCK CHARGE	>/=2,000kg	<5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

ORICA The Blasting Professionals™	Customer: **Nelson** **Blast Design**	Quarry: Burlington P.O. #: Blast Date: 2017-07-04	Blast Number: 17-014 A Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Kevin Toplis

#
Quarry Manager:

Signature required, indicating sign-off on Blast Design

1085878

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
7:00	13:30
ORDER NUMBER / N° DE COMMANDE	**B/L NUMBER / N° DE CONNAISSEMENT**
2207581	85695134

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
04 Jul 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
04 Jul 2017	FOB Dest'n, Own Truck	F-73289	PT 12013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
245	PC	X	85	160	PENTEX BC 340 (49/CS)	5	89.425
160	PC	X	81	79	*uni tronic 600-06.0M CU/ZC(20')80PC	2	11.680
66	PC	X	23	43	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
72	PC	X	34	38	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
200	PC		160	40	Stem + Gravel		
					TOTAL GROSS WEIGHT		139.399 KG
					**** TOTAL PACKAGES ****	11	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI X NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE
$

NETTE No. CONV
PRESSAGE
WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
Tristan Nelly	Tristan Nely	
SIGNATURE	SIGNATURE	SIGNATURE
DATE 4 7 17 (D/J M/M Y/A)	DATE 4 7 17 (D/J M/M Y/A)	DATE (D/J M/M Y/A)

3 MEMORANDUM / MÉMORANDUM

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPEDITION PAR MESSAGERIES DOIT ETRE SIGNE PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Customer: **Nelson**

Blast Report

Quarry: Burlington | Blast Number: 17-014 B
P.O. #: | Orica Order #: 2207581
Blast Date: 2017-07-04 | Blast Time: 12:46 PM

page 1

Blaster-in-charge: Kevin Topllis (Print Name)

Blast Location: Lower middle bench (Bench / Face)
GPS Coordinates: 43.40347 °N Latitude (Centre of Blast) | 79.88363 °W Longitude (Centre of Blast)

Wind from the: SE at 10 kph | Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 9,144 m

tonnes Blasted:	21,631 te / 8,163 m³
Total tonnes per day:	33,601 te (Rate Code: TBA)
Total Holes Loaded:	36 holes
… including:	0 Dead Holes
… and:	0 Helper Holes
Helper Hole Collar:	0.0 ft avg
# Rows Blasted:	3 rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes: 36	=	2,840.4 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:	=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.5 ft avg
# Holes:	11 front row

Burden:	9.0 ft avg
Spacing:	10.5 ft avg
# Holes:	25
Bench Height:	76.9 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	78.9 ft avg

- Stone Decking -

Front Row:	15.0 ft avg
Main Body:	0.0 ft avg
# Stone Decks:	1 per blast

- Collar Stemming -

Front Row:	8.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75 clear

- Charge Length -

Front Row:	55.9 ft avg
Main Body:	71.9 ft avg

- Charge Weight -

Front Row:	163.0 kg/hole
Main Body:	209.7 kg/hole
Max. per delay:	250.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	8,678 kg
Rock Density:	2.65 g/cc = te/m³

- Powder Factor -

1.792 lb/yd³	Yield PF:	0.401 kg/te	(actual)
1.001 lb/yd³	Front row:	0.224 kg/te	(theoretical)
1.717 lb/yd³	Main Body:	0.384 kg/te	(theoretical)
###### lb/yd³	"KPI" PF:	#DIV/0! kg/te	(theoretical)

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	29,193	20,540	8,653

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	74	25.2

total explosives weight in Blast (kg): 8,678
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			36
UNITRONIC 600 30M			38

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	20
	units	

Resource Deployment:

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		14.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

blaster hours: 7.5
helper hours: 6.5
This shot was fired with 17-014 A, with a 5 second delay.
Hole A11 was loaded to 65ft, stone deck to 41ft.
Hola A10 got a 14ft collar, Hole A1 got a 10ft collar, Holes, A4+5 got 14ft collar.

ORICA The Blasting Professionals	Customer:	**Nelson**	Quarry:	Burlington	Blast Number: 17-014 B
	Blast Design		P.O. #:		Orica Order #: 2207581
			Blast Date:	2017-07-04	Blast Time: 12:46 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40345**	**79.88364**	0.757533	1.394232
Front Row Corner	43.40335	79.88349	0.757531	1.394230
Back Row Corner	43.40362	79.88376	0.757536	1.394235
Average (Centre of Blast)	43.40347	79.88363	0.757533	1.394232

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (1st Seis. From Centre of Blast)	**0.0**	m		
Post Blast Data: ppV:	**1.3**	mm/s	Trigger set at: **2.0**	mm/s
frequency:		Hz	V / T / L : **T**	(Vertical, Transverse or Longitudinal)
air overpressure:	**88.0**	dB	Trigger set at: **115**	dB

Northwest- colling rd (Nelson monitor)

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043

Distance **(2nd Seis. From Centre of Blast**	**0.0**	m		
Post Blast Data: ppV:	**12.2**	mm/s	Trigger set at: **2.0**	mm/s
frequency:		Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**95.9**	dB	Trigger set at: **115**	dB

2450 2nd concession (Nelson monitor)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	**0.0**	m		
Post Blast Data: ppV:	**4.2**	mm/s	Trigger set at: **2.0**	mm/s
frequency:		Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**88.0**	dB	Trigger set at: **115**	dB

Southwest- Camisle (Nelson monitor)

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg

jim bray

Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

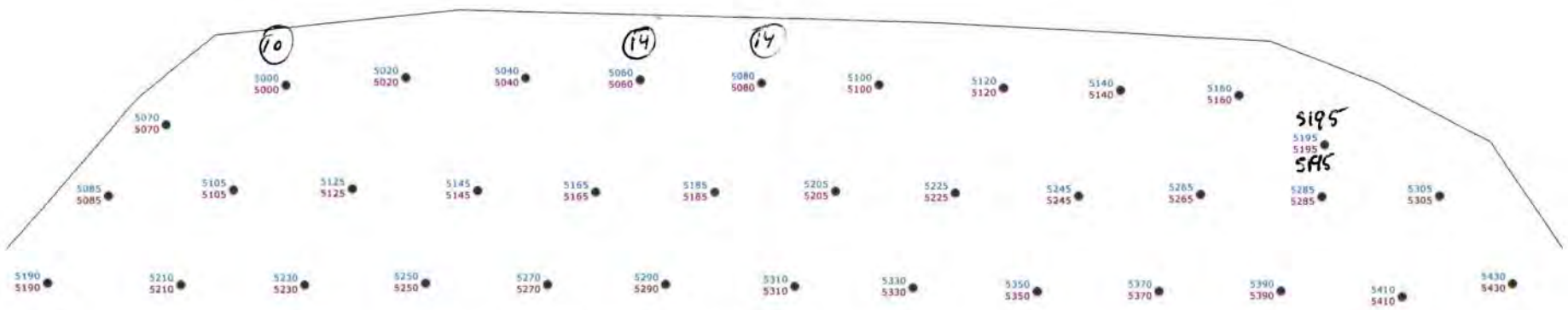
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2841.9ft	Blasted tonnage: 20,509S/T	

timing

open face



Lower Middle 17-014 Part B
12x10.5 Front Row, 9x10.5 Body
4" Hole Diamter
250m Elevation + 0.6m subdrill

Not to scale

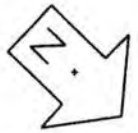
SHOTPlus 5.6.3.6		03/07/2017
Mine	Burlington	
Location	Lower Middle Bench	
Title/author	Lower Middle 17-014 Part B	Ken George
Filename	Blast_17-014_Lower_Middle_Design_Part_B.sp	

SHOTPlus 5 Plan

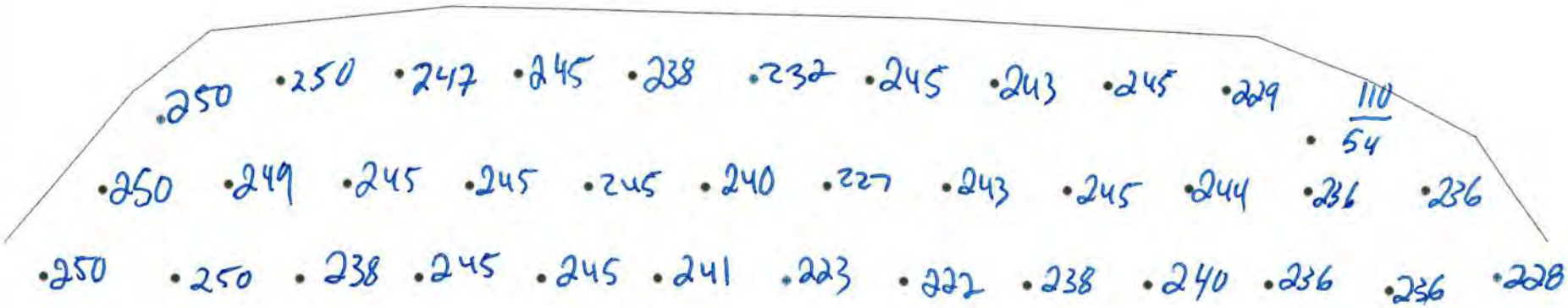
Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2841.9ft	Blasted tonnage: 20,509S/T	

load sheet
pc counter:
max load 233kg



open face



Lower Middle 17-014 Part B
12x10.5 Front Row, 9x10.5 Body
4" Hole Diamter
250m Elevation + 0.6m subdrill

Q570

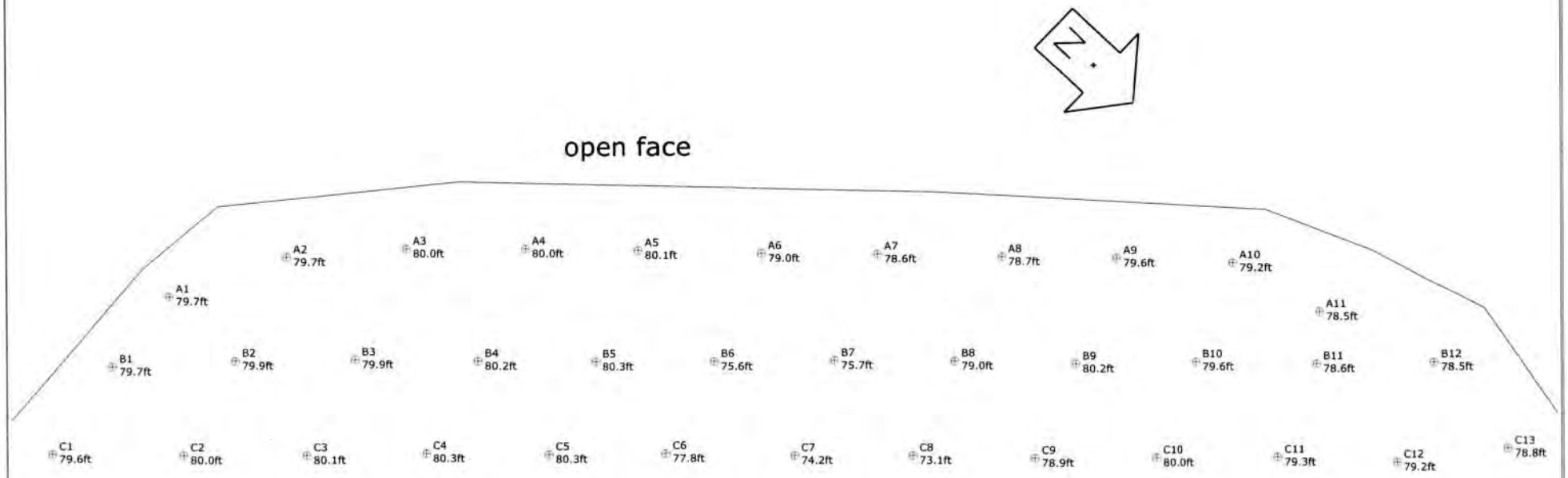
ORICA

Not to scale

SHOTPlus 5.6.3.6	03/07/2017
Mine	Burlington
Location	Lower Middle Bench
Title/author	Lower Middle 17-014 Part B Ken George
Filename	Blast_17-014_Lower_Middle_Design_Part_B.s

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2841.9ft	Blasted tonnage: 20,509S/T	



Lower Middle 17-014 Part B
12x10.5 Front Row, 9x10.5 Body
4" Hole Diamter
250m Elevation + 0.6m subdrill

Not to scale

SHOTPlus 5.6.4.3		22/06/2017
Mine	Burlington	
Location	Lower Middle Bench	
Title/author	Lower Middle 17-014 Part B	Ken Ge
Filename	Blast 17-014 Lower Middle Design Pa	

ORICA The Blasting Professionals

Customer: Nelson

Blast Design

Quarry: Burlington
P.O. #:
Design Date: 2017-07-04

Blast Number: 17-014 B
Orica Order #:

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Lower middle bench (Bench / Face)
GPS Coordinates: 43.40347 °N Latitude (Centre of Blast) 79.88363 °W Longitude (Centre of Blast)

Design te Blasted:	21,631	te
Total Holes Loaded:	36	holes
... including:	0	Dead Holes
... and:	0	Helper Holes
Helper Hole Collar:	0.0	ft avg
# Rows Blasted:	3	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 36	=	2,840.4 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden:	12.0	ft avg
Spacing:	10.5	ft avg
# Holes:	11	front row

- Design Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.5	ft avg
# Holes:	25	main body
Bench Height:	76.9	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	78.9	ft avg

- Design Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75 clear	

Bulk Explosives Req'd: kg

CENTRA GOLD 70	ChargeWt.exe	8,294

Pkgd Explosives Req'd: kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	72	24.5

total explosives weight in Blast (kg):	8,318
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 30M		36
UNITRONIC 600 9M		36

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row:	71.9	ft avg
Main Body:	71.9	ft avg

- Design Charge Weight -

Front Row:	209.7	kg/hole
Main Body:	209.7	kg/hole
Max Chge Wt / delay:	230.0	kg/delay

Required kg Loaded:	8,318	kg
Rock Density:	2.65	g/cc = te/m^3

- Design Powder Factor -

	Expected Yield PF:	0.385	kg/te (actual)
1.288 lb/yd^3	Front row:	0.288	kg/te (theoretical)
1.717 lb/yd^3	Main Body:	0.384	kg/te (theoretical)
1.574 lb/yd^3	"KPI" PF:	0.352	kg/te (theoretical)

Resource Deployment

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

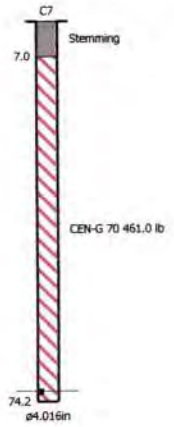
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

ORICA The Blasting Professionals™	Customer: **Nelson** **Blast Design**	Quarry: Burlington P.O. #: Blast Date: 2017-07-04	Blast Number: 17-014B Orica Order #:	

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Kevin Toplis

#
Quarry Manager:

Signature required, indicating sign off on Blast Design

Blast Report

Customer: **Nelson**

Quarry: Burlington | Blast Number: 17-015
P.O. #: | Orica Order #: 2216725
Blast Date: 2017-07-25 | Blast Time: 11:57 AM

page 1

Blaster-in-charge: Kevin Topllis (Print Name)

Blast Location: Lower middle bench (Bench / Face)
GPS Coordinates: 43.40395 °N Latitude (Centre of Blast) 79.88376 °W Longitude (Centre of Blast)

Wind from the: NE at 5 kph | Temperature: 16 to 20 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 9,144 m

tonnes Blasted:	15,057 te / 5,682 m³
Total tonnes per day:	15,057 te (Rate Code: TBA)
Total Holes Loaded:	52 holes
… including:	3 Dead Holes
… and:	0 Helper Holes
Helper Hole Collar:	0.0 ft avg
# Rows Blasted:	4 rows

- Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.5 ft avg
# Holes:	13 front row

- Drilling Information -

			Angle from Vertical				Nominal Bit Diameter:	
Primary Bit diam:	101.6	mm	0°	# Holes:	52	=	2,184.0 ft	(4 " diam)
Secondary Bit diam:		mm	°	# Holes:		=	0.0 ft	(" diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft	(" diam)

Burden:	9.0 ft avg
Spacing:	10.5 ft avg
# Holes:	39
Bench Height:	40.0 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	42.0 ft avg

- Stone Decking -

Front Row:	0.0 ft avg
Main Body:	0.0 ft avg
# Stone Decks:	0 per blast

- Collar Stemming -

Front Row:	9.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75 clear

- Charge Length -

Front Row:	33.0 ft avg
Main Body:	35.0 ft avg

- Charge Weight -

Front Row:	96.2 kg/hole
Main Body:	102.1 kg/hole
Max. per delay:	125.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	5,848 kg
Rock Density:	2.65 g/cc = te/m³

Theoretical PF (Based on a single hole)

- Powder Factor -

1.735 lb/yd³	Yield PF:	0.388 kg/te	(actual)
1.136 lb/yd³	Front row:	0.254 kg/te	(theoretical)
1.607 lb/yd³	Main Body:	0.360 kg/te	(theoretical)
###### lb/yd³	"KPI" PF:	#DIV/0! kg/te	(theoretical)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,100	21,270	5,830

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	52	17.7

total explosives weight in Blast (kg): 5,848
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 15M			52

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		12.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

blaster hours: 6.5
helper hours: 5.5
Tech hours: GPS 1hr
adjusted collars to holes: A1,3,4-10ft +O21:AA54A7,8-11ft A9,10,11-10ft A12-12ft A13-B1, C1, D1-10ft X1-20ft X2-12ft X3-10ft

ORICA The Blasting Professionals	Customer:	**Nelson**	Quarry:	Burlington	Blast Number: 17-015
	Blast Design		P.O. #:		Orica Order #: 2216725
			Blast Date:	2017-07-25	Blast Time: 11:57 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40393**	**79.88378**	0.757542	1.394235
Front Row Corner	43.40406	79.88393	0.757544	1.394238
Back Row Corner	43.40385	79.88356	0.757540	1.394231
Average (Centre of Blast)	43.40395	79.88376	0.757542	1.394235

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (1st Seis. From Centre of Blast)	**0.0** m			
	Post Blast Data: ppV:	**1.1** mm/s	Trigger set at: **2.0** mm/s		
	frequency:	Hz	V / T / L : **T** (Vertical, Transverse or Longitudinal)		
	air overpressure:	**112.8** dB	Trigger set at: **115** dB		
	Northwest- colling rd (Nelson monitor)				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.71939	80.38847	0.763047	1.403043
	2nd Reading				
	Average	43.71939	80.38847	0.763047	1.403043
	Distance **(2nd Seis. From Centre of Blast**	**0.0** m			
	Post Blast Data: ppV:	**3.6** mm/s	Trigger set at: **2.0** mm/s		
	frequency:	Hz	V / T / L : **?** (Vertical, Transverse or Longitudinal)		
	air overpressure:	**91.5** dB	Trigger set at: **115** dB		
	2450 2nd concession (Nelson monitor)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	**0.0** m			
	Post Blast Data: ppV:	**2.2** mm/s	Trigger set at: **2.0** mm/s		
	frequency:	Hz	V / T / L : **?** (Vertical, Transverse or Longitudinal)		
	air overpressure:	**88.0** dB	Trigger set at: **115** dB		
	Southwest- Camisle (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg

jim bray

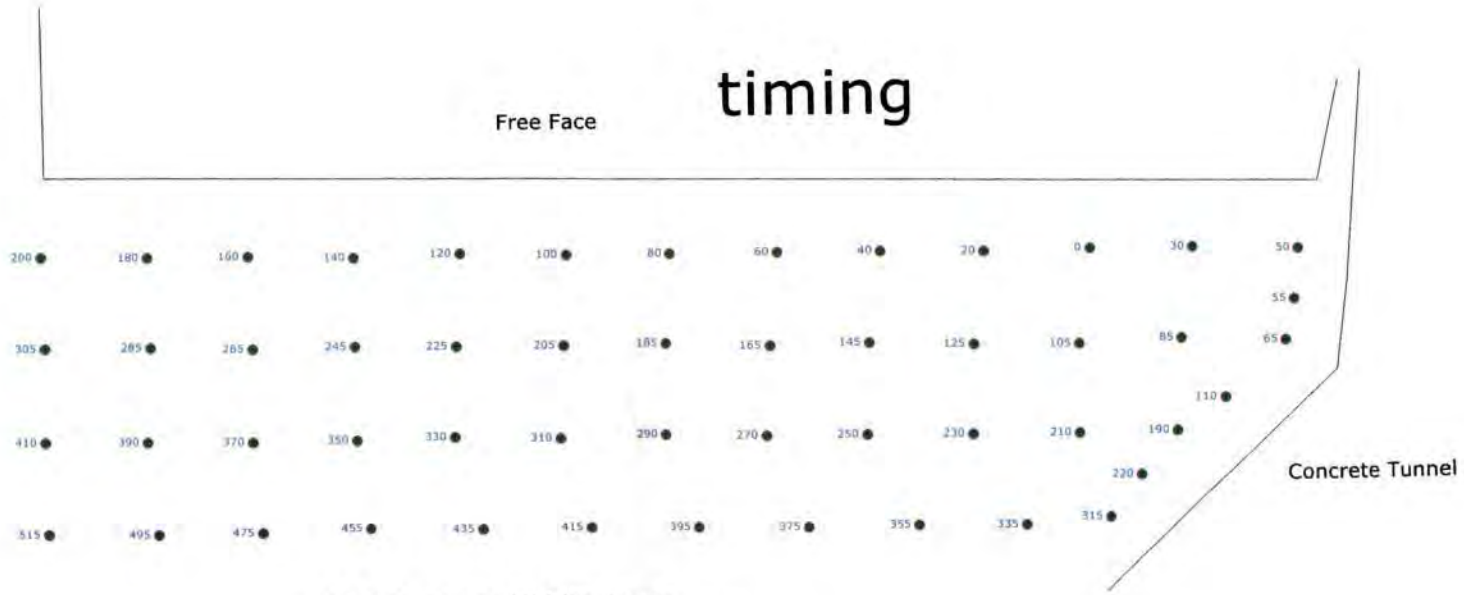
Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 52	Hole angle: 0.0°
Total drilled: 2188.5ft			



17-015 Lower Middle Bench
12' X 10.5' Front Row - 9' X 10.5' Body
4" Drill Bit
250 Floor Elevation + .6 Sub

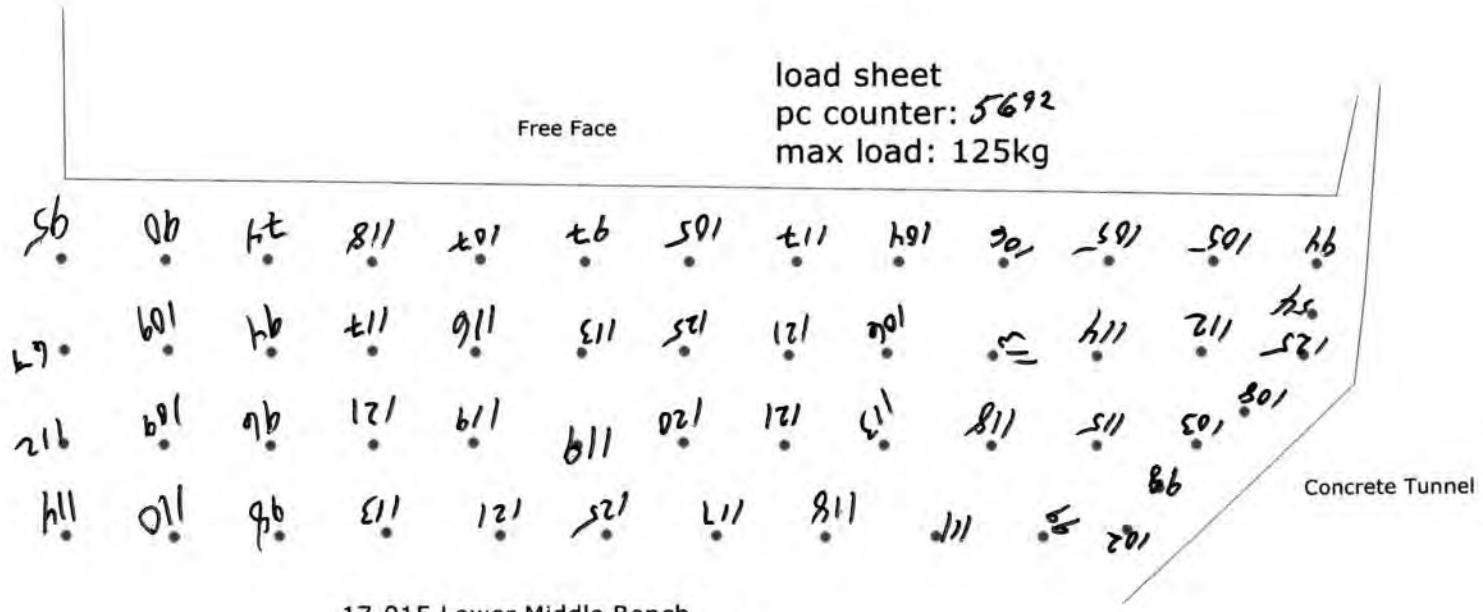
Not to scale

SHOTPlus 5.6.3.6		24/07/2017
Mine	Burlington	
Location		
Title/author	17-015 Lower Middle Bench G. Palcso	
Filename	17-015_Lower_Middle_Bench_Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 52	Hole angle: 0.0°
Total drilled: 2188.5ft			



17-015 Lower Middle Bench
12' X 10.5' Front Row - 9' X 10.5' Body
4" Drill Bit
250 Floor Elevation + .6 Sub

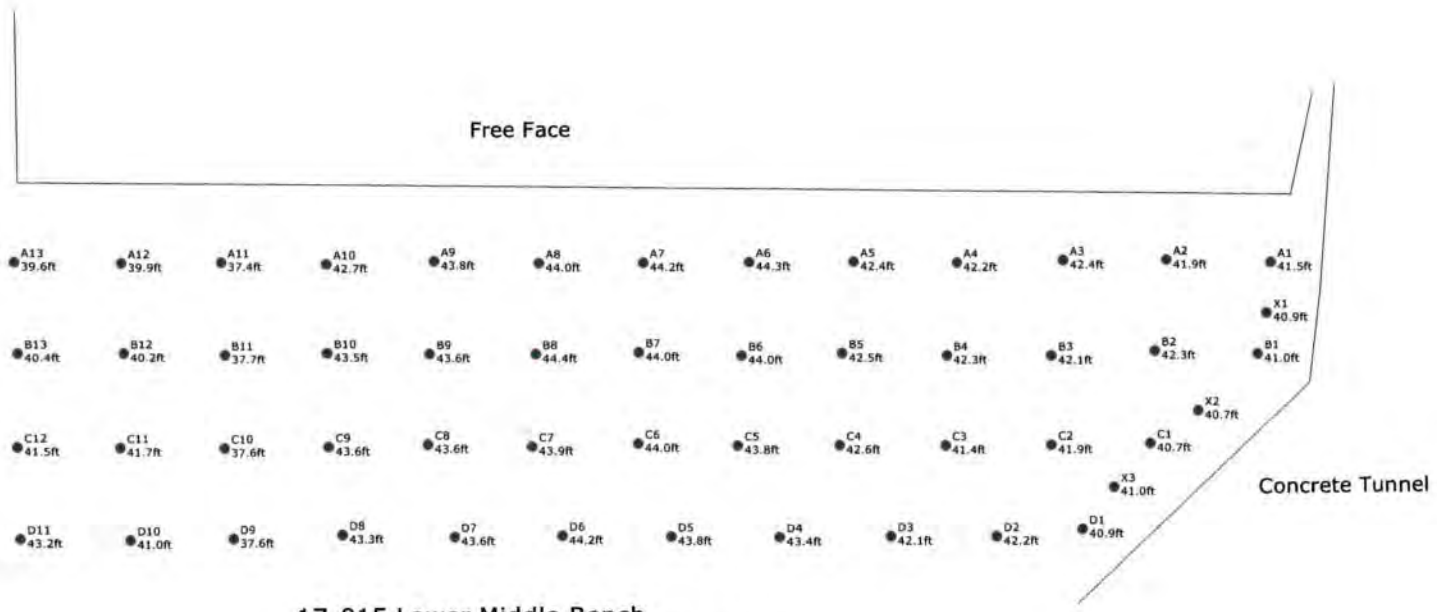
Not to scale

SHOTPlus 5.6.3.6		24/07/2017
Mine	Burlington	
Location		
Title/author	17-015 Lower Middle Bench G. Palcso	
Filename	17-015_Lower_Middle_Bench_Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 52	Hole angle: 0.0°
Total drilled: 2188.5ft			



17-015 Lower Middle Bench
12' X 10.5' Front Row - 9' X 10.5' Body
4" Drill Bit
250 Floor Elevation + .6 Sub

Not to scale

SHOTPlus 5.6.3.6		24/07/2017
Mine	Burlington	
Location		
Title/author	17-015 Lower Middle Bench G. Palcso	
Filename	17-015_Lower_Middle_Bench_Final.spf	

ORICA The Blasting Professionals

Customer: Nelson

Blast Design

Quarry: Burlington
P.O. #:
Design Date: 2017-07-25

Blast Number: 17-015
Orica Order #:

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Lower middle bench (Bench / Face)
GPS Coordinates: 43.40395 °N Latitude (Centre of Blast) 79.88376 °W Longitude (Centre of Blast)

Design te Blasted:	15,057	te					
Total Holes Loaded:	52	holes					
... including:	3	Dead Holes					
... and:	0	Helper Holes					
Helper Hole Collar:	0.0	ft avg					
# Rows Blasted:	4	rows					

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:		
Primary Bit diam:	101.6	mm	0 °	# Holes:	52	=	2,184.0 ft (4	" diam)
Secondary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (	" diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (	" diam)

- Design Pattern (Front Row) -

Burden:	12.0	ft avg
Spacing:	10.5	ft avg
# Holes:	13	front row

- Design Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.5	ft avg
# Holes:	39	main body
Bench Height:	40.0	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	42.0	ft avg

- Design Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg

- Design Collar Stemming -

Front Row:	8.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75 clear	

- Design Charge Length -

Front Row:	34.0	ft avg
Main Body:	35.0	ft avg

- Design Charge Weight -

Front Row:	99.1	kg/hole
Main Body:	102.1	kg/hole
Max Chge Wt / delay:	115.0	kg/delay

Required kg Loaded:	5,842	kg
Rock Density:	2.65	g/cc = te/m^3

- Design Powder Factor -

	Expected Yield PF:	0.388	kg/te (actual)
1.171 lb/yd^3	Front row:	0.262	kg/te (theoretical)
1.607 lb/yd^3	Main Body:	0.360	kg/te (theoretical)
1.498 lb/yd^3	"KPI" PF:	0.335	kg/te (theoretical)

Bulk Explosives Req'd:

		kg
CENTRA GOLD 70	ChargeWt.exe	5,824

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	52	17.7

total explosives weight in Blast (kg):	5,842
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 15M		52

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

1086292

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
6:50	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2216725	85716915

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
25 Jul 2017	00:00:00	NELSON AGGREGATE COMPANY	N/A

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
25 Jul 2017	FOB Dest'n, Own Truck	F-73289	16055

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
98	PC	X	46	52	PENTEX BC 340 (49/CS)	2	35.770
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	80	0	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
132	PC	X	80	52	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
100	PC		100	0	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		70.722 KG
					**** TOTAL PACKAGES ****	6	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

ADDITIONAL INFORMATION / RENSEIGNEMENTS SUPPLÉMENTAIRES

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ✓ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE
$

NETTE No. CONV
PRESSAGE
WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Neil Knight	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Neil Knight	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE: 25 07 17 (D/J M/M Y/A)	SIGNATURE	DATE: 25 07 17 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Customer: **Nelsons**

Blast Report

Quarry: Burlington | Blast Number: 17-016
P.O. #: NA | Orica Order #: 2232326
Blast Date: 2017-08-30 | Blast Time: 12:01 PM

page 1

Blaster-in-charge: Mitch Ossington (Print Name)

Blast Location: South face (Bench / Face)
GPS Coordinates: 43.39837 °N Latitude (Centre of Blast) | 79.88412 °W Longitude (Centre of Blast)

Wind from the: SW at 5 kph | Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30000ft m

	tonnes Blasted:	16,211 te	6,118 m³
	Total tonnes per day:	16,211 te	TBA Rate Code
	Total Holes Loaded:	28 holes	
	… including:	0 Dead Holes	
	… and:	3 Helper Holes	
	Helper Hole Collar:	7.0 ft avg	
	# Rows Blasted:	3 rows	
	- Pattern (Front Row)-		
	Burden:	10.0 ft avg	
	Spacing:	10.5 ft avg	
	# Holes:	14 front row	
	- Pattern (Main Body) -		
	Burden:	10.0 ft avg	
	Spacing:	10.5 ft avg	
	# Holes:	14 main body	
	Bench Height:	82.3 ft avg	
	Sub-drill:	2.0 ft avg	
	Hole Depth:	84.3 ft avg	
	- Stone Decking -		
	Front Row:	4.0 ft avg	
	Main Body:	4.0 ft avg	
	# Stone Decks:	28 per blast	
	- Collar Stemming -		
	Front Row:	10.0 ft avg	
	Main Body:	7.0 ft avg	
	Material used:	1/2" crush	
	- Charge Length -		
	Front Row:	70.3 ft avg	
	Main Body:	73.3 ft avg	
	- Charge Weight -		
	Front Row:	205.0 kg/hole	
	Main Body:	213.7 kg/hole	
	Max. per delay:	150.0 kg/delay	
	SD () Equation:	0.0 kg/delay	
	Total kg Loaded:	6,808 kg	
	Rock Density:	2.65 g/cc = te/m³	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

- Powder Factor -

1.876 lb/yd³	Yield PF:	0.420 kg/te (actual)
1.412 lb/yd³	Front row:	0.316 kg/te (theoretical)
1.472 lb/yd³	Main Body:	0.330 kg/te (theoretical)
1.464 lb/yd³	"KPI" PF:	0.328 kg/te (theoretical)

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes: 28	=	2,360.4 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:	=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,280	20,510	6,770

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	112	38.1

total explosives weight in Blast (kg): 6,808
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			28
UNITRONIC 600 20M			28
UNITRONIC 600 30M			56

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Blaster Hours= 6hr
Helper Hours= 10hrs

Customer:	**Nelsons**	Quarry:	Burlington
	Blast Design	P.O. #:	NA
		Blast Date:	2017-08-30
		Blast Number:	17-016
		Orica Order #:	2232326
		Blast Time:	12:01 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39827	79.88426	0.757443	1.394243
Front Row Corner	43.39837	79.88413	0.757444	1.394241
Back Row Corner	43.39847	79.88398	0.757446	1.394238
Average (Centre of Blast)	43.39837	79.88412	0.757444	1.394241

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	1.1	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
air overpressure:	107.5	dB	Trigger set at: 115	dB
Colling Rd				

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance **(2nd Seis. From Centre of Blast**	0.0	m		
Post Blast Data: ppV:	1.5	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	91.5	dB	Trigger set at: 115	dB
2450 #2 sideroad				

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	1.5	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	88.0	dB	Trigger set at: 115	dB
Camisle				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

jim bray

Orica
Blaster-in-charge: Mitch Ossington

Signature required, indicating that
Blast Report is Complete & Accurate.

ORICA The Blasting Professionals

Customer: Nelsons

Blast Design

Quarry: Burlington
P.O. #: NA
Design Date: 2017-08-30

Blast Number: 17-016
Orica Order #:

page 1

Blaster-in-charge: Mitch Ossington (Print Name)

Blast Location: South Face (Bench / Face)
GPS Coordinates: 43.39805 °N Latitude (Centre of Blast) 79.88433 °W Longitude (Centre of Blast)

Design te Blasted:	18,157	te
Total Holes Loaded:	28	holes
... including:	0	Dead Holes
... and:	3	Helper Holes
Helper Hole Collar:	7.0	ft avg
# Rows Blasted:	3	rows

- Drilling Information -

		Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0°	# Holes:	28	=	2,360.4 ft (4 " diam)
Secondary Bit diam:	mm	0°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:	mm	0°	# Holes:		=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	10.0	ft avg
Spacing:	10.5	ft avg
# Holes:	14	front row

- Design Pattern (Main Body) -

Burden:	10.0	ft avg
Spacing:	10.5	ft avg
# Holes	14	main body
Bench Height:	82.3	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	84.3	ft avg

- Design Stone Decking -

Front Row:	4.0	ft avg
Main Body:	4.0	ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	1/2" crush	

- Design Charge Length -

Front Row:	73.3	ft avg
Main Body:	73.3	ft avg

- Design Charge Weight -

Front Row:	213.7	kg/hole
Main Body:	213.7	kg/hole
Max Chge Wt / delay:	130.0	kg/delay

Required kg Loaded:	6,551	kg
Rock Density:	2.65	g/cc = te/m³

Bulk Explosives Req'd:

		kg
CENTRA GOLD 70	ChargeWt.exe	6,500

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 16 (OR EQUIVALENT)	0.45	112	50.8

total explosives weight in Blast (kg):	6,551
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 30M		56
UNITRONIC 600 20M		28
UNITRONIC 600 9M		28

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	
	units	

- Design Powder Factor -

	Expected Yield PF:	0.361	kg/te (actual)
1.472 lb/yd³	Front row:	0.330	kg/te (theoretical)
1.472 lb/yd³	Main Body:	0.330	kg/te (theoretical)
1.472 lb/yd³	"KPI" PF:	0.330	kg/te (theoretical)

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Fee per Blast)		1
BORETRACK	Enter "1" if Boretraked		
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

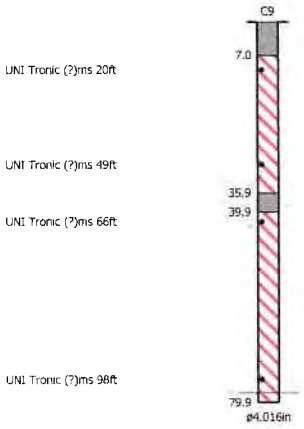
Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

130 kg in bottom deck. Bob the top deck to collar.

ORICA The Blasting Professionals	Customer: **Nelsons** Blast Design	Quarry: Burlington P.O. #: Blast Date: 2017-08-30	Blast Number: 17-019 Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Mitch Ossington

#
Quarry Manager:

Signature required, indicating sign off on Blast Design

1086863

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	845
TIME OUT / HEURE SORTIE	1230
ORDER NUMBER / N° DE COMMANDE	2232326
B/L NUMBER / N° DE CONNAISSEMENT	85752392

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
30 Aug 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
30 Aug 2017	FOB Dest'n, Own Truck	F-73289	

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG / MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
196	PC	X	84	112	PENTEX BC 340 (49/CS)	4	71.540
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	52	28	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
66	PC	X	38	28	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
72	PC	X	16	56	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
100	PC		100	0	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		118.552 KG
					**** TOTAL PACKAGES ****	9	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT (YES / OUI — NO / NON)	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA:
ERAP 2-1510	1-877-561-3636		Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: [illegible]	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: [illegible]	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR: [illegible]
SIGNATURE: [signature]	DATE: 30 8 17 (D/J M/M Y/A)	SIGNATURE: [signature]
SIGNATURE: [signature]	DATE: 30 8 17 (D/J M/M Y/A)	SIGNATURE: [signature]
SIGNATURE:	DATE: (D/J M/M Y/A)	

3 MEMORANDUM / MÉMORANDUM

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPEDITION PAR MESSAGERIES DOIT ETRE SIGNE PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

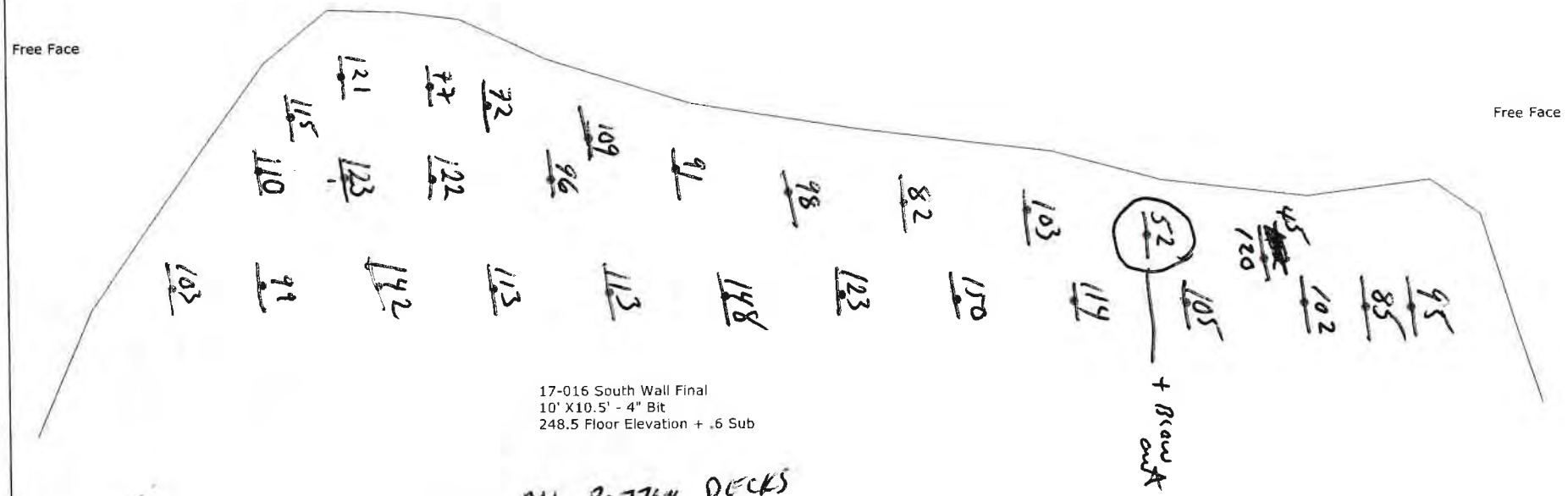
SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 10.0ft	Hole Diameter: 4.0in	Number of holes: 28	Hole angle: 0.0°
Total drilled: 2362.0ft			



17-016 South Wall Final
10' X10.5' - 4" Bit
248.5 Floor Elevation + .6 Sub

ALL BOTTOM DECKS TOOK 130 Kg UNLESS MARKED.

ORICA

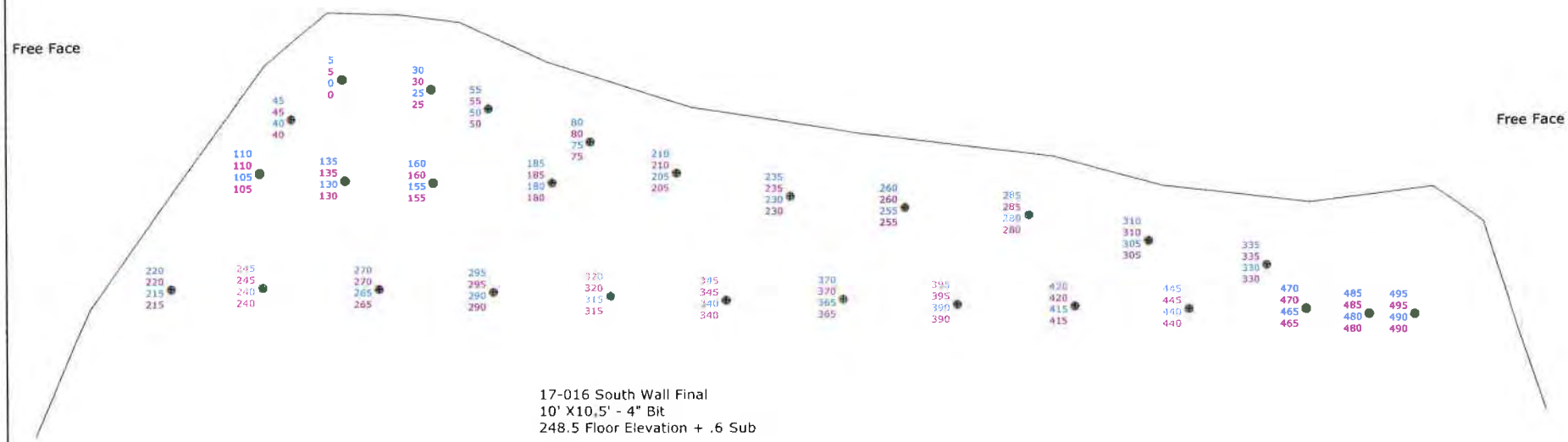
Scale 1:175

SHOTPlus 5.6.2.7		29/08/2017
Mine	Burlington	
Location		
Title/author	17-016 South Wall Final G. Palcso	
Filename	17-016 South Wall Final Timing.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 10.0ft	Hole Diameter: 4.0in	Number of holes: 28	Hole angle: 0.0°
Total drilled: 2362.0ft			



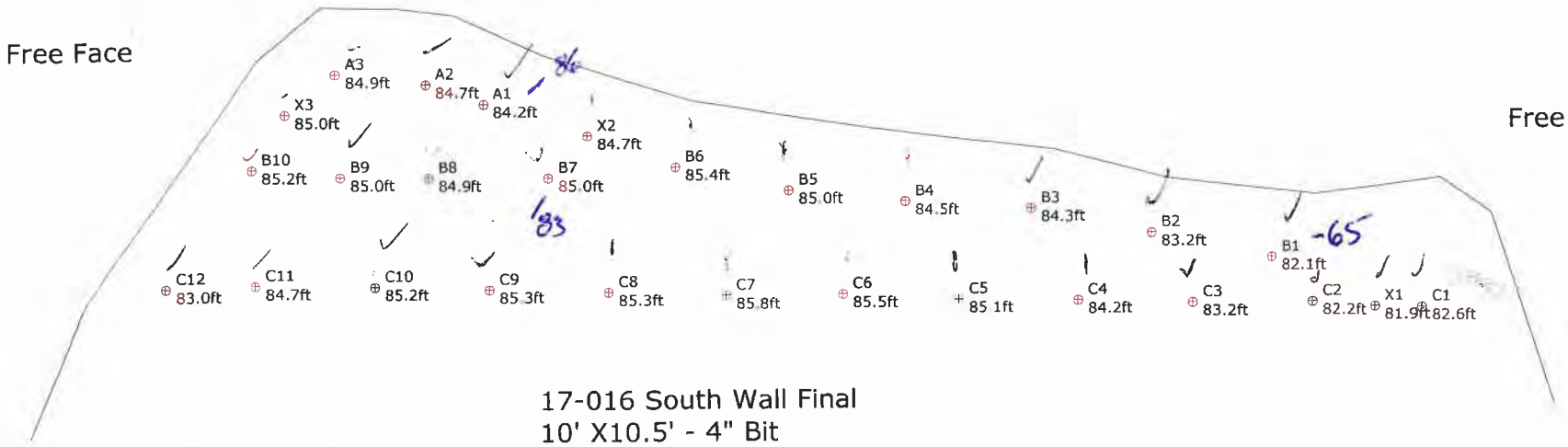
ORICA

Scale 1:175

SHOTPlus 5.6.2.7		29/08/2017
Mine	Burlington	
Location		
Title/author	17-016 South Wall Final G. Palcso	
Filename	17-016 South Wall Final Timing.spf	

SHOTPlus 5 Plan

Blast Summary Data			
Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 10.0ft	Hole Diameter: 4.0in	Number of holes: 28	Hole angle: 0.0°
Total drilled: 2362.1ft			



17-016 South Wall Final
10' X10.5' - 4" Bit
248.5 Floor Elevation + .6 Sub

over drilled 2' needs to be backfilled.

Not to scale

ShotPlus5 5.2.29.0		13/07/2017
Mine	Burlington	
Location		
Title/author	17-016 South Wall Final G. Palcso	
Filename	17-016 South Wall Final.spf	

Blast Report

Customer: **Nelson**

Quarry: Burlington | Blast Number: 17-017
P.O. #: | Orica Order #: 2220757
Blast Date: 2017-08-03 | Blast Time: 12:41 PM

page 1

Blaster-in-charge: Kevin Topllis (Print Name)

Blast Location: Upper middle bench (Bench / Face)
GPS Coordinates: 43.40358 °N Latitude (Centre of Blast) | 79.88363 °W Longitude (Centre of Blast)

Wind from the: N at 0 kph | Temperature: 26 to 30 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	x

Ceiling: 9,144 m

tonnes Blasted:	11,832 te	4,465 m^3	
Total tonnes per day:	11,832 te	TBA	Rate Code
Total Holes Loaded:	23 holes		
… including:	2 Dead Holes		
… and:	0 Helper Holes		
Helper Hole Collar:	0.0 ft avg		
# Rows Blasted:	4 rows		

- Drilling Information -

		Angle from Vertical				Nominal Bit Diameter:	
Primary Bit diam:	101.6 mm	0°	# Holes:	7	=	539.7 ft (4 " diam)	
Secondary Bit diam:	114.3 mm	°	# Holes:	6	=	462.6 ft (4 1/2 " diam)	
Tertiary Bit diam:	127.0 mm	°	# Holes:	8	=	616.8 ft (5 " diam)	

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.5	ft avg
# Holes:	4	front row

Burden:	9.0	ft avg
Spacing:	10.5	ft avg
# Holes:	19	
Bench Height:	75.1	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	77.1	ft avg

- Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg
# Stone Decks:	0	per blast

- Collar Stemming -

Front Row:	9.0	ft avg
Main Body:	8.0	ft avg
Material used:	.75 clear	

- Charge Length -

Front Row:	68.1	ft avg
Main Body:	69.1	ft avg

- Charge Weight -

Front Row:	198.6	kg/hole
Main Body:	201.5	kg/hole
Max. per delay:	393.0	kg/delay
SD () Equation:	0.0	kg/delay
Total kg Loaded:	5,876	kg
Rock Density:	2.65	g/cc = te/m^3

Theoretical PF (Based on a single hole)

- Powder Factor -

2.218 lb/yd^3	Yield PF:	0.497 kg/te	(actual)
1.249 lb/yd^3	Front row:	0.280 kg/te	(theoretical)
1.690 lb/yd^3	Main Body:	0.378 kg/te	(theoretical)
###### lb/yd^3	"KPI" PF:	#DIV/0! kg/te	(theoretical)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	31,090	25,230	5,860

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	46	15.6

total explosives weight in Blast (kg): 5,876
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 30M			26
UNITRONIC 600 9M			20

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	2
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)		1
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		13.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Blaster hours: 7
helper hours: 6
B1 and X1 are 6"
Ajusted collars to holes: A1-23ft, A2-16ft, A3-14ft, A4-16ft, A5-20ft, B1-20ft, C1-15ft
C6-load to 63ft 10ft collar, D1-20ft, D7-12ft, D8-12ft, X1 load to 35ft 10ft collar, X2-28ft
Holes C6, X1 and X2 got 2 30m uni,

Customer:	**Nelson**	Quarry:	Burlington
	Blast Design	P.O. #:	
		Blast Date:	2017-08-03
		Blast Number:	17-017
		Orica Order #:	2220757
		Blast Time:	12:41 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40358**	**79.88365**	0.757535	1.394233
Front Row Corner	43.40365	79.88370	0.757537	1.394234
Back Row Corner	43.40350	79.88355	0.757534	1.394231
Average (Centre of Blast)	43.40358	79.88363	0.757535	1.394232

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (1st Seis. From Centre of Blast)	**0.0**	m		
Post Blast Data: ppV:	**did**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**not**	Hz	V / T / L : **T**	(Vertical, Transverse or Longitudinal)
air overpressure:	**trigger**	dB	Trigger set at: **115**	dB

Northwest- colling rd (Nelson monitor)

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043

Distance **(2nd Seis. From Centre of Blast**	**0.0**	m		
Post Blast Data: ppV:	**2.9**	mm/s	Trigger set at: **2.0**	mm/s
frequency:		Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**88.0**	dB	Trigger set at: **115**	dB

2450 2nd concession (Nelson monitor)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	**0.0**	m		
Post Blast Data: ppV:	**1.3**	mm/s	Trigger set at: **2.0**	mm/s
frequency:		Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**88.0**	dB	Trigger set at: **115**	dB

Southwest- Camisle (Nelson monitor)

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg

jim bray

Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 23	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1775.1ft	Blasted tonnage: 18,453S/T	

Timing

A2, A3, B4, B5, D7, and D8 are 4.5" Diameter
A1, B1, C1, D1, X1, X2, B6, and C6 are 5" Diameter
all other holes drill 4" Diameter

open face

Upper Middle 17-017 Final
12x10.5 9x10.5 Pattern
4" - 4.5" - 5" Hole Diameter
250m Elevation + 0.6m Subdrill

Not to scale

SHOTPlus 5.6.3.6		03/08/2017
Mine		
Location		
Title/author	Middle/ Upper 17-015 Design	G. Palcso
Filename	17-017_Upper_Middle_Final.spf	

Blast Summary Data

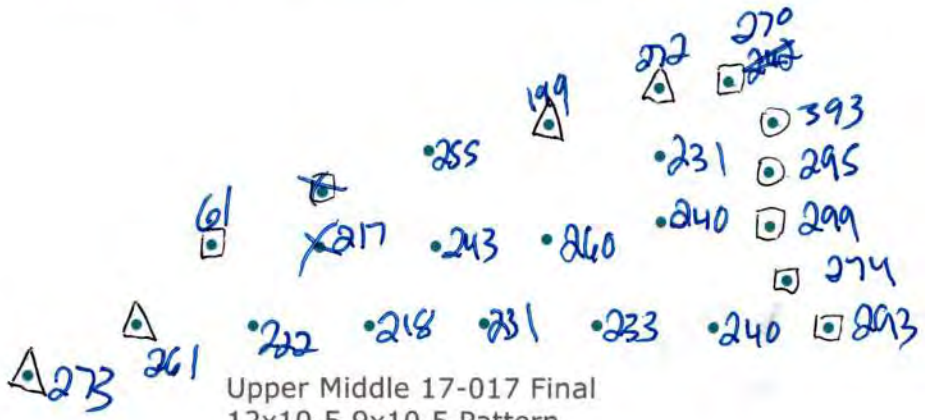
Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 23	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1775.1ft	Blasted tonnage: 14,442S/T	

O - 6"
□ - 5"
△ - 4.5"

A2, A3, B4, B5, D7, and D8 are 4.5" Diameter
A1, B1, C1, D1, X1, X2, B6, and C6 are 5" Diameter
all other holes drill 4" Diameter

load sheet
pc counter:

open face



Upper Middle 17-017 Final
12x10.5 9x10.5 Pattern
4" - 4.5" - 5" Hole Diameter
250m Elevation + 0.6m Subdrill

5731 kgs

ORICA

Not to scale

SHOTPlus 5.6.3.6	03/08/2017
Mine	
Location	
Title/author	Middle/ Upper 17-015 Design G. Palcso
Filename	17-017_Upper_Middle_Final.spf

ORICA The Blasting Professionals

Customer: Nelson

Blast Design

Quarry: Burlington
P.O. #:
Design Date: 2017-08-03

Blast Number: 17-017
Orica Order #: 2220757

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Upper middle bench (Bench / Face)
GPS Coordinates: 43.40358 °N Latitude (Centre of Blast) 79.88363 °W Longitude (Centre of Blast)

Design te Blasted:	11,670	te
Total Holes Loaded:	23	holes
... including:	2	Dead Holes
... and:	0	Helper Holes
Helper Hole Collar:	0.0	ft avg
# Rows Blasted:	4	rows

- Drilling Information -

		Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0 °	# Holes:	9 =	693.9 ft (4 " diam)
Secondary Bit diam:	114.3 mm	0 °	# Holes:	6 =	462.6 ft (4 1/2 " diam)
Tertiary Bit diam:	127.0 mm	0 °	# Holes:	8 =	616.8 ft (5 " diam)

- Design Pattern (Front Row) -

Burden:	12.0	ft avg
Spacing:	10.5	ft avg
# Holes:	3	front row

- Design Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.5	ft avg
# Holes:	20	main body
Bench Height:	75.1	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	77.1	ft avg

- Design Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg

- Design Collar Stemming -

Front Row:	8.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75 clear	

Bulk Explosives Req'd:

		kg
CENTRA GOLD 70	ChargeWt.exe	

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	52	17.7

total explosives weight in Blast (kg):	18
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 30M		23

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row:	69.1	ft avg
Main Body:	70.1	ft avg

- Design Charge Weight -

Front Row:	201.5	kg/hole
Main Body:	204.4	kg/hole
Max Chge Wt / delay:		kg/delay

Required kg Loaded:	18	kg
Rock Density:	2.65	g/cc = te/m^3

- Design Powder Factor -

	Expected Yield PF:	0.002	kg/te (actual)
1.267 lb/yd^3	Front row:	0.284	kg/te (theoretical)
1.714 lb/yd^3	Main Body:	0.384	kg/te (theoretical)
1.603 lb/yd^3	"KPI" PF:	0.359	kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

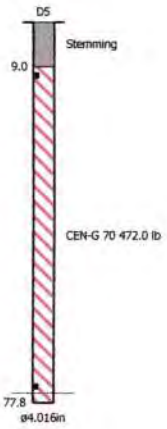
Services Req'd:

BULK TRUCK CHARGE	<2,000kg	
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS	Must be pre-authorized	

ORICA The Blasting Professionals	Customer: **Nelson** **Blast Design**	Quarry:	Burlington	Blast Number:	17-017
		P.O. #:		Orica Order #:	
		Blast Date:	2017-08-03		

page 2

Paste ShotPlus Diagram inside Rectangle



Orica
Blaster-in-charge: Kevin Toplis

#
Quarry Manager:

Signature required, indicating sign off on Blast Design

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 23	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1775.1ft	Blasted tonnage: 14,442S/T	

A2, A3, B4, B5, D7, and D8 are 4.5" Diameter
A1, B1, C1, D1, X1, X2, B6, and C6 are 5" Diameter
all other holes drill 4" Diameter

open face

Upper Middle 17-017 Final
12x10.5 9x10.5 Pattern
4" - 4.5" - 5" Hole Diameter
250m Elevation + 0.6m Subdrill

ORICA

Not to scale

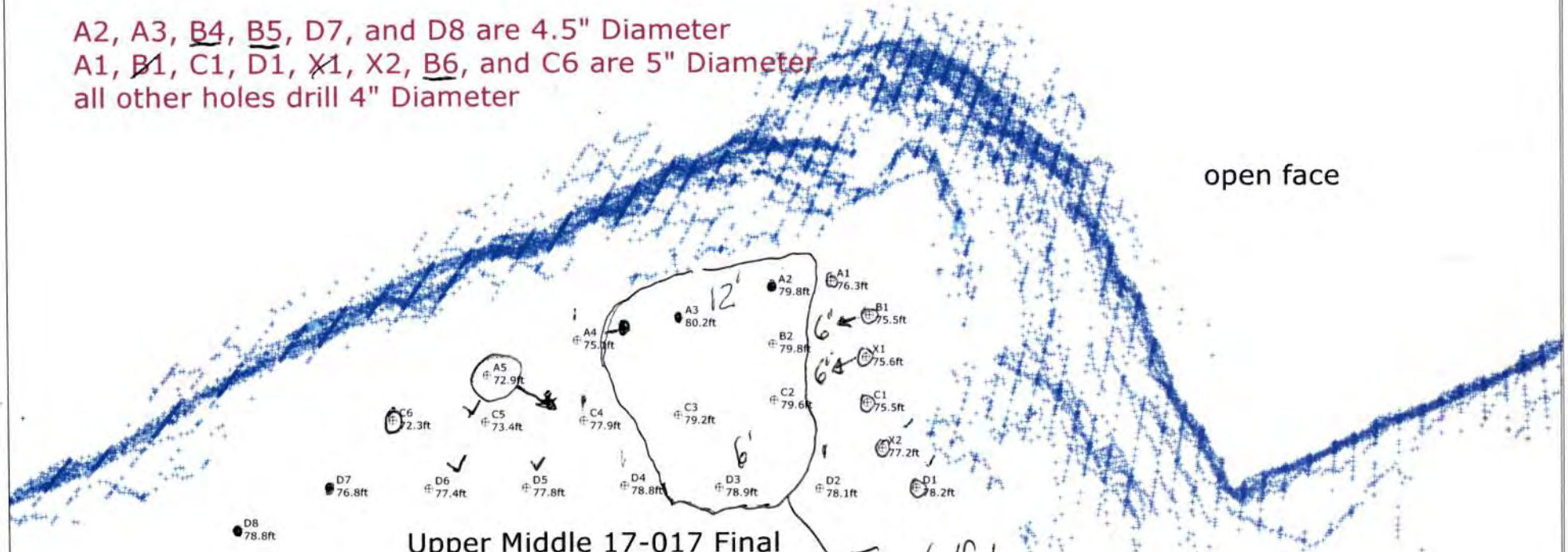
SHOTPlus 5.6.3.6	03/08/2017
Mine	
Location	
Title/author	Middle/ Upper 17-015 Design G. Palcso
Filename	17-017_Upper_Middle_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 23	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1775.1ft	Blasted tonnage: 14,442S/T	

A2, A3, B4, B5, D7, and D8 are 4.5" Diameter
A1, B1, C1, D1, X1, X2, B6, and C6 are 5" Diameter
all other holes drill 4" Diameter



Upper Middle 17-017 Final
12x10.5 9x10.5 Pattern
4" - 4.5" - 5" Hole Diameter
250m Elevation + 0.6m Subdrill

Top shelf loop
layered Rock 12' front - 6' Back

holes overdrilled need to be backfilled

ORICA

Not to scale

INDEMNITY & RELEASE AGREEMENT

Orica	**Orica Canada Inc.**, a Canadian corporation with its principal place of business at 301 Hotel de Ville, Brownsburg, Quebec J8G 3B5 ("Orica")
Customer	**Cox Construction Limited**, with a place of business at 965 York Road, Guelph, Ontario Canada.
Date	June 1, 2017
Site	Nelson Aggregates, Burlington Quarry
Blasting Plan	Crushing production requires that a the crushing plant and other equipment and property be left in the designated blast area during the blast. Crusher is 64 meters from blast.

Subject to the terms and conditions of this Indemnity & Release Agreement (this "Agreement"), Orica has agreed to perform certain blasting services (the "Services") for Customer in accordance with the Blasting Plan. Customer recognizes and acknowledges that the performance of the Services in accordance with the Blasting Plan, despite the use of best practices, subjects Orica and Customer to increased risks (a) that the intended blasting results will not be obtained, and (b) of injury and/or death to persons and damage and/or destruction to real and personal property, including without limitation, any property listed above in the Blasting Plan.

Customer, for itself and its parent companies, subsidiaries, shareholders, affiliates and each of their respective agents, representatives, managers, members, directors, officers, employees, heirs, executors, successors and assigns (the "Customer Parties"), shall forever release, discharge, defend and indemnify Orica, its direct and indirect shareholders, subsidiaries, affiliates and parent companies, and each of their respective agents, representatives, managers, members, directors, officers, employees, successors and assigns (collectively, the "Orica Parties"), of, from and against each and every claim made, asserted or threatened and any and all disputes, suits, losses, demands, actions, causes of action, damages, compensation, costs, fees, expenses, interest, awards, judgment, diminution in value, fines, contracts, covenants, obligations, liens, debts and liabilities of every kind and nature whatsoever, presently known or unknown, that the Customer Parties or any third party may now or in the future claim, assert or have, whether in tort, contract, law, equity or otherwise, against the Orica Parties, resulting from, arising out of or relating in any way to the performance of the Services in accordance with the Blasting Plan.

This Agreement constitutes the entire agreement between Customer and Orica with respect to all matters referred to herein and there is no other understanding, agreement, warranty or representation whether express or implied (whether by statute or otherwise) in any way extending, defining or otherwise relating to this Agreement. This Agreement may only be varied or amended by an agreement in writing between Orica and Customer. This Agreement shall be governed and construed in accordance with the laws of the Province of Ontario, without reference to its rules regarding conflicts of laws. This Agreement may be executed by electronic signature and in one or more counterparts.

Cox Constuction Limited

By: Bill White

Name: Bill White

Title: Super

1086458

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	7:00
TIME OUT / HEURE SORTIE	1:00
ORDER NUMBER / N° DE COMMANDE	2220757
B/L NUMBER / N° DE CONNAISSEMENT	85726282

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
03 Aug 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
03 Aug 2017	FOB Dest'n, Own Truck	F-73289	DT-15001

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY / QTÉ	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
147	PC	X	101	46	PENTEX BC 340 (49/CS)	3	53.655
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
60	PC	X	40	20	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
66	PC	X	66	0	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
72	PC	X	46	26	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
100	PC		98	2	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		98.529 KG
					**** TOTAL PACKAGES ****	8	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	BAGS USED / SACS UTILISÉS
ERAP 2-1510	1-877-561-3636	YES / OUI: X NO / NON:	

FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
Orica Canada Inc.
301 rue hotel de ville
Brownsburg-Chatham, QC
J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.
$	

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Tristan Neely	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Tristan Neely	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE: 3 8 17 (D/J M/M Y/A)	SIGNATURE:	DATE: 3 8 17 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

1 ORIGINAL - NOT NEGOTIABLE
ORIGINAL - NON NÉGOCIABLE

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ETRE SIGNÉ PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

ORICA The Blasting Professionals

Customer: Nelson

Blast Report

Quarry: Burlington
P.O. #:
Blast Date: 2017-08-28

Blast Number: 17-018
Orica Order #: 2230835
Blast Time: 12:32 PM

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.37370 °N Latitude (Centre of Blast) 79.92779 °W Longitude (Centre of Blast)

Wind from the: W at 5 kph
Temperature: 21 to 25 °C

Clear:		Rain:		Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 9,144 m

tonnes Blasted:	26,351 te / 9,944 m³
Total tonnes per day:	26,351 te (Rate Code: tba)
Total Holes Loaded:	167 holes
... including:	8 Dead Holes
... and:	0 Helper Holes
Helper Hole Collar:	0.0 ft avg
# Rows Blasted:	8 rows
- Pattern (Front Row)-	
Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	26 front row

- Drilling Information -

		Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0°	# Holes: 188	=	3,327.6 ft (4 " diam)
Secondary Bit diam:	mm	0°	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:	mm	°	# Holes:	=	0.0 ft (" diam)

Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	26,325
Bench Height:	16.7 ft avg
Sub-drill:	1.0 ft avg
Hole Depth:	17.7 ft avg
- Stone Decking -	
Front Row:	0.0 ft avg
Main Body:	0.0 ft avg
# Stone Decks:	0 per blast
- Collar Stemming -	
Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	3/4 Clear
- Charge Length -	
Front Row:	10.7 ft avg
Main Body:	10.7 ft avg
- Charge Weight	
Front Row:	31.2 kg/hole
Main Body:	31.2 kg/hole
Max. per delay:	45.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	5,277 kg
Rock Density:	2.65 g/cc = te/m³

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,130	21,910	5,220

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	167	56.8

total explosives weight in Blast (kg): 5,277
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:	case #'s	ms	# used
EXEL HANDIDET 12m		25/500	167
CONNECTADET 12M		42 ms	31
UNITRONIC 600 6M			1
CONNECTADET 9M		25 ms	3

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter "1" if Layout by GPS		0
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)		12.0

0.894 lb/yd³	Yield PF:	0.200 kg/te (actual)
0.841 lb/yd³	Front row:	0.188 kg/te (theoretical)
0.841 lb/yd³	Main Body:	0.188 kg/te (theoretical)
#DIV/0! lb/yd³	"KPI" PF:	#DIV/0! kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Holes F1, 16, 21, 22, 23, G18,19,20,21 H9, 11, 17,18,19 D24, 25 E20,21,22,23,24,25 where left out of the shot, due to not being drilled, or to short on depth.

Blaster hours: 7
Helper hours: 5

ORICA
The Blasting Professionals

Customer: **Nelson**

Blast Design

Quarry:	Burlington	Blast Number:	17-018
P.O. #:		Orica Order #:	2230835
Blast Date:	2017-08-28	Blast Time:	12:32 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.31765	80.00309	0.756036	1.396317
Front Row Corner	43.40165	79.88986	0.757502	1.394341
Back Row Corner	43.40179	79.89043	0.757504	1.394351
Average (Centre of Blast)	43.37370	79.92779	0.757014	1.395003

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043

Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	4.7	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
air overpressure:	104.9	dB	Trigger set at: 115	dB

2450 #2 Side Rd (Nelson monitor)

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	1.1	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	107.5	dB	Trigger set at: 115	dB

Northwest (Nelson monitor)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data: ppV:	3.3	mm/s	Trigger set at: 2.0	mm/s
frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	88.0	dB	Trigger set at: 115	dB

Southwest (Nelson monitor)

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting.

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate

Blast Report

Customer:	Nelson	Quarry:	Burlington	Blast Number:	17-019
		P.O. #:		Orica Order #:	2237955
		Blast Date:	2017-09-12	Blast Time:	11:49 AM

page 1

Blaster-in-charge: Kevin Topllis (Print Name)

Blast Location: Lower middle bench-north (Bench / Face)

GPS Coordinates: 43.40436 °N Latitude (Centre of Blast) 79.88425 °W Longitude (Centre of Blast)

Wind from the: SE at 10 kph Temperature: 21 to 25 °C

	x		x		
Clear:		Rain:		Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 9,144 m

tonnes Blasted:	10,087 te	3,806 m^3	
Total tonnes per day:	21,101 te	TBA	Rate Code
Total Holes Loaded:	37 holes		
… including:	3 Dead Holes		
… and:	1 Helper Holes		
Helper Hole Collar:	0.0 ft avg		
# Rows Blasted:	3 rows		

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:		
Primary Bit diam:	101.6	mm	0°	# Holes:	37	= 1,513.3 ft	(4	" diam)
Secondary Bit diam:		mm	°	# Holes:		= 0.0 ft	(	" diam)
Tertiary Bit diam:		mm	°	# Holes:		= 0.0 ft	(	" diam)

- Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.5 ft avg
# Holes:	12 front row

Burden:	9.0 ft avg
Spacing:	10.5 ft avg
# Holes:	25
Bench Height:	38.9 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	40.9 ft avg

- Stone Decking -

Front Row:	4.0 ft avg
Main Body:	4.0 ft avg
# Stone Decks:	2 per blast

- Collar Stemming -

Front Row:	8.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75 clear

- Charge Length -

Front Row:	28.9 ft avg
Main Body:	29.9 ft avg

- Charge Weight -

Front Row:	84.3 kg/hole
Main Body:	87.2 kg/hole
Max. per delay:	140.0 kg/delay
SD () Equation:	0.0 kg/delay
Total kg Loaded:	5,391 kg
Rock Density:	2.65 g/cc = te/m^3

- Powder Factor -

2.387 lb/yd^3	Yield PF:	0.534 kg/te	(actual)
1.023 lb/yd^3	Front row:	0.229 kg/te	(theoretical)
1.412 lb/yd^3	Main Body:	0.316 kg/te	(theoretical)
###### lb/yd^3	"KPI" PF:	#DIV/0! kg/te	(theoretical)

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	30,317	24,940	5,377

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	41	13.9

total explosives weight in Blast (kg): 5,391

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 15M			39
UNITRONIC 600 9M			2

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	6
	units	

Resource Deployment:

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

total labour charge, see blast report 17-021

4ft stone decks where used in holes A1 and B8

This blast was shot with 17-021, 6 second delay, this shot going first

adjusted collars to following holes: A1 12ft, A4 13ft, A9 14ft A12 15ft

ORICA The Blasting Professionals	Customer:	**Nelson**	Quarry:	Burlington	Blast Number: 17-019
	Blast Design		P.O. #:		Orica Order #: 2237955
			Blast Date:	2017-09-12	Blast Time: 11:49 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40436**	**79.88428**	0.757549	1.394244
Front Row Corner	43.40423	79.88413	0.757547	1.394241
Back Row Corner	43.40450	79.88436	0.757551	1.394245
Average (Centre of Blast)	43.40436	79.88425	0.757549	1.394243

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (1st Seis. From Centre of Blast)	**0.0** m			
	Post Blast Data: ppV:	**1.0** mm/s	Trigger set at: **2.0** mm/s		
	frequency:	Hz	V / T / L : **T** (Vertical, Transverse or Longitudinal)		
	air overpressure:	**114.6** dB	Trigger set at: **115** dB		
	Northwest- colling rd (Nelson monitor)				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.71939	80.38847	0.763047	1.403043
	2nd Reading				
	Average	43.71939	80.38847	0.763047	1.403043
	Distance **(2nd Seis. From Centre of Blast**	**0.0** m			
	Post Blast Data: ppV:	**2.9** mm/s	Trigger set at: **2.0** mm/s		
	frequency:	Hz	V / T / L : **?** (Vertical, Transverse or Longitudinal)		
	air overpressure:	**88.0** dB	Trigger set at: **115** dB		
	2450 2nd concession (Nelson monitor)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	**0.0** m			
	Post Blast Data: ppV:	**1.9** mm/s	Trigger set at: **2.0** mm/s		
	frequency:	Hz	V / T / L : **?** (Vertical, Transverse or Longitudinal)		
	air overpressure:	**94.0** dB	Trigger set at: **115** dB		
	Southwest- Camisle (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg

jim bray

Orica
Blaster-in-charge: Kevin Toplis

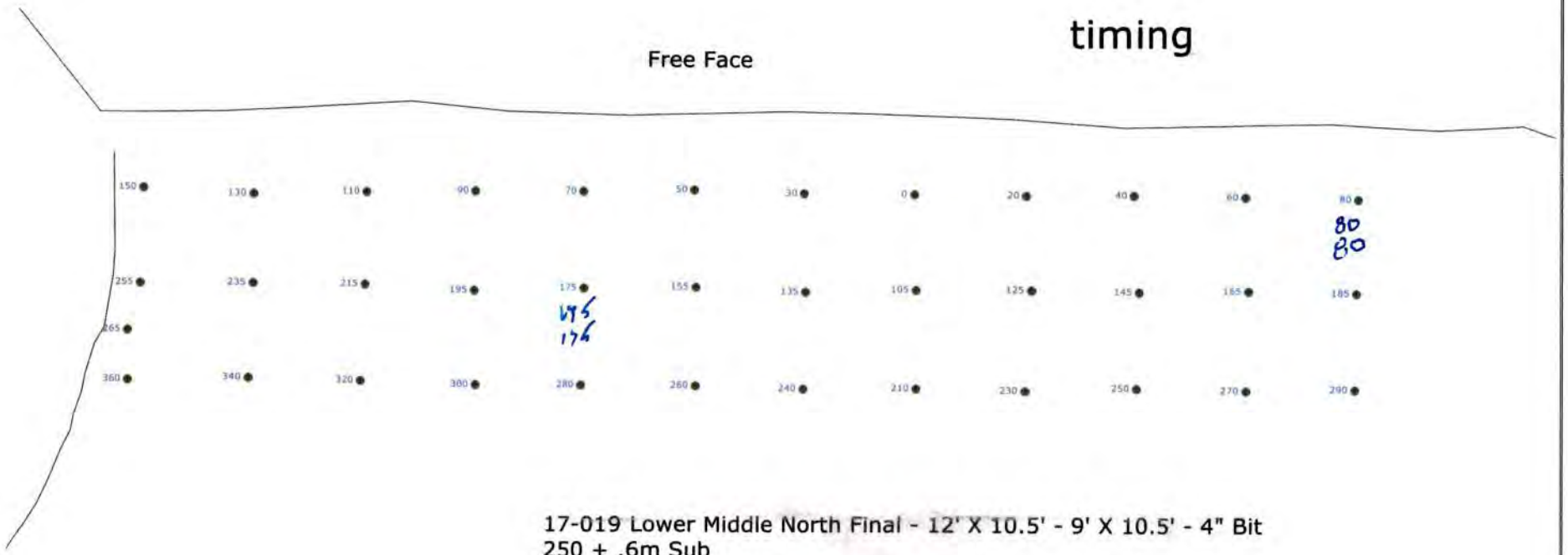
Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 37	Hole angle: 0.0°
Total drilled: 1515.0ft			

timing



17-019 Lower Middle North Final - 12' X 10.5' - 9' X 10.5' - 4" Bit
250 + .6m Sub

ORICA

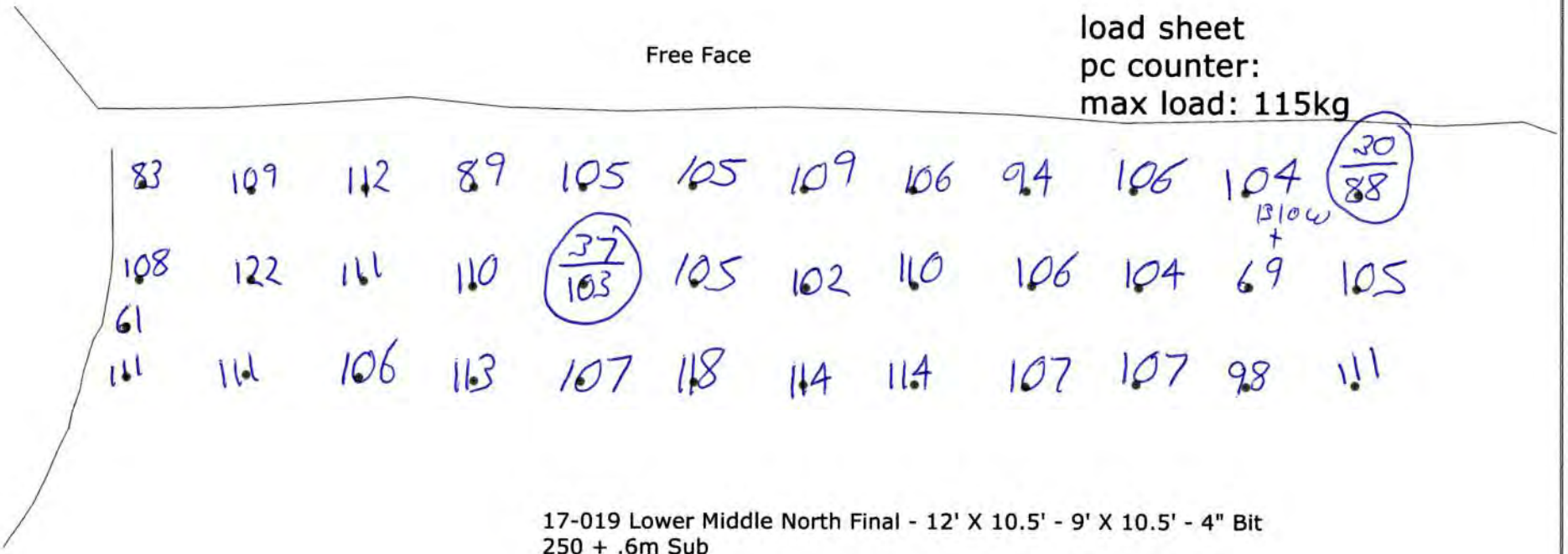
Not to scale

SHOTPlus 5.6.3.6		11/09/2017
Mine	Burlington	
Location		
Title/author	17-019 Lower Middle North Final	G. Palcso
Filename	17-019_Lower_Middle_North_Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 37	Hole angle: 0.0°
Total drilled: 1515.0ft			



17-019 Lower Middle North Final - 12' X 10.5' - 9' X 10.5' - 4" Bit
250 + .6m Sub

8148

ORICA

Not to scale

SHOTPlus 5.6.3.6		11/09/2017
Mine	Burlington	
Location		
Title/author	17-019 Lower Middle North Final	G. Palcso
Filename	17-019_Lower_Middle_North_Final.spf	

ORICA The Blasting Professionals

Customer: Nelson

Blast Design

Quarry: Burlington
P.O. #:
Design Date: 2017-09-12

Blast Number: 17-019
Orica Order #:

page 1

Blaster-in-charge: Kevin Toplis (First Name)

Blast Location: Lower middle bench-north (Bench / Face)
GPS Coordinates: 43.40436 °N Latitude (Centre of Blast) 79.88425 °W Longitude (Centre of Blast)

Design te Blasted:	10,393	te
Total Holes Loaded:	37	holes
... including:	3	Dead Holes
... and:	1	Helper Holes
Helper Hole Collar:	0.0	ft avg
# Rows Blasted:	3	rows

- Drilling Information -

			Angle from Vertical				Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	37	=	1,513.3 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden:	12.0	ft avg
Spacing:	10.5	ft avg
# Holes:	12	front row

- Design Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.5	ft avg
# Holes	25	main body
Bench Height:	38.9	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	40.9	ft avg

- Design Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg

- Design Collar Stemming -

Front Row:	8.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75 clear	

- Design Charge Length -

Front Row:	32.9	ft avg
Main Body:	33.9	ft avg

- Design Charge Weight -

Front Row:	95.9	kg/hole
Main Body:	98.8	kg/hole
Max Chge Wt / delay:	115.0	kg/delay

Required kg Loaded:	4,038	kg
Rock Density:	2.65	g/cc = te/m^3

- Design Powder Factor -

	Expected Yield PF:	0.388	kg/te (actual)
1.165 lb/yd^3	Front row	0.261	kg/te (theoretical)
1.601 lb/yd^3	Main Body	0.358	kg/te (theoretical)
1.455 lb/yd^3	"KPI" PF:	0.326	kg/te (theoretical)

Bulk Explosives Req'd:

		kg
CENTRA GOLD 70	ChargeWt.exe	4,025

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	37	12.6

total explosives weight in Blast (kg):	4,038
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 15M		37

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

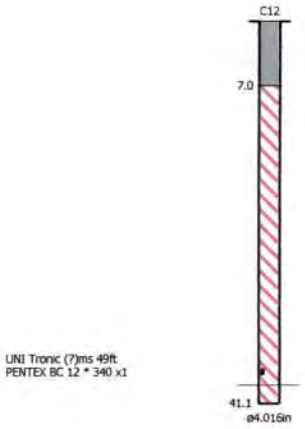
BULK TRUCK CHARGE	>/=2,000kg	<5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

ORICA The Blasting Professionals™	Customer: **Nelson** **Blast Design**	Quarry: Burlington P.O. #: Blast Date: 2017-09-12	Blast Number: 17-019 Orica Order #:	

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Kevin Toplis

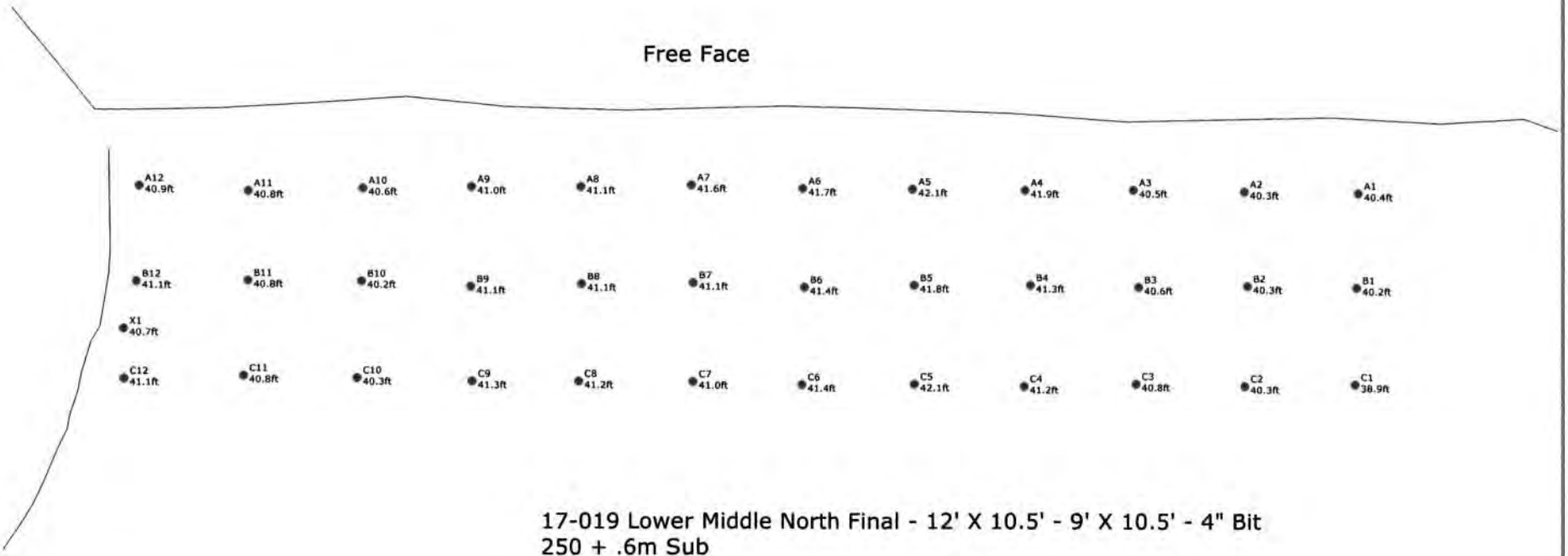
#
Quarry Manager:

Signature required, indicating sign off on Blast Design

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 37	Hole angle: 0.0°
Total drilled: 1515.0ft			



17-019 Lower Middle North Final - 12' X 10.5' - 9' X 10.5' - 4" Bit
250 + .6m Sub

Not to scale

SHOTPlus 5.6.3.6		11/09/2017
Mine	Burlington	
Location		
Title/author	17-019 Lower Middle North Final	G. Palcso
Filename	17-019_Lower_Middle_North_Final.spf	

1086994

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2237955	85765597

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
12 Sep 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
12 Sep 2017	FOB Dest'n, Own Truck	F-73289	1605

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
98	PC	X	19	79	PENTEX BC 340 (49/CS)	2	35.770
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
60	PC	X	56	4	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
132	PC	X	57	75	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
100	PC		88	12	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		70.762 KG
					**** TOTAL PACKAGES ****	6	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ___ NO / NON ___	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
BRAD HUTCHINS	BRAD HUTCHINS	
SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A
	12 9 17		12 9 17		

3 MEMORANDUM / MÉMORANDUM

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPEDITION PAR MESSAGERIES DOIT ETRE SIGNE PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Blast Report

Customer:	Nelsons	Quarry:	Burlington	Blast Number:	17-020
		P.O. #:	NA	Orica Order #:	2244865
		Blast Date:	2017-09-27	Blast Time:	12:01 PM

page 1

Blaster-in-charge: Mitch Ossington (Print Name)

Blast Location: South face (Bench / Face)

GPS Coordinates: 43.39828 °N Latitude (Centre of Blast) 79.88401 °W Longitude (Centre of Blast)

Wind from the: W at 10 kph Temperature: 26 to 30 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30000ft m

tonnes Blasted:	27,877 te	10,520 m³
Total tonnes per day:	27,877 te	TBA (Rate Code)
Total Holes Loaded:	40 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.5 ft avg	
# Holes:	16 front row	
Burden:	10.0 ft avg	
Spacing:	10.5 ft avg	
# Holes:	24	
Bench Height:	81.9 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	83.9 ft avg	
- Stone Decking -		
Front Row:	6.0 ft avg	
Main Body:	6.0 ft avg	
# Stone Decks:	40 per blast	
- Collar Stemming -		
Front Row:	10.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	1/2" crush	
- Charge Length -		
Front Row:	67.9 ft avg	
Main Body:	70.9 ft avg	
- Charge Weight -		
Front Row:	198.0 kg/hole	
Main Body:	206.7 kg/hole	
Max. per delay:	150.0 kg/delay	
SD () Equation:	0.0 kg/delay	
Total kg Loaded:	9,523 kg	
Rock Density:	2.65 g/cc = te/m³	
- Powder Factor -		
Yield PF:	0.342 kg/te (actual)	
Front row:	0.256 kg/te (theoretical)	
Main Body:	0.320 kg/te (theoretical)	
"KPI" PF:	#DIV/0! kg/te (theoretical)	

Theoretical PF (Based on a single hole)

1.526	lb/yd³
1.142	lb/yd³
1.431	lb/yd³
######	lb/yd³

Yield Powder Factor (kg Loaded / te Blasted)

- Drilling Information -

			Angle from Vertical				Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes:	34	=	2,852.6 ft (4 " diam)
Secondary Bit diam:	114.3	mm	0°	# Holes:	6	=	503.4 ft (4 1/2 " diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,070	24,600	9,470

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	157	53.4

total explosives weight in Blast (kg): 9,523

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			36
UNITRONIC 600 20M			41
UNITRONIC 600 30M			80

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	2
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)		1
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Line Item (Hourly Rate)		1
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Deck height veried if deck was in a void.

Blaster Hours= 6hr

Helper Hours= 11hrs

Customer:	**Nelsons**	Quarry:	Burlington
	Blast Design	P.O. #:	NA
		Blast Date:	2017-09-27
		Blast Number:	17-020
		Orica Order #:	2244865
		Blast Time:	12:01 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39844	79.88387	0.757446	1.394237
Front Row Corner	43.39826	79.88401	0.757443	1.394239
Back Row Corner	43.39813	79.88414	0.757440	1.394241
Average (Centre of Blast)	43.39828	79.88401	0.757443	1.394239

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (1st Seis. From Centre of Blast)	0.0	m		
	Post Blast Data: ppV:	DNT	mm/s	Trigger set at: 2.0	mm/s
	frequency:	DNT	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure:	DNT	dB	Trigger set at: 115	dB
	Colling Rd				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance **(2nd Seis. From Centre of Blast**	0.0	m		
	Post Blast Data: ppV:	2.5	mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:	103.5	dB	Trigger set at: 115	dB
	2450 #2 sideroad				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	0.0	m		
	Post Blast Data: ppV:	3.2	mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:	88.0	dB	Trigger set at: 115	dB
	Camisle				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 0 kg

jim bray

Orica
Blaster-in-charge: Mitch Ossington

Signature required, indicating that
Blast Report is Complete & Accurate.

ORICA The Blasting Professionals

Customer: Nelsons

Blast Design

Quarry: Burlington
P.O. #: NA
Design Date: 2017-09-27

Blast Number: 17-020
Orica Order #:

page 1

Blaster-in-charge: Mitch Ossington (Print Name)

Blast Location: South Face (Bench / Face)
GPS Coordinates: 0.00000 °N Latitude (Centre of Blast) 0.00000 °W Longitude (Centre of Blast)

Design te Blasted:	27,877	te
Total Holes Loaded:	40	holes
... including:	0	Dead Holes
... and:	3	Helper Holes
Helper Hole Collar:	0.0	ft avg
# Rows Blasted:	3	rows

- Drilling Information -

			Angle from Vertical				Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	40	=	3,356.0 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

12:01 pm
28°c fewclouds
11km/h W
30, over VT

- Design Pattern (Front Row) -

Burden:	12.0	ft avg
Spacing:	10.5	ft avg
# Holes:	16	front row

- Design Pattern (Main Body) -

Burden:	10.0	ft avg
Spacing:	10.5	ft avg
# Holes:	24	main body
Bench Height:	81.9	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	83.9	ft avg

- Design Stone Decking -

Front Row:	4.0	ft avg
Main Body:	4.0	ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	1/2" crush	

Bulk Explosives Req'd:

		kg
CENTRA GOLD 70	ChargeWt.exe	9,500

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	160	54.4

total explosives weight in Blast (kg):	9,554
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Req'd:

	ms	# req'd
UNITRONIC 600 30M		80
UNITRONIC 600 20M		40
UNITRONIC 600 9M		40

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	
	units	

- Design Charge Length -

Front Row:	72.9 ft avg
Main Body:	72.9 ft avg

- Design Charge Weight -

Front Row:	212.6 kg/hole
Main Body:	212.6 kg/hole
Max Chge Wt / delay:	150.0 kg/delay

Required kg Loaded:	9,554	kg
Rock Density:	2.65	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.343 kg/te (actual)
1 226 lb/yd³	Front row:	0 275 kg/te (theoretical)
1 471 lb/yd³	Main Body:	0 329 kg/te (theoretical)
1.390 lb/yd³	"KPI" PF:	0.311 kg/te (theoretical)

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

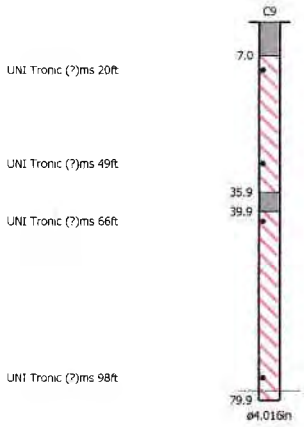
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Fee per Blast)		1
BORETRACK	Enter "1" if Boretraked		
LABOUR CHARGE (enter HOURS	Must be pre-authorized		

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

ORICA The Blasting Professionals	Customer: **Nelsons** Blast Design	Quarry: Burlington P.O. #: Blast Date: 2017-09-27	Blast Number: 17-020 Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Mitch Ossington

#
Quarry Manager:

Signature required, indicating sign off on Blast Design

1087276

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
6:30	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2244865	85781592

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

Walter Milton Stephen Tatlow Jr.

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
27 Sep 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
27 Sep 2017	FOB Dest'n, Own Truck	F-73289	DT-1501

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
196	PC	X	39	157	PENTEX BC 340 (49/CS)	4	71.540
2	PC		2	0	Harness Wire Duplex (6 pack) 400m	1	5.840
60	PC	X	24	36	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
66	PC	X	25	41	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
120	PC	X	64	80	*uni tronic 600-30M C/Z SPL(100')36P	4	~~35.280~~ 42.336
75	PC		73	2	MINI STEM PLUGS - PART #6015		0.525
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		132.529 KG
					**** TOTAL PACKAGES ****	11	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION 1-800-806-6666

PALLETS USED / PALETTES UTILISÉES	PALLETS RETURNED / PALETTES RETOURNÉES	BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT
ERAP 2-1510	1-877-561-3636	✓ YES / OUI NO / NON

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE
$

NETTE No. CONV
PRESSAGE
WT AGREEMENT NO.

FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
Orica Canada Inc.
301 rue hotel de ville
Brownsburg-Chathan, QC
J8G 3B5

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Tristan Neely	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Tristan Neely	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE: 27 9 17 (D/J M/M Y/A)	SIGNATURE	DATE: 27 9 17 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

3 MEMORANDUM / MÉMORANDUM

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPEDITION PAR MESSAGERIES DOIT ETRE SIGNE PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

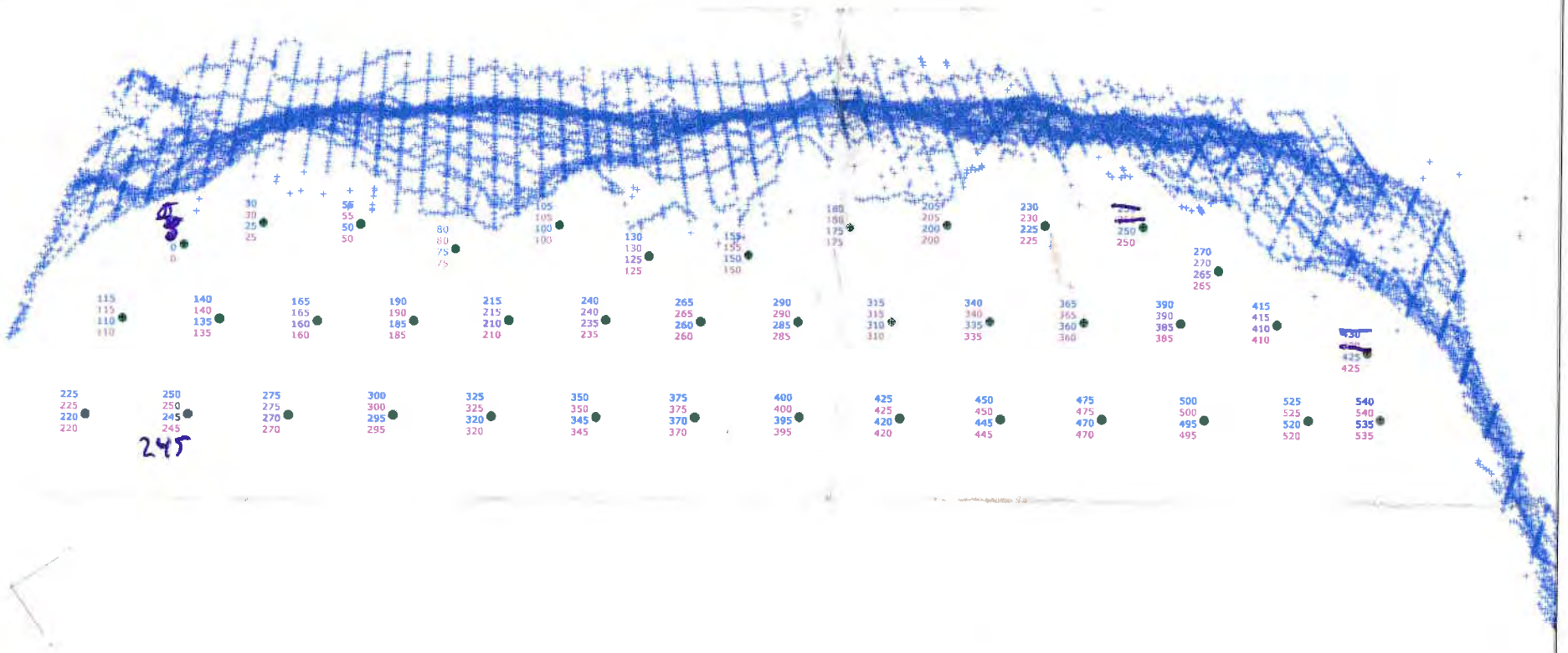
SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 12.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 10.0ft	Hole Diameter: 4.0in	Number of holes: 40	Hole angle: 0.0°
Total drilled: 3358.0ft			



ORICA

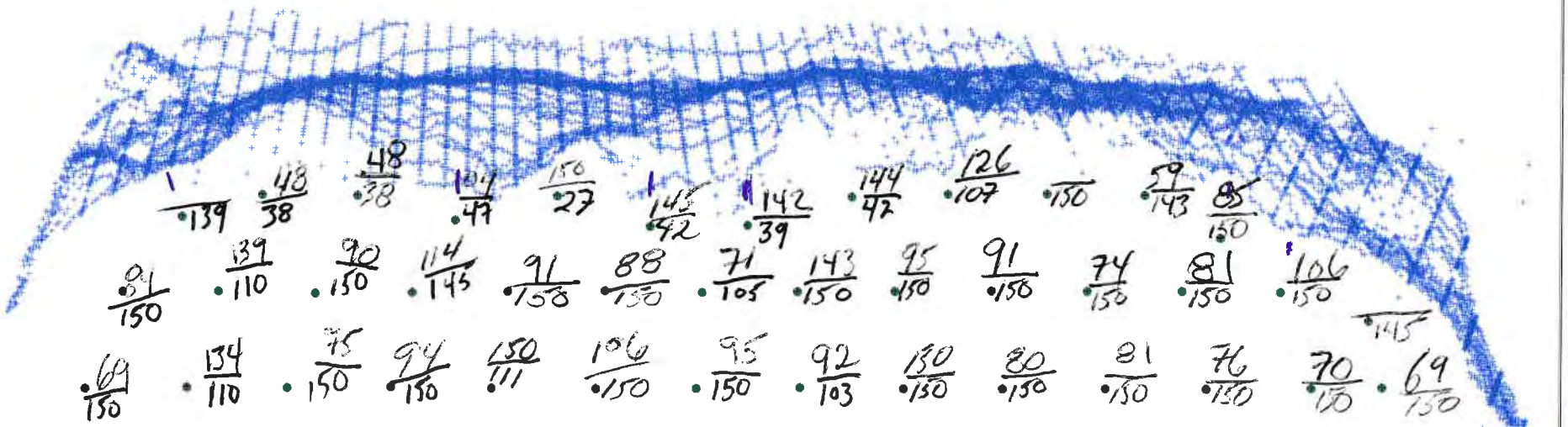
Scale 1:200

SHOTPlus 5.6.2.7	27/09/2017
Mine	Burlington
Location	
Title/author	17-016 South Wall Final G. Palcso
Filename	17-020_South_Wall_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 12.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 10.0ft	Hole Diameter: 4.0in	Number of holes: 40	Hole angle: 0.0°
Total drilled: 3358.0ft			



ORICA

Scale 1:200

SHOTPlus 5.6.2.7		27/09/2017
Mine	Burlington	
Location		
Title/author	17-016 South Wall Final G. Palcso	
Filename	17-020_South_Wall_Final.spf	

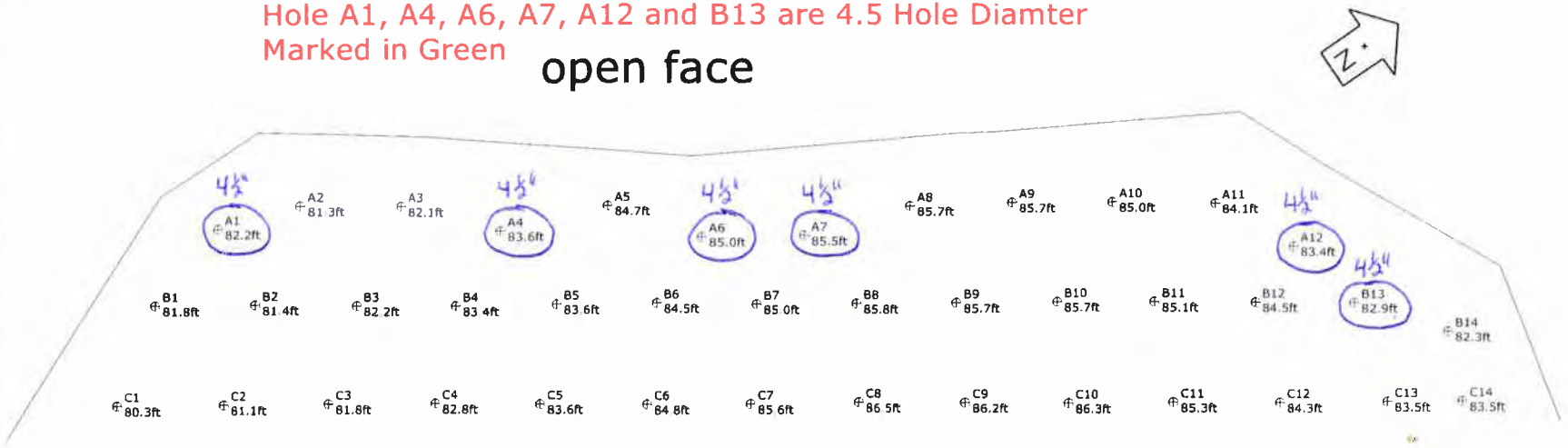
SHOTPlus 5 Plan

Blast Summary Data

Burden: 12.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 10.0ft	Hole Diameter: 4.0in	Number of holes: 40	Hole angle: 0.0°
Total drilled: 3358.0ft			

Hole A1, A4, A6, A7, A12 and B13 are 4.5 Hole Diamter
Marked in Green

open face



South Face 17-020
12x10.5 Front Row - 10x10.5 Body
4" Hole Diamater
248.5m Floor Elevation + 0.6m Sub

ORICA

Not to scale

ORICA The Blasting Professionals

Customer: Nelson Aggregat

Blast Report

Quarry:	Burlington	Blast Number:	18-001
P.O. #:		Orica Order #:	2322201
Blast Date:	2018-04-09	Blast Time:	11:56 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40358 °N Latitude (Centre of Blast) 79.88337 °W Longitude (Centre of Blast)

Wind from the: SE at 5 kph Temperature: 1 to 5 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

3oooo

tonnes Blasted:	27,194 te	10,262 m³
# Holes Loaded:	49	holes
... including:	0	Dead Holes
... and:	3	Helper Holes
Helper Hole Collar:	8.0	ft avg
# Rows Blasted:	3	rows

- Drilling Information -

		mm	Angle from Vertical		# Holes:		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0	# Holes:	49	=	3,797.5 ft (4 " diam)
Secondary Bit diam:		mm	0	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0	# Holes:		=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	13	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	36	main body
Bench Height:	75.5	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	77.5	ft avg

- Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg
# Stone Decks:	0	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75 clear	

- Charge Length -

Front Row:	70.5	ft avg
Main Body:	70.5	ft avg

- Charge Weight -

Front Row:	205.6	kg/hole
Main Body:	205.6	kg/hole
Max. per delay:	256.0	kg/delay
SD () Equation:	#NUM!	kg/delay
Total kg Loaded:	12,365	kg
Rock Density:	2.65	g/cc = te/m³

- Powder Factor -

2.031 lb/yd³	Yield PF:	0.455	kg/te (actual)
1.351 lb/yd³	Front row:	0.302	kg/te (theoretical)
1.801 lb/yd³	Main Body:	0.403	kg/te (theoretical)
1.651 lb/yd³	"KPI" PF:	0.370	kg/te (theoretical)

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,030	21,700	12,330

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	102	34.7

total explosives weight in Blast (kg): 12,365

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 9M			48
UNITRONIC 600 30M			52

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

		# req'd		
# of Blasts today (this Quarry)		1		
# of Blasters (this Blast)		1	6	hr
# of Helpers (this Blast)	Note Exceptior	2	12	hr
# of MMU's (this Blast)		1		

Services:

ADVANCED BLAST DESIGN	Enter "1" if Advance Blast Des	
BULK TRUCK CHARGE	As per agreement	1
SHOT SERVICE FEE *	As per agreement	1
BORETRACK	Enter "1" if Boretraked	0
SEISMOGRAPH RENTAL	Enter # of Seismographs Use	0

NOTES:

Hole A-10 Received A stone deck from 50'-32 due to lean burden

Hole X-3 Received A stone deck from 60'-50' due to lean burden

Hole X-1 Received a toe load to 55'

Hole X-2 was plugged at 24'

Rate Code TBA by sale representative

6 Blaster hours

6 Helper hours times 2 Helpers

ORICA
The Blasting Professionals™

Customer: Nelson Aggregat

Blast Design

Quarry:	Burlington	Blast Number:	18-001
P.O. #:		Orica Order #:	2322201
Blast Date:	2018-04-09	Blast Time:	11:56 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40358	79.88339	0.757535	1.394228
Front Row Corner	43.40343	79.88334	0.757533	1.394227
Back Row Corner	43.40374	79.88338	0.757538	1.394228
Average (Centre of Blast)	43.40358	79.88337	0.757535	1.394228

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	441.3	m		
Post Blast Data: ppV:	3.6	mm/s	Trigger set at: 2.0	mm/s
frequency:	7.3	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	115.3	dB	Trigger set at: 115	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance (2nd Seis. From Centre of Blast	902.8	m		
Post Blast Data: ppV:	0.4	mm/s	Trigger set at: 2.0	mm/s
frequency:	7.4	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	121.9	dB	Trigger set at: 115	dB

Colling Road & Blind line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	#NUM!	m		
Post Blast Data: ppV:	1.2	mm/s	Trigger set at: 2.0	mm/s
frequency:	7.3	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
air overpressure:	119.7	dB	Trigger set at: 115	dB

South West Corner Of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{\text{\#NUM!}}{30^2} \text{ kg}$$

$$= \frac{\text{\#NUM!}}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = #NUM! kg

jim bray

Orica
Blaster-in-charge: Mike Derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate

Customer: Nelson Aggregat

Blast Report

Quarry: Burlington
P.O. #:
Blast Date: 2018-04-11

Blast Number: 18-002
Orica Order #: 2323512
Blast Time: 11:16 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40235 °N Latitude (Centre of Blast) 79.88634 °W Longitude (Centre of Blast)

Wind from the: SW at 10 kph Temperature: 1 to 5 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

3oooo

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:		
Primary Bit diam:	101.6	mm	0°	# Holes:	180	= 1,980.0 ft	(4	" diam)
Secondary Bit diam:		mm	0°	# Holes:		= 0.0 ft	(	" diam)
Tertiary Bit diam:		mm	0°	# Holes:		= 0.0 ft	(	" diam)

tonnes Blasted:	19,279 te	7,415 m^3	
# Holes Loaded:	180 holes		
… including:	0 Dead Holes		
… and:	0 Helper Holes		
Helper Hole Collar:	0.0 ft avg		
# Rows Blasted:	9 rows		
- Pattern (Front Row)-			
Burden:	11.5 ft avg		
Spacing:	11.5 ft avg		
# Holes:	28 front row		
- Pattern (Main Body) -			
Burden:	11.5 ft avg		
Spacing:	11.5 ft avg		
# Holes:	152 main body		
Bench Height:	11.0 ft avg		
Sub-drill:	0.0 ft avg		
Hole Depth:	11.0 ft avg		
- Stone Decking -			
Front Row:	0.0 ft avg		
Main Body:	0.0 ft avg		
# Stone Decks:	0 per blast		
- Collar Stemming -			
Front Row:	7.0 ft avg		
Main Body:	7.0 ft avg		
Material used:	.75 clear		
- Charge Length -			
Front Row:	4.0 ft avg		
Main Body:	4.0 ft avg		
- Charge Weight -			
Front Row:	11.7 kg/hole		
Main Body:	11.7 kg/hole		
Max. per delay:	14.0 kg/delay		
SD () Equation:	#NUM! kg/delay		
Total kg Loaded:	2,582 kg		
Rock Density:	2.60 g/cc	= te/m^3	
- Powder Factor -			
Yield PF:	0.134 kg/te	(actual)	0.587 lb/yd^3
Front row:	0.109 kg/te	(theoretical)	0.477 lb/yd^3
Main Body:	0.109 kg/te	(theoretical)	0.477 lb/yd^3
"KPI" PF:	0.109 kg/te	(theoretical)	0.477 lb/yd^3

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blaste

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	30,150	27,630	2,520

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	182	61.9

total explosives weight in Blast (kg):	2,582
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 12m		25/500	182
CONNECTADET 9M		25 ms	3
CONNECTADET 9M		42 ms	30

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:		# req'd		
# of Blasts today (this Quarry)	Enter #		1	
# of Blasters (this Blast)		1	7	hr
# of Helpers (this Blast)	Note Exception	2	10	hr
# of MMU's (this Blast)		1		

Services:

ADVANCED BLAST DESIGN	Enter "1" if Advance Blast Des	
BULK TRUCK CHARGE	As per agreement	1
SHOT SERVICE FEE *	As per agreement	#DIV/0!
BORETRACK	Enter "1" if Boretraked	0
SEISMOGRAPH RENTAL	Enter # of Seismographs Used	0

NOTES:

5 Holes in the pattern had caved in when we measured the shot the morning of, we were unable to load those 5 holes

Customer: Nelson Aggregat	Quarry:	Burlington	Blast Number: 18-002
Blast Design	P.O. #:		Orica Order #: 2323512
	Blast Date:	2018-04-11	Blast Time: 11:16 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40230	79.88635	0.757513	1.394280
Front Row Corner	43.40209	79.88602	0.757509	1.394274
Back Row Corner	43.40267	79.88664	0.757519	1.394285
Average (Centre of Blast)	43.40235	79.88634	0.757514	1.394280

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	663.1	m				
Post Blast Data: ppV:		mm/s	Trigger set at:	2.0	mm/s	
frequency:		Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:		dB	Trigger set at:	115	dB	

2450 2nd Line Did not set up for this blast (as per bill)

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	744.0	m				
Post Blast Data: ppV:	Did	mm/s	Trigger set at:	2.0	mm/s	
frequency:	Not	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	Trigger	dB	Trigger set at:	115	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	#NUM!	m				
Post Blast Data: ppV:	2.0	mm/s	Trigger set at:	2.0	mm/s	
frequency:	3.3	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	88.4	dB	Trigger set at:	115	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{\text{\#NUM!}}{30^2} \text{ kg}$$

$$= \frac{\text{\#NUM!}}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = #NUM! kg

jim bray

Orica
Blaster-in-charge: Mike Derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

Blast Report

Quarry:
P.O. #:
Blast Date: 2018-04-18

Blast Number: 18-003
Orica Order #: 2326529
Blast Time: 10:54 AM

page 1 Blaster-in-charge: Mike der Kinderen

Blast Location: Lower Middle
GPS Coordinates: 43.40418 °N Latitude 79.88352 °W Longitude

Wind from the: W at 10 kph Temperature: 1 to 5 °C

Clear: Rain: Overcast: X
Partly Cloudy: Snow: Inversion: Ceiling 30,000 ft

Tonnes Blasted: 11,087 te 4,184 m3
Total tonnes per day: 11,087 te TBA Rate Code
Total Holes Loaded: 39 holes
... including: 0 Dead Holes
... and: 1 Helper Holes
Helper Hole Collar: 7.0 ft avg
Rows Blasted: 4 rows

Pattern (Front Row)
Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 9

Pattern (Main Body)
Burden: 9.0 ft avg
Spacing: 10.0 ft avg

Bench Height: 40.1 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 42.1 ft avg

Stone Decking
Front Row: 8.0 ft avg
Main Body: 0.0 ft avg
Decks: 1 per blast

Collar Stemming
Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: 3/4 Stone

Charge Length
Front Row: 27.1 ft avg
Main Body: 35.1 ft avg

Charge Weight
Front Row: 79.1 kg/hole
Main Body: 102.4 kg/hole
Max. per delay: 129.0 kg/delay
SD () Equation: 251.0 kg/delay
Total kg Loaded: 4,817 kg
Rock Density: 2.65 g/cc = te/m3

Drilling Information

Angle from Vertical

Primary Bit diam:	101.6	mm	0°	# Holes: 39	=	1,642.4 ft (4	" diam)
Secondary Bit diam:		mm	0°	# Holes:	=	0.0 ft (	" diam)
Tertiary Bit diam:		mm	0°	# Holes:	=	0.0 ft (	" diam)

Nominal Bit Diameter:

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	29,810	25,070	4,740

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	6	4	50

Boosters:

	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	78	26.5

total explosives weight in Blast (kg): 4,817
Pkgd Prod (50 kg) % of Total kg: 1.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			39
UNITRONIC 600 15M			39

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>/=2,000kg <5,000kg	1
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	4.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

1.941 lb/yd3
0.575 lb/yd3
1.696 lb/yd3
1.511 lb/yd3

Yield PF: 0.434 kg/te (actual)
Front row: 0.219 kg/te (theoretical)
Main Body: 0.379 kg/te (theoretical)
"KPI" PF: 0.338 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B.S. Explor IS from previous Blast

Holes D-1 D-2 D-3 Had either caved in or were to short to load

Hole B-1 Was loaded to 18' then package was used on the top

A-7 Received a stone deck from 16'-24' due to a void identified on the drill log

Please contact our sales rep for Rate code

Blast Report

Quarry:
P.O. #:
Blast Date: 2018-04-18

Blast Number: 18-003
Orica Order #: 2326529
Blast Time: 10:54 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40418	79.88317	0.757546	1.394224
Front Row Corner	43.40423	79.88351	0.757547	1.394230
Back Row Corner	43.40412	79.88387	0.757545	1.394236
Average (Centre of Blast)	43.40418	79.88352	0.757546	1.394230

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)	475.3	m		
Post Blast Data: ppV:	2.7	mm/s		
frequency:	43.0	Hz		
air overpressure:	119.7	dB		

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413
Distance (2nd Seis. From Centre of Blast)	873.3	m		
Post Blast Data: ppV:	DID	mm/s		
frequency:	NOT	Hz		
air overpressure:	TRIGGER	dB		

Colling Road & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323
Distance (3rd Seis. From Centre of Blast)	1274.5	m		
Post Blast Data: ppV:	DID	mm/s		
frequency:	NOT	Hz		
air overpressure:	TRIGGER	dB		

South West Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(475.3)^2}{30^2} \text{ kg}$$

$$= \frac{225,910}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 251 kg

Orica
Blaster-in-charge: Mike der kinderen

Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-05-22

Blast Number: 18-004
Orica Order #: 2339509
Blast Time: 12 02 PM

page 1

Blaster-in-charge: Mike der Kinderen

Blast Location: Upper Middle
GPS Coordinates: 43.40364 °N Latitude 79.88324 °W Longitude

Wind from the: SE at 5 kph Temperature: 11 to 15 °C

Clear: Rain: Overcast: X
Partly Cloudy: Snow: Inversion: Ceiling 1,000 ft

			Angle from Vertical			Nominal Bit Diameter:		
Primary Bit diam:	101.6	mm	0 °	# Holes:	40	=	3,098.6 ft	(4 " diam)
Secondary Bit diam:	114.3	mm	0 °	# Holes:	9	=	697.2 ft	(4 1/2 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft	(" diam)

Tonnes Blasted:	26,332 te	9,937 m³	
Total tonnes per day:	26,332 te	NB80-01	Rate Code
Total Holes Loaded:	49 holes		
... including:	0 Dead Holes		
... and:	0 Helper Holes		
Helper Hole Collar:	0.0 ft avg		
# Rows Blasted:	3 rows		
Burden:	12.0 ft avg		
Spacing:	10.0 ft avg		
# Holes:	8		
Burden:	9.0 ft avg		
Spacing:	10.0 ft avg		
Bench Height:	75.5 ft avg		
Sub-drill:	2.0 ft avg		
Hole Depth:	77.5 ft avg		
Front Row:	ft avg		
Main Body:	ft avg		
# Decks:	per blast		
Front Row:	7.0 ft avg		
Main Body:	7.0 ft avg		
Material used:	75" Stone		
Front Row:	70.5 ft avg		
Main Body:	70.5 ft avg		
Front Row:	205.5 kg/hole		
Main Body:	205.5 kg/hole		
Max. per delay:	298.0 kg/delay		
SD () Equation:	208.9 kg/delay		
Total kg Loaded:	11,953 kg		
Rock Density:	2.65 g/cc	= te/m³	

Bulk Explosives:

	In (kg)	out (kg)	kg
CENTRA GOLD 70	33,680	21,760	11,920

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	98	33.3

total explosives weight in Blast (kg): 11,953
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 9M			49
UNITRONIC 600 25M			14
UNITRONIC 600 30M			35

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

2.028 lb/yd³	Yield PF:	0.454 kg/te (actual)
1.651 lb/yd³	"KPI" PF:	0.370 kg/te (theoretical)

Resource Deployment

# of Blasts today (this Quarry)	1
# of Blasters (this Blast)	1
# of Helpers (this Blast)	1
# of MMU's (this Blast)	1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	5.5
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	2
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

If was extremely foggy during the blast

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-004
P.O. #:		Orica Order #:	2339509
Blast Date:	2018-05-22	Blast Time:	12:02 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40362	79.88325	0.757536	1.394226
Front Row Corner	43.40349	79.88326	0.757534	1.394226
Back Row Corner	43.40382	79.88322	0.757540	1.394225
Average (Centre of Blast)	43.40364	79.88324	0.757536	1.394226

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	433.6	m
Post Blast Data: ppV:	3.3	mm/s
frequency:	8.1	Hz
air overpressure:	124.3	dB

2450 2nd Line

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance (2nd Seis. From Centre of Blast)	910.4	m
Post Blast Data: ppV:	0.3	mm/s
frequency:	8.9	Hz
air overpressure:	123.1	dB

Colling Rd & Blind Line Bruce Trail

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88680	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88680	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	1228.7	m
Post Blast Data: ppV:	0.3	mm/s
frequency:	100.0	Hz
air overpressure:	39.1	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(433.6)^2}{30^2} \text{ kg}$$

$$= \frac{188{,}009}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 209 kg

Orica
Blaster-in-charge: Mike der Kinderen

Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-04

Blast Number: 18-005
Orica Order #: 2345753
Blast Time: 11:50 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle South (Bench / Face)
GPS Coordinates: 43.40398 °N Latitude (Centre of Blast) 79.88319 °W Longitude (Centre of Blast)

Wind from the: W at 15 kph Temperature: 16 to 20 °C

Clear:		Rain:		Overcast:	
Partly Cloudy:	X	Snow:		Inversion:	Ceiling 2,563 ft

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes: 67	=	2,963.5 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0°	# Holes:	=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,890	25,710	8,180

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	138	46.9

total explosives weight in Blast (kg): 8,227
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			69
UNITRONIC 600 15M			69

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Tonnes Blasted: 20,811 te 7,853 m3
Total tonnes per day: 20,811 te NB40-07 Rate Code
Total Holes Loaded: 67 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 8 rows

- Pattern (Front Row) -
Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 8 front row

- Pattern (Main Body) -
Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 59 main body
Bench Height: 44.2 ft avg
Sub-drill: 0.0 ft avg
Hole Depth: 44.2 ft avg

- Stone Decking -
Front Row: 0.0 ft avg
Main Body: 5.0 ft avg
Decks: 2 per blast

- Collar Stemming -
Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" stone

- Charge Length -
Front Row: 37.2 ft avg
Main Body: 32.2 ft avg

- Charge Weight -
Front Row: 108.6 kg/hole
Main Body: 94.0 kg/hole
Max. per delay: 132.0 kg/delay
SD () Equation: 217.6 kg/delay
Total kg Loaded: 8,227 kg
Rock Density: 2.65 g/cc = te/m³

Theoretical PF (based on a single hole)
Yield Powder Factor (kg Loaded / te Blasted)

- Powder Factor -

1.766 lb/yd³	Yield PF:	0.395 kg/te	(actual)
1.218 lb/yd³	Front row:	0.273 kg/te	(theoretical)
1.405 lb/yd³	Main Body:	0.315 kg/te	(theoretical)
1.382 lb/yd³	"KPI" PF:	0.309 kg/te	(theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Stone decks were required at E-7 & F-7 due to voids identified on drill log

Hole H-5 was at 38'

1st seismograph was set to trigger at 100db and when I went to pick it up the memory was ful truck traffic going by.

ORICA
The Blasting Professionals™

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-005
P.O. #:		Orica Order #:	2345753
Blast Date:	2018-06-04	Blast Time:	11:50 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40399	79.88318	0.757542	1.394225
Front Row Corner	43.40400	79.88336	0.757543	1.394228
Back Row Corner	43.40396	79.88302	0.757542	1.394222
Average (Centre of Blast)	43.40398	79.88319	0.757542	1.394225

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	442.5	m		
Post Blast Data: ppV:	Memory	mm/s	Trigger set at: 2.0 mm/s	
frequency:	Was	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
air overpressure:	Full	dB	Trigger set at: 100 dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance (2nd Seis. From Centre of Blast)	904.3	m		
Post Blast Data: ppV:	Did	mm/s	Trigger set at: 2.0 mm/s	
frequency:	Not	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
air overpressure:	Trigger	dB	Trigger set at: 115 dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	1263.7	m		
Post Blast Data: ppV:	Did	mm/s	Trigger set at: 2.0 mm/s	
frequency:	Not	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
air overpressure:	Trigger	dB	Trigger set at: 115 dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(442.5)^2}{30^2} \text{ kg}$$

$$= \frac{195{,}806}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 218 kg

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that Blast Report is Complete & Accurate

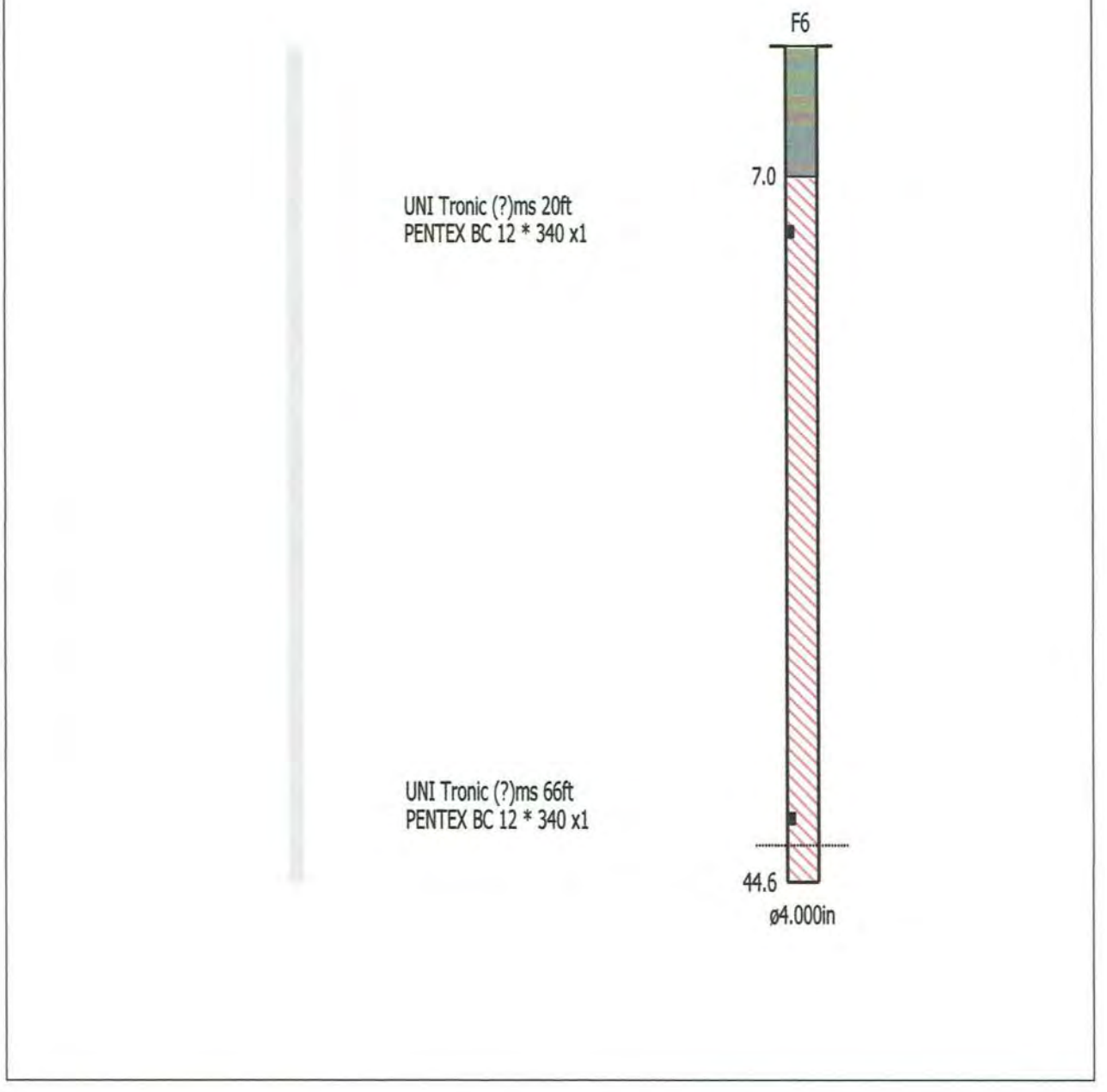
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-005
P.O. #:		Orica Order #:	
Blast Date:	6/4/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:

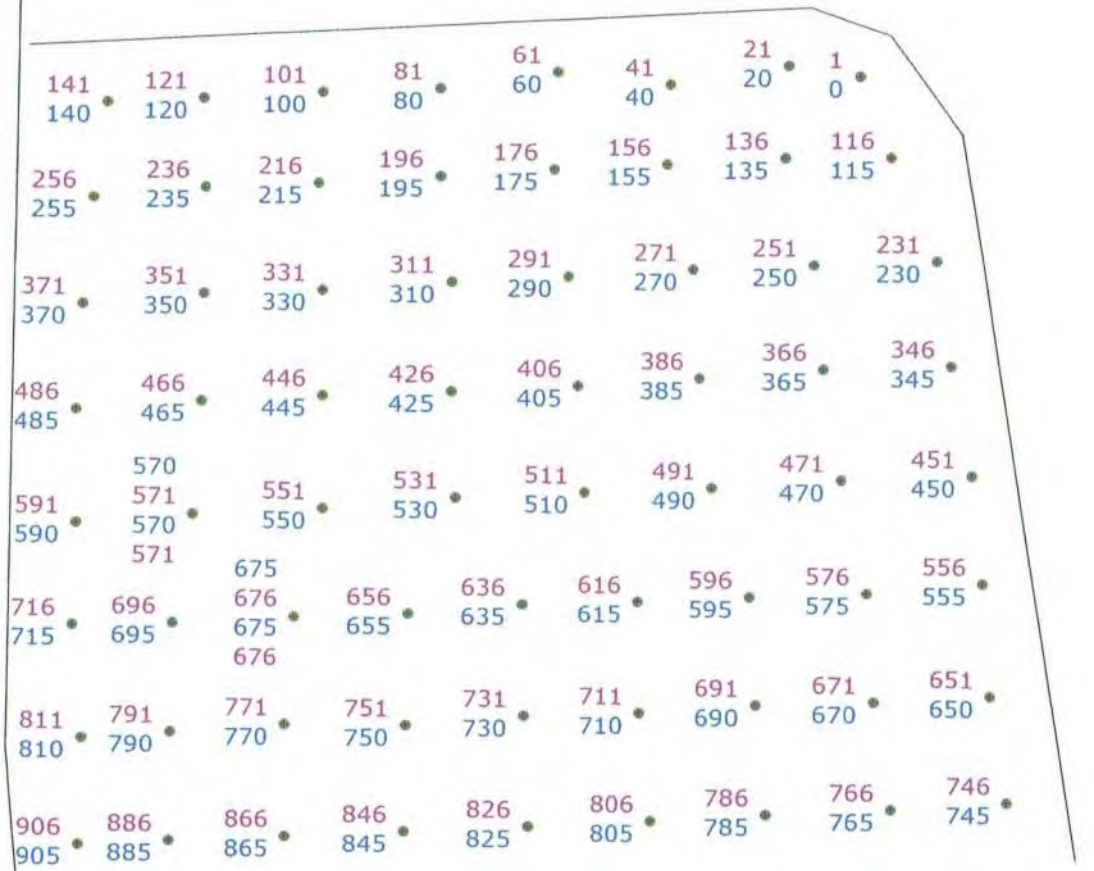


Orica
Blaster-in-charge: Mike der Kinderen

Quarry Manager: Bill White

Signature required, indicating sign off on Blast Design

Timing



Not to scale

SHOTPlus 5.7.1.1		6/4/2018
Mine	Burlington	
Location		
Title/author	18-005 Bottom Middle South I. Deemert	
Filename	2018-06-04 18-005 Lower Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 0.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 67	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2963.6ft	Blasted tonnage: 21,880S/T	

Load Sheet 132kg MAX

Highwall

74	108	92	117	114	116	114	112
114	116	108	121	113	113	131	97
118	114	118	116	117	126	119	112
124	124	122	132	123	116	106	109
119	15/124	121	123	125	124	109	116
123	126	7/132	119	122	107	119	111	97
131	104	128	121	119	94	115	129	121
129	129	132	123	99	121	121	120	107

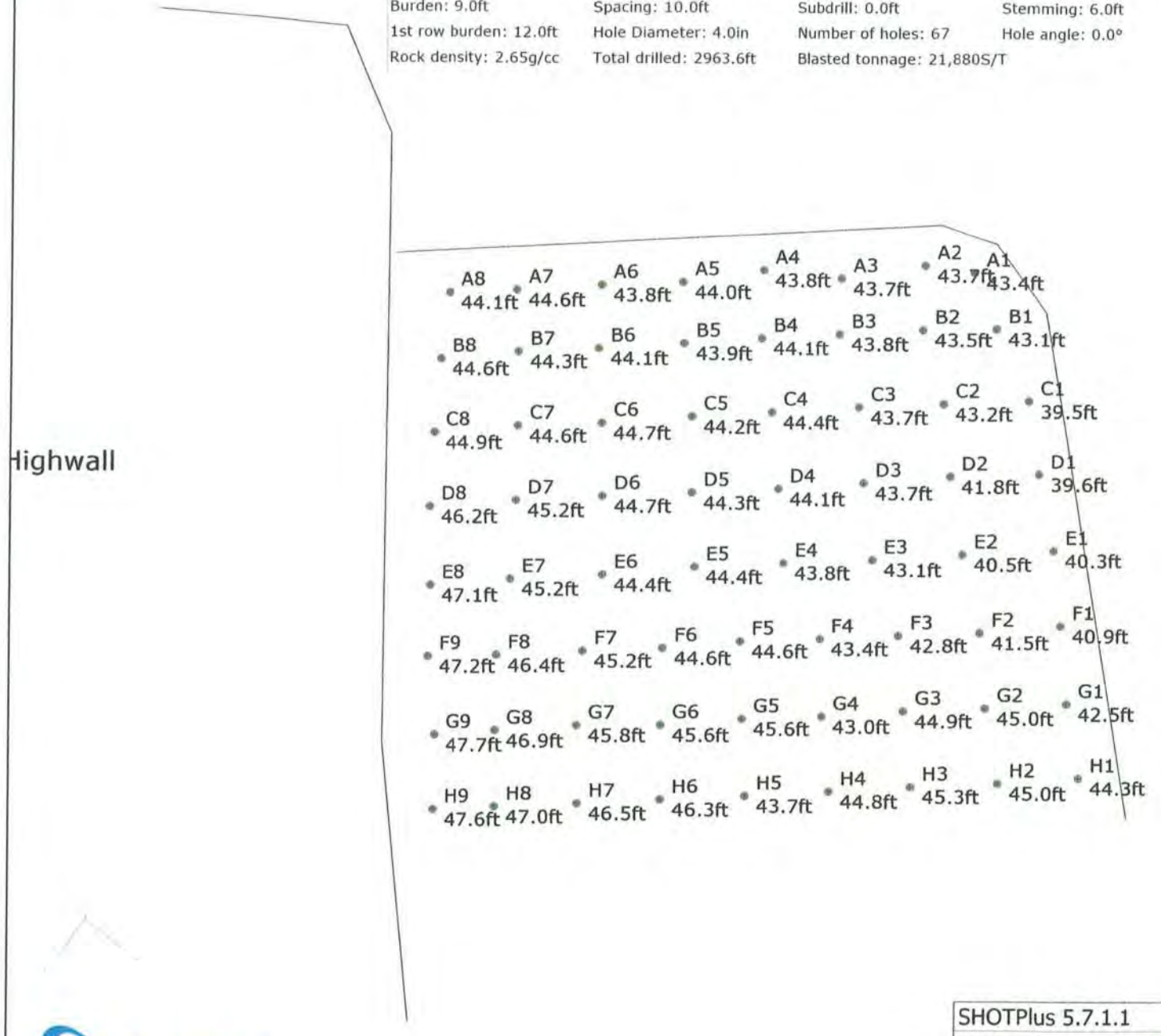
Not to scale

SHOTPlus 5.7.1.1		5/30/2018
Mine	Burlington	
Location		
Title/author	18-005 Bottom Middle South	I. Deemert
Filename	2018-06-04 18-005 Lower Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 0.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 67	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2963.6ft	Blasted tonnage: 21,880S/T	



ORICA

Not to scale

SHOTPlus 5.7.1.1		5/30/2018
Mine	Burlington	
Location		
Title/author	18-005 Bottom Middle South I. Deemert	
Filename	2018-06-04 18-005 Lower Middle.spf	

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

1089712

Bill of Lading / Connaissement

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR	GRAND VALLEY 033411 SIDE ROAD 21-22 GRAND VALLEY ON CA L9W 7G1
CONSIGNEE / CONSIGNATAIRE	NELSON AGGREGATE COMPANY BURLINGTON ON CA L7R 4L8

BLASTER : MIKE D
HELP : MIKE A
KEETH
BULK : JEFF

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
6:50	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2345753	86028794

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
04 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
04 Jun 2018	FOB Dest'n, Own Truck	F-73289	15013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
196	PC	X	58	138	PENTEX BC 340 (49/CS)	4	71.540
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	11	69	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
132	PC	X	63	69	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
66	PC	X	66	0	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
100	PC		95	5	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		119.956 KG
					**** TOTAL PACKAGES ****	9	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.ha@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ✓ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV / PRESSAGE / WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: K. PLATT	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: K. PLATT	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE: K Platt	DATE: 4 6 18 (D/J M/M Y/A)	SIGNATURE: K Platt
DATE: 4 6 18 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉES AU VERSO

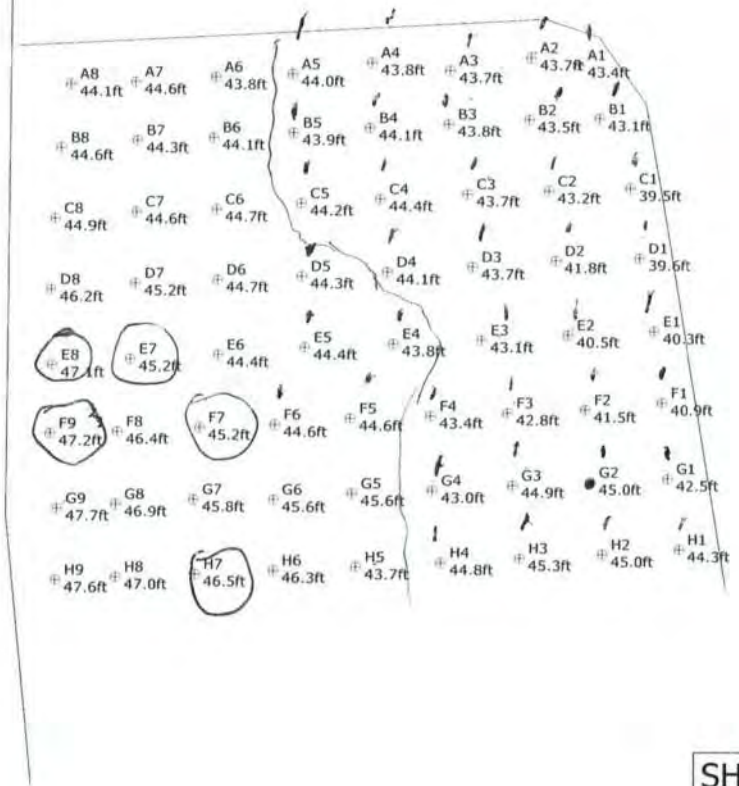
D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 0.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 67	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2963.6ft	Blasted tonnage: 21,880S/T	

Open Face



Highwall

Bottom Middle South 18-005
12x10 Front Row 9x10 Body
4" Hole Diameter
250m Floor Elevation + 0.6m Sub

Not to scale

SHOTPlus 5.7.2.1		02/05/2018
Mine	Burlington	
Location		
Title/author	18-005 Bottom Middle South	I. Dee
Filename	18-005 Design Final.spf	

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-006
P.O. #:		Orica Order #:	2346925
Blast Date:	2018-06-06	Blast Time:	12:10 PM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Bench (Bench / Face)

GPS Coordinates: 43.40428 °N Latitude (Centre of Blast) 79.88387 °W Longitude (Centre of Blast)

Wind from the: W at 5 kph

Temperature: 11 to 15 °C

Clear:		Rain:		Overcast:	X
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 3,116 ft

Tonnes Blasted:	17,948 te	6,773 m3
Total tonnes per day:	17,948 te	NB40-08 Rate Code
Total Holes Loaded:	61 holes	
... including:	Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	11 rows	

- Pattern (Front Row) -

Burden:	12.0 ft avg
Spacing:	10.0 ft avg
# Holes:	8 front row

- Pattern (Main Body) -

Burden:	9.0 ft avg
Spacing:	10.0 ft avg
# Holes:	53 main body
Bench Height:	41.7 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	43.7 ft avg

- Stone Decking -

Front Row:	7.0 ft avg
Main Body:	5.0 ft avg
# Decks:	6 per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75" stone

- Charge Length -

Front Row:	29.7 ft avg
Main Body:	31.7 ft avg

- Charge Weight -

Front Row:	86.7 kg/hole
Main Body:	92.6 kg/hole
Max. per delay:	145.0 kg/delay
SD () Equation:	284.6 kg/delay
Total kg Loaded:	7,270 kg
Rock Density:	2.65 g/cc = te/m3

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam:	101.6 mm	0°	# Holes: 61	=	2,668.2 ft (	4	" diam)
Secondary Bit diam:	mm	0°	# Holes:	=	0.0 ft (		" diam)
Tertiary Bit diam:	mm	0°	# Holes:	=	0.0 ft (		" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	26,650	19,410	7,240

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# usec	kg
PENTEX 8 (OR EQUIVALENT)	0.23	130	29.5

total explosives weight in Blast (kg): 7,270

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			59
UNITRONIC 600 15M			71

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	8
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Theoretical PF (Based on a single hole)

Mid Powder Factor (kg Loaded / in Blaslec

- Powder Factor -

1.809 lb/yd3	Yield PF:	0.405 kg/te (actual)
1.031 lb/yd3	Front row:	0.231 kg/te (theoretical)
1.467 lb/yd3	Main Body:	0.328 kg/te (theoretical)
1.427 lb/yd3	"KPI" PF:	0.319 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or tS from previous Blast:

Due to voids identified on drill log and found while loading we had to put in 6 stone decks rang from 5'-7'

Every front row hole hole had lean burden, therefore we used toe loads and stem plugs

See load adjustment sheet in report

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-006
P.O. #:		Orica Order #:	2346925
Blast Date:	2018-06-06	Blast Time:	12:10 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40427	79.88388	0.757547	1.394237
Front Row Corner	43.40428	79.88368	0.757548	1.394233
Back Row Corner	43.40428	79.88405	0.757548	1.394240
Average (Centre of Blast)	43.40428	79.88387	0.757548	1.394237

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	506.1	m		
Post Blast Data: ppV:	Did	mm/s	Trigger set at: 2.0 mm/s	
frequency:	Not	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
air overpressure:	Trigger	dB	Trigger set at: 120 dB	
2450 2nd Line				

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance (2nd Seis. From Centre of Blast)	842.9	m		
Post Blast Data: ppV:	Did	mm/s	Trigger set at: 2.0 mm/s	
frequency:	Not	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
air overpressure:	Trigger	dB	Trigger set at: 115 dB	
Colling Rd & Blind Line Bruce Trail				

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	1276.3	m		
Post Blast Data: ppV:	Did	mm/s	Trigger set at: 2.0 mm/s	
frequency:	Not	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
air overpressure:	Trigger	dB	Trigger set at: 115 dB	
SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(506.1)^2}{30^2} \text{ kg}$$

$$= \frac{256{,}137}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 285 kg

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that Blast Report is Complete & Accurate

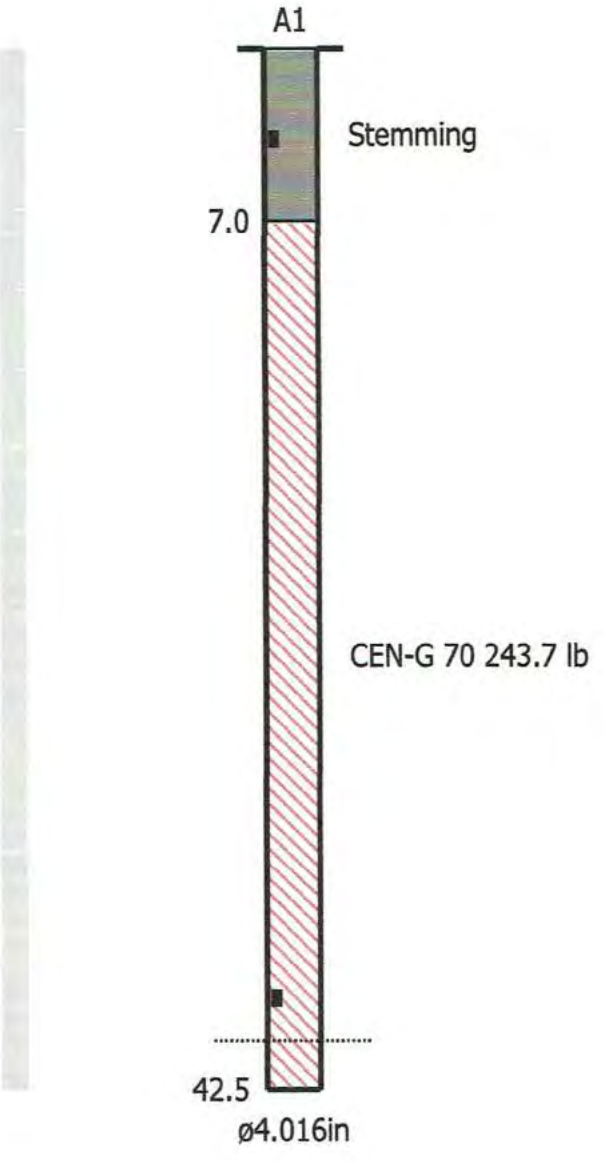
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-006
P.O. #:		Orica Order #:	
Blast Date:	6/6/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



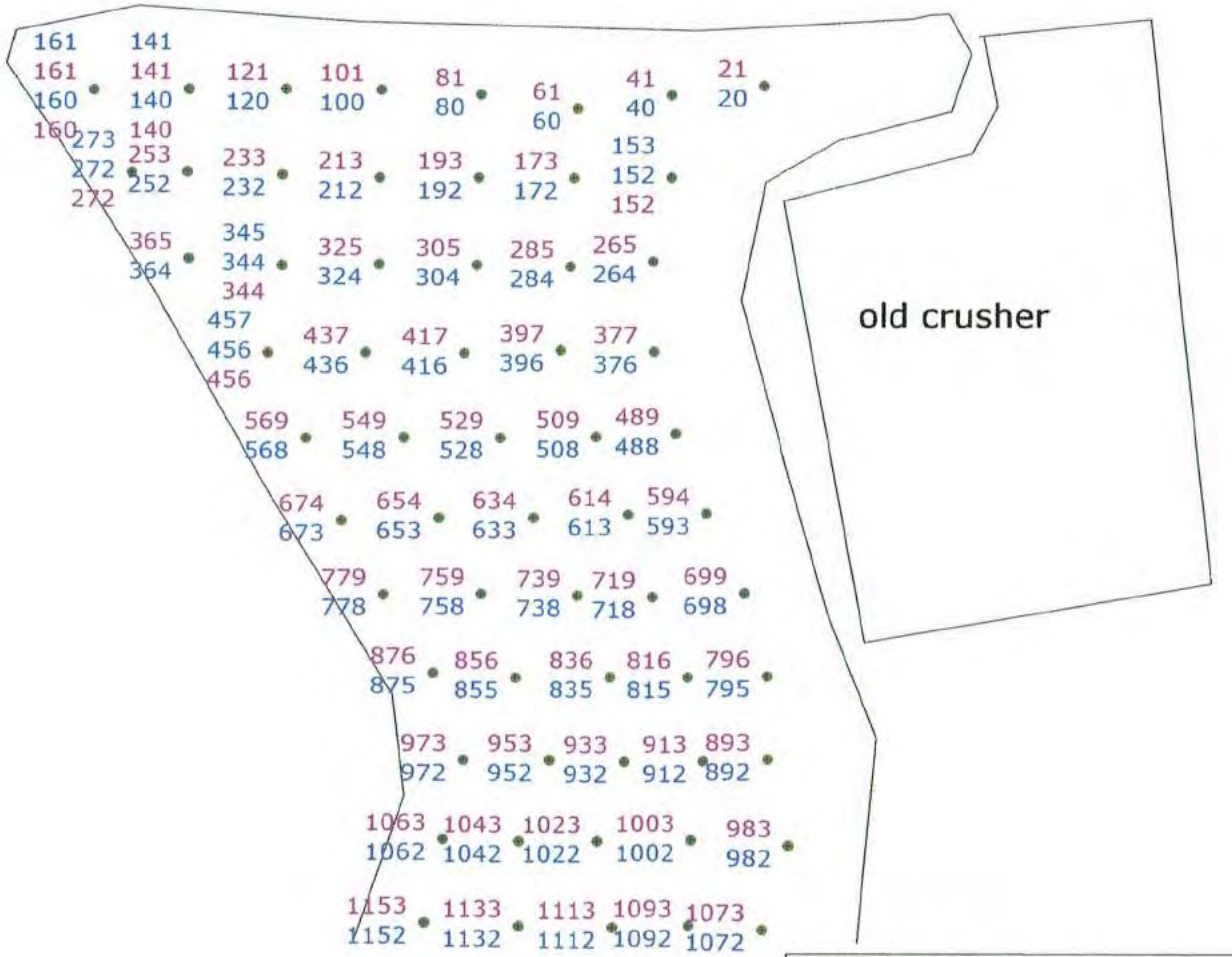
Orica

Blaster-in-charge: Mike der Kinderen

Quarry Manager: Bill White

Signature required, indicating sign off on Blast Design.

Timing



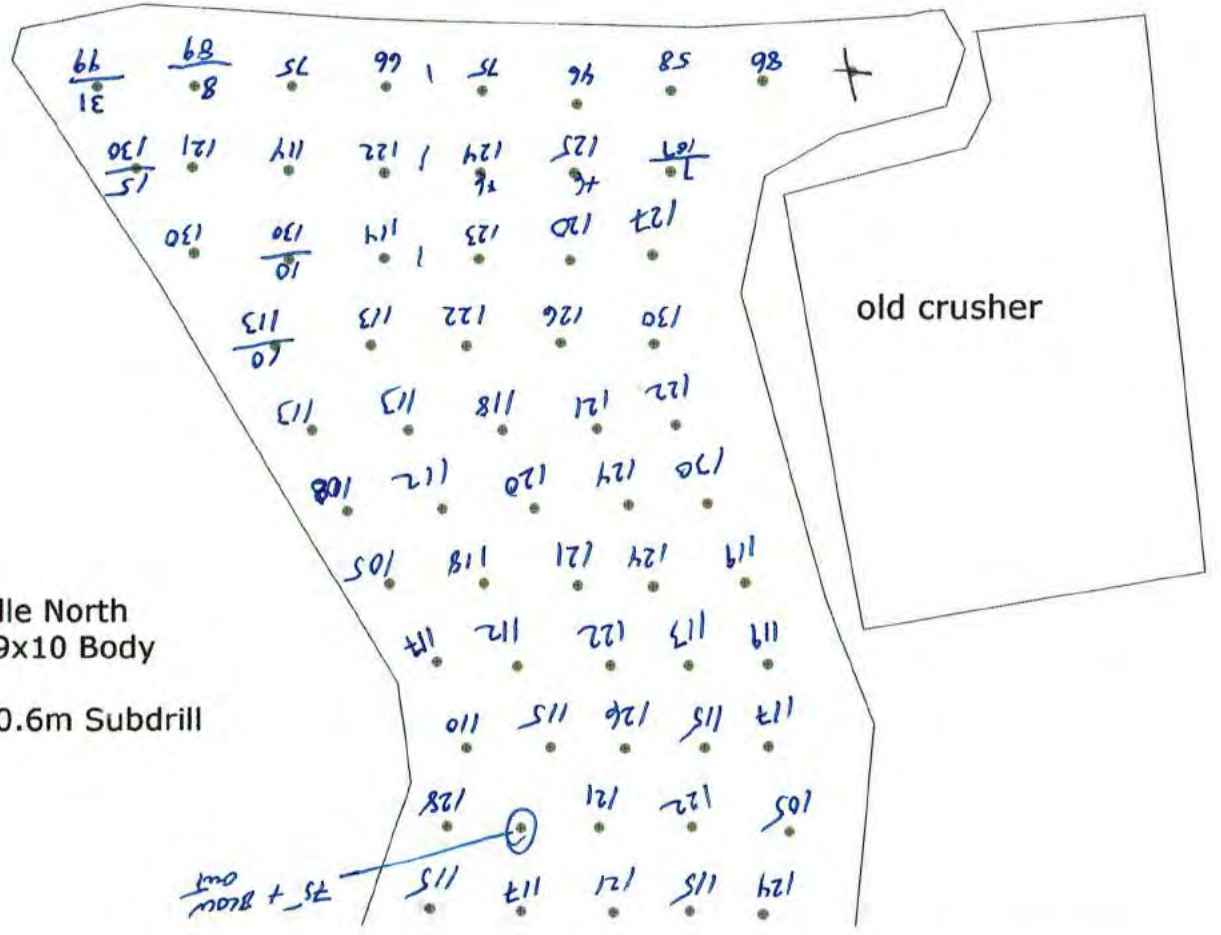
Not to scale

SHOTPlus 5.7.1.1		6/7/2018
Mine	Burlington	
Location		
Title/author	18-006 K. George	
Filename	2018-06-06 18-006.spf	

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 62	Hole angle: 0.0°
Total drilled: 2588.0ft			

Load Sheet 130Kg MAX



open face

18-006 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diamteter
250m Elevation + 0.6m Subdrill

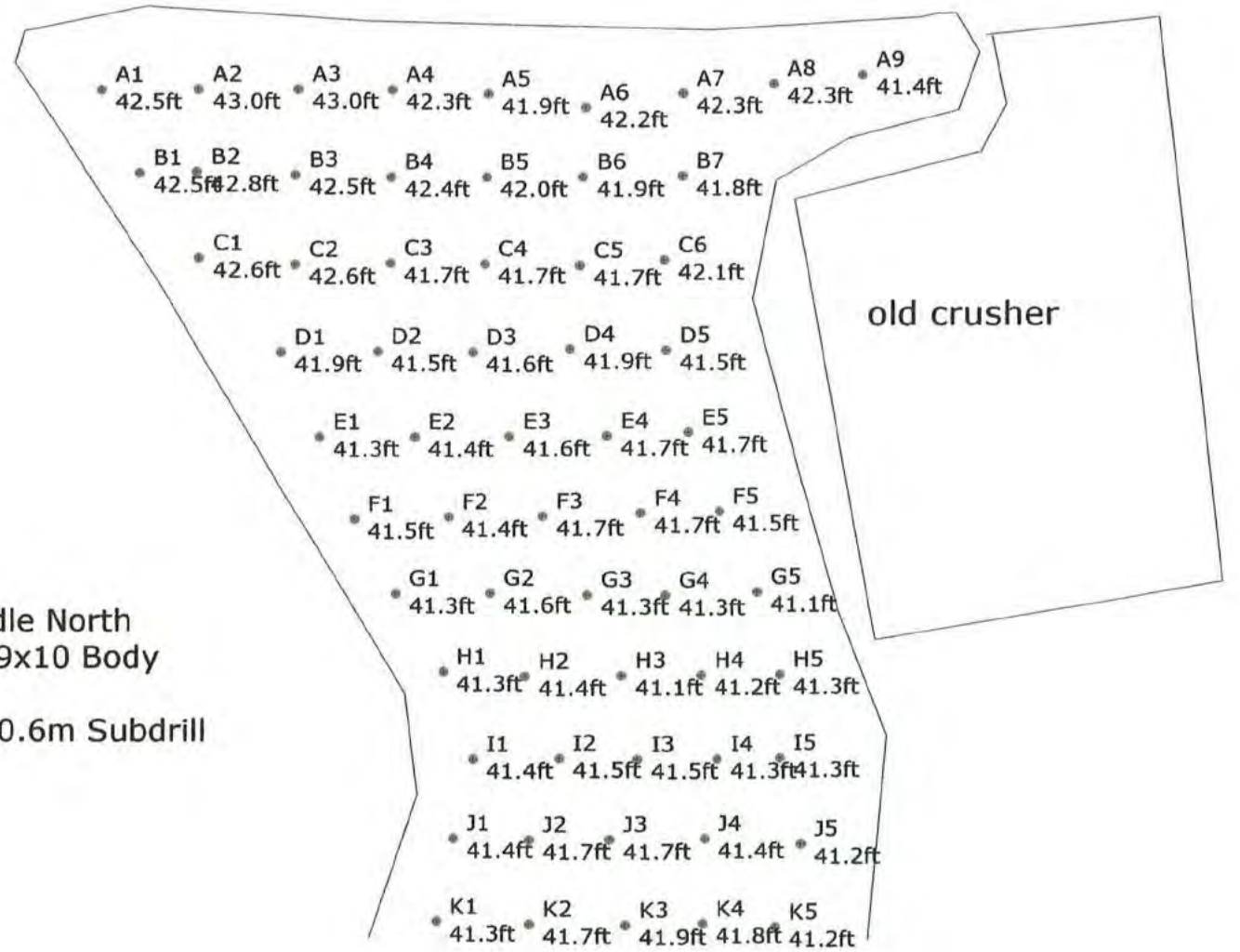
Not to scale

SHOTPlus 5.7.1.1		6/4/2018
Mine	Burlington	
Location		
Title/author	18-006 K. George	
Filename	2018-06-06 18-006.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 62	Hole angle: 0.0°
Total drilled: 2588.0ft			



open face

18-006 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diamteter
250m Elevation + 0.6m Subdrill

ORICA

Not to scale

SHOTPlus 5.7.1.1		6/4/2018
Mine	Burlington	
Location		
Title/author	18-006 K. George	
Filename	2018-06-06 18-006.spf	

1089736

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2346925	86032192

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

Blaster - Mike
Helpers - Dylan
Ken

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
06 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
06 Jun 2018	FOB Dest'n, Own Truck	F-73289	PT 15001

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
196	PC	X	66	130	PENTEX BC 340 (49/CS)	4	71.540
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	21	59	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
132	PC	X	61	71	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
100	PC		92	8	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		106.492 KG
					**** TOTAL PACKAGES ****	8	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ✓ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.:

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY

SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
Dylan Tratt	Dylan Tratt	

SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A
	06 06 18		06 06 18		

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

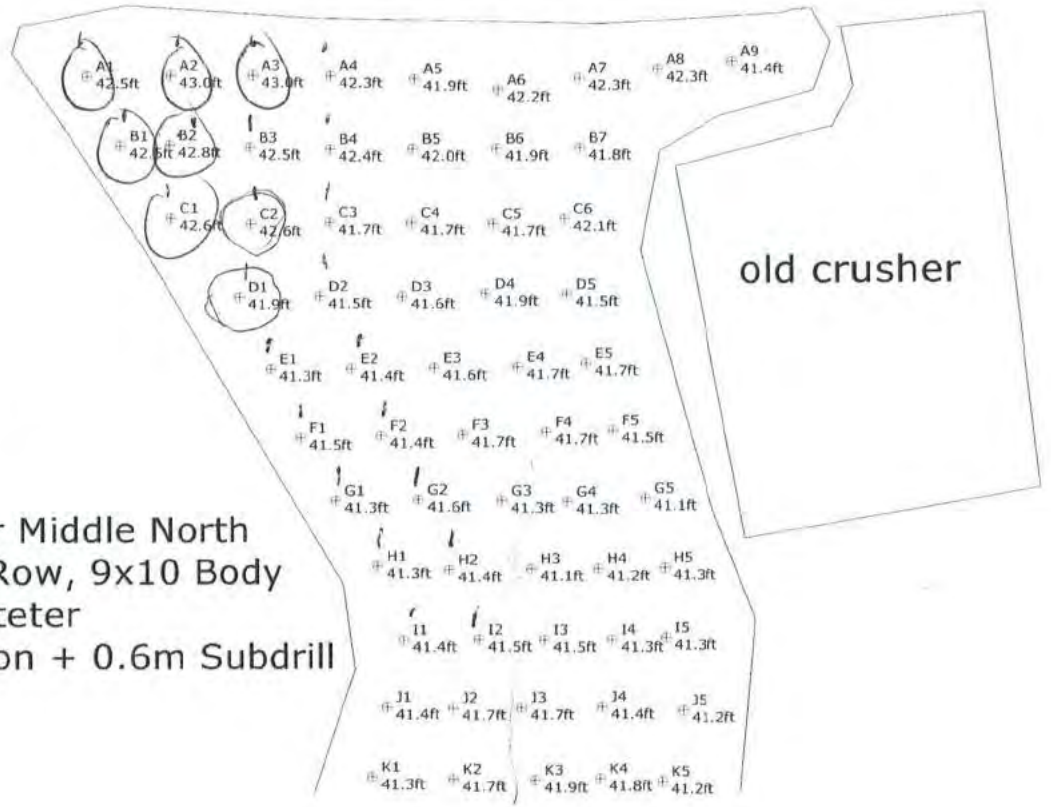
SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 62	Hole angle: 0.0°
Total drilled: 2588.0ft			



open face

18-006 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diamteter
250m Elevation + 0.6m Subdrill

Not to scale

SHOTPlus 5.7.2.1	02/05/2018
Mine	Burlington
Location	
Title/author	18-006 K. George
Filename	18-006 Lower Middle.spf

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-007
P.O. #:		Orica Order #:	2348563
Blast Date:	2018-06-11	Blast Time:	11:56 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40368 °N Latitude (Centre of Blast) 79.88315 °W Longitude (Centre of Blast)

Wind from the: E at 15 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	X	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	28,467 te	10,742 m3
Total tonnes per day:	28,467 te	NB80-01 Rate Code
Total Holes Loaded:	55 holes	
… including:		Dead Holes
… and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	4 rows	

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 54	=	4,055.1 ft (4 " diam)
Secondary Bit diam:	101.6	mm	0 °	# Holes: 1	=	75.1 ft (4 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	8	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	47	main body
Bench Height:	73.1	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	75.1	ft avg

- Stone Decking -

Front Row:		ft avg
Main Body:		ft avg
# Decks:		per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

- Charge Length -

Front Row:	68.1	ft avg
Main Body:	68.1	ft avg

- Charge Weight -

Front Row:	198.6	kg/hole
Main Body:	198.6	kg/hole
Max. per delay:	261.0	kg/delay
SD () Equation:	202.9	kg/delay
Total kg Loaded:	12,797	kg
Rock Density:	2.65	g/cc = te/m^3

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

2.008 lb/yd^3	Yield PF:	0.450	kg/te (actual)
1.347 lb/yd^3	Front row:	0.302	kg/te (theoretical)
1.797 lb/yd^3	Main Body:	0.402	kg/te (theoretical)
1.684 lb/yd^3	"KPI" PF:	0.377	kg/te (theoretical)

Bulk Explosives:

	in (kg)	out (kg)	kg
	33,850	21,090	12,760

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	110	37.4

total explosives weight in Blast (kg): 12,797

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			54
UNITRONIC 600 15M			1
UNITRONIC 600 25M			55

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	10
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE		>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours		0.0
HELPER HOURS	Enter total Helper man-hours		0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Some holes received an 8' or 9' collar due to broken rock on top or lean burden at the crest

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-007
P.O. #:		Orica Order #:	2348563
Blast Date:	2018-06-11	Blast Time:	11:56 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40364**	**79.88314**	0.757536	1.394224
Front Row Corner	43.40353	79.88317	0.757535	1.394224
Back Row Corner	43.40386	79.88312	0.757540	1.394223
Average (Centre of Blast)	43.40368	79.88315	0.757537	1.394224

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**427.3**	m				
Post Blast Data: ppV:	**2.7**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**12.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**116.9**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**916.8**	m				
Post Blast Data: ppV:	**0.2**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**10.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**120.2**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1233.5**	m				
Post Blast Data: ppV:	**0.1**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**0.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**119.6**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(427.3)^2}{30^2} \text{ kg}$$

$$= \frac{182{,}585}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 203 kg

jim bray

Orica
Blaster-in-charge: *Mike der Kinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

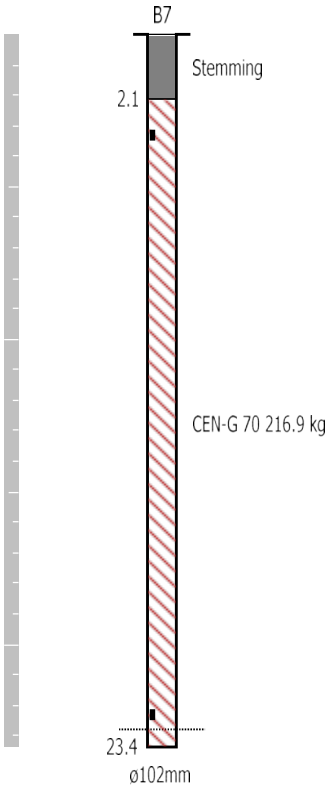
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-007
P.O. #:		Orica Order #:	2348563
Blast Date:	6/11/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

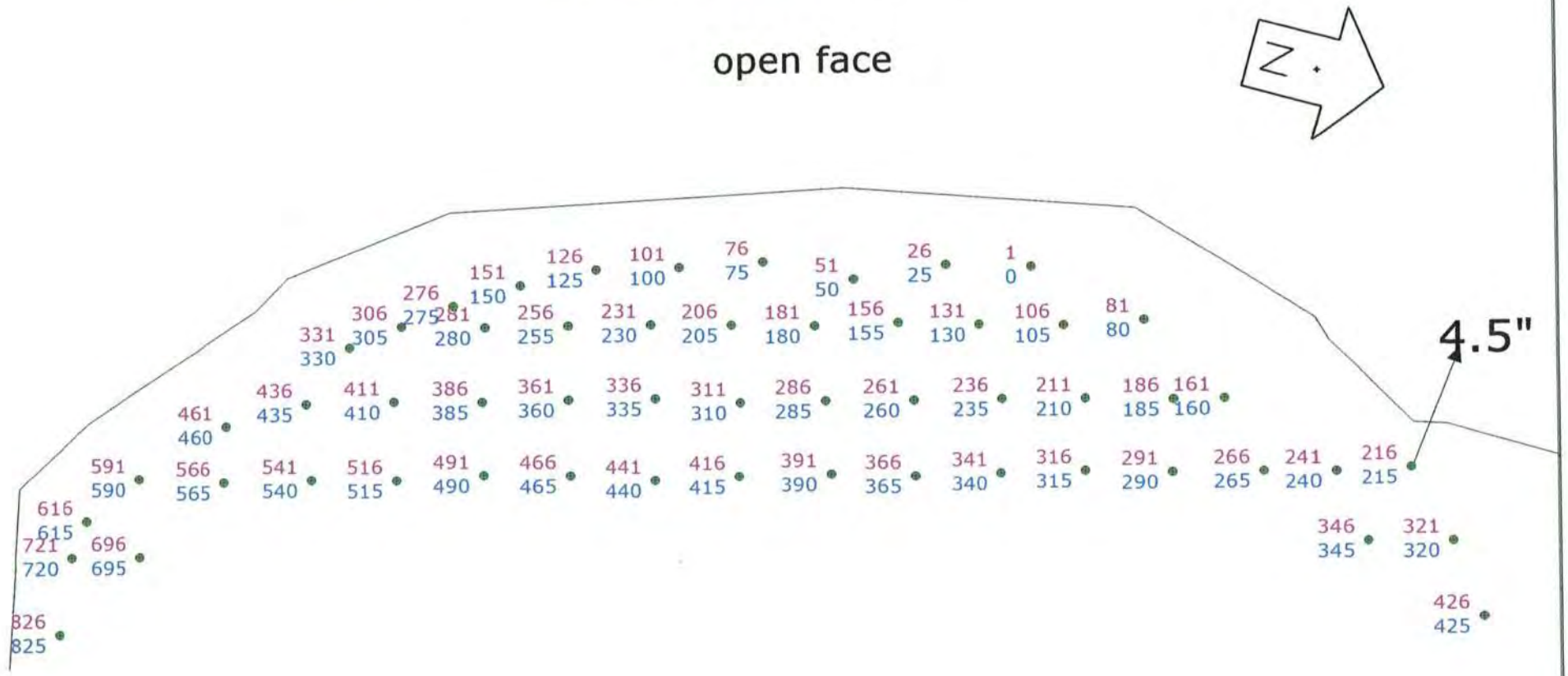
Quarry Manager: Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 2.7m	Spacing: 3.0m	Subdrill: 0.2m	Stemming: 2.1m
1st row burden: 3.7m	Hole Diameter: 102.0mm	Number of holes: 55	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1292.0m	Blasted tonnage: 29,020tne	



Not to scale

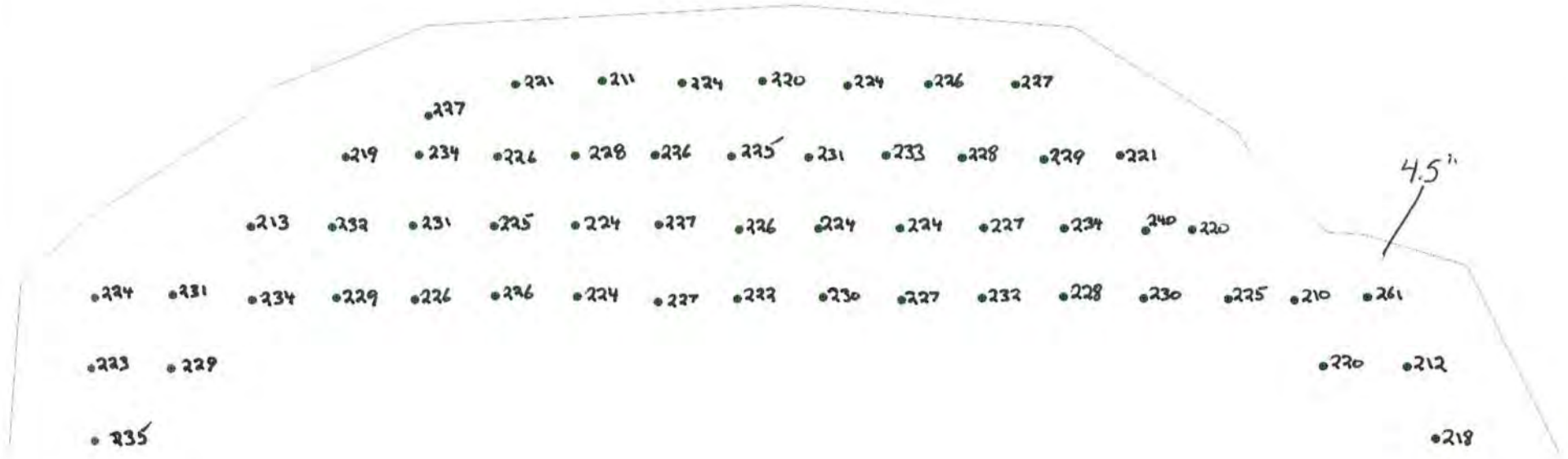
SHOTPlus 5.7.1.1		6/11/2018
Mine	Burlington	
Location	Upper Middle Bench	
Title/author	18-007 Upper Middle Design	Ken George
Filename	18-007_Upper_Middle_Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 0.6ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 55	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 4130.2ft	Blasted tonnage: 25,592S/T	

Load Sheet Max Load 240kg



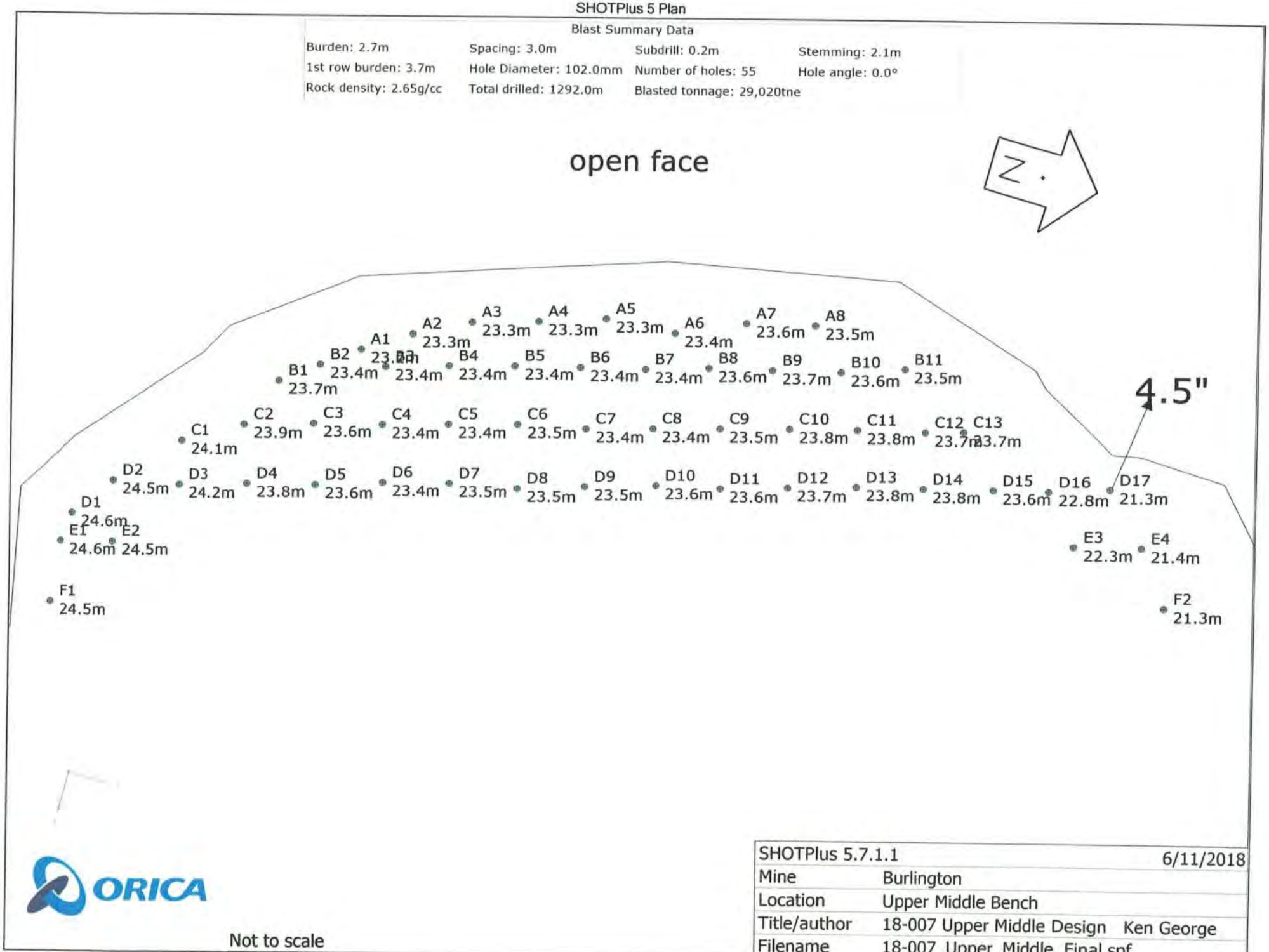
Not to scale

SHOTPlus 5.7.1.1		6/7/2018
Mine	Burlington	
Location	Upper Middle Bench	
Title/author	18-007 Upper Middle Design	Ken George
Filename	18-007_Upper_Middle_Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 2.7m	Spacing: 3.0m	Subdrill: 0.2m	Stemming: 2.1m
1st row burden: 3.7m	Hole Diameter: 102.0mm	Number of holes: 55	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1292.0m	Blasted tonnage: 29,020tne	



ORICA

Not to scale

SHOTPlus 5.7.1.1		6/11/2018
Mine	Burlington	
Location	Upper Middle Bench	
Title/author	18-007 Upper Middle Design	Ken George
Filename	18-007_Upper_Middle_Final.spf	

1089791

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2348563	86036212

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
11 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
11 Jun 2018	FOB Dest'n, Own Truck	F-73289	PT 15013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
147	PC	X	37	110	PENTEX BC 340 (49/CS)	3	53.655
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	26	54	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
66	PC	X	65	1	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
108	PC	X	53	55	*uni tronic 600-25M CU/ZC SPL(80')54P	2	26.352
100	PC		90	10	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		103.673 KG
					**** TOTAL PACKAGES ****	8	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	✓ YES / OUI ___ NO / NON	301 rue hotel de ville Brownsburg-Chathan, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV / PRESSAGE / WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Ryan Benham	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Ryan Benham	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE: 11 06 18 (D/J M/M Y/A)	SIGNATURE	DATE: 11 06 18 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

3 MEMORANDUM / MÉMORANDUM

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPEDITION PAR MESSAGERIES DOIT ETRE SIGNE PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-06-11

Blast Number: 18-007
Orica Order #:

page 1

Blaster-in-charge: Mike der Kinderen (Phot Name)

Blast Location: Upper Middle (Bench / Face)
GPS Coordinates: 43.40368 °N Latitude (Centre of Blast) 79.88315 °W Longitude (Centre of Blast)

Design te Blasted: 27,150 te
Total Holes Loaded: 55 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 4 rows

- Drilling Information -

		mm	Angle from Vertical	# Holes:		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0	# Holes:	55	= 4,130.2 ft (4 " diam)
Secondary Bit diam:		mm	0	# Holes:		= 0.0 ft (" diam)
Tertiary Bit diam:		mm	0	# Holes:		= 0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 55 main body
Bench Height: 73.1 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 75.1 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

Bulk Expl. Required:

		kg
CENTRA GOLD 70		13,200

Pkgd Expl. Required:

		kg

Boosters Required:

	kg/u	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	110	37.4

total explosives weight in Blast (kg): 13,237
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		55
UNITRONIC 600 25M		55

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row: 68.1 ft avg
Main Body: 68.1 ft avg

- Design Charge Weight -

Front Row: 198.6 kg/hole
Main Body: 198.6 kg/hole
Max Chge Wt / delay: 240.0 kg/delay

Required kg Loaded: 13,237 kg
Rock Density: 2.65 g/cc = te/m^3

- Design Powder Factor -

Expected Yield PF: 0.488 kg/te (actual)
1.347 lb/yd^3 Front row: 0.302 kg/te (theoretical)
1.797 lb/yd^3 Main Body: 0.402 kg/te (theoretical)
1.684 lb/yd^3 "KPI" PF: 0.377 kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

A-3 (9)
C-1 (8)
D 17 L-20 P(8)

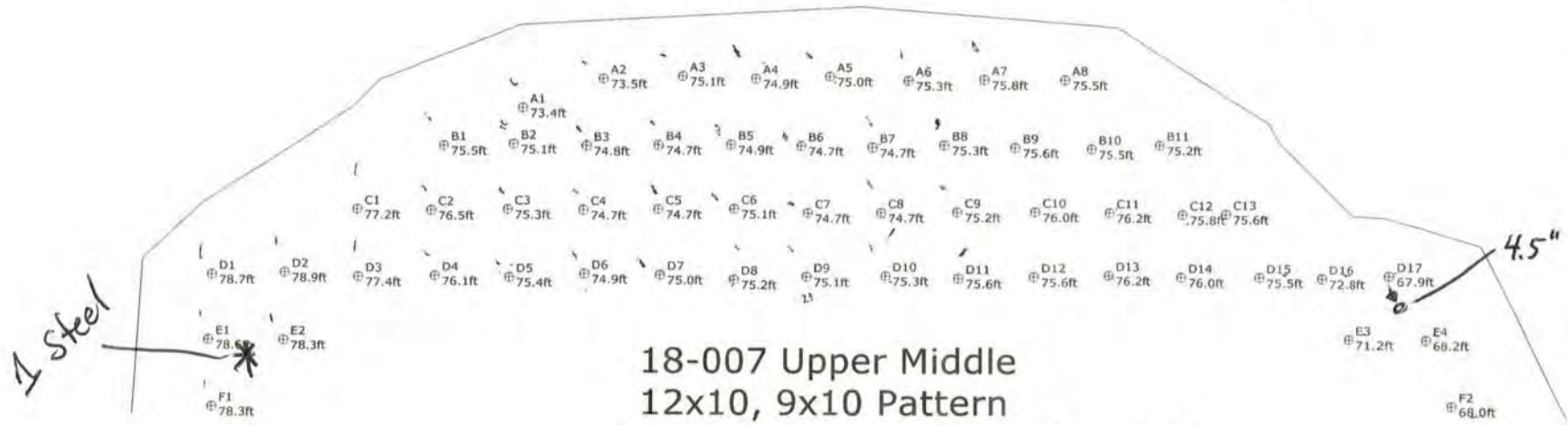
A1 - A8
B1
C1
D1
E1

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 0.6ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 55	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 4130.2ft	Blasted tonnage: 25,862S/T	

N

open face



18-007 Upper Middle
12x10, 9x10 Pattern
4" Hole Unless otherwise noted
250m + 0.6m Subdrill

ORICA

Not to scale

SHOTPlus5Beta 5.7.3.9		04/06/2018
Mine	Burlington	
Location	Upper Middle Bench	
Title/author	18-004 Upper Middle Design	Ken G
Filename	18-007 Upper Middle Final.spf	

Event Report

Date/Time	Long at 11:56:25 June 11, 2018
Trigger Source	Geo: 2.000 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.5 Volts
Unit Calibration	May 3, 2017 by Instantel
File Name	__TEMP.EVT

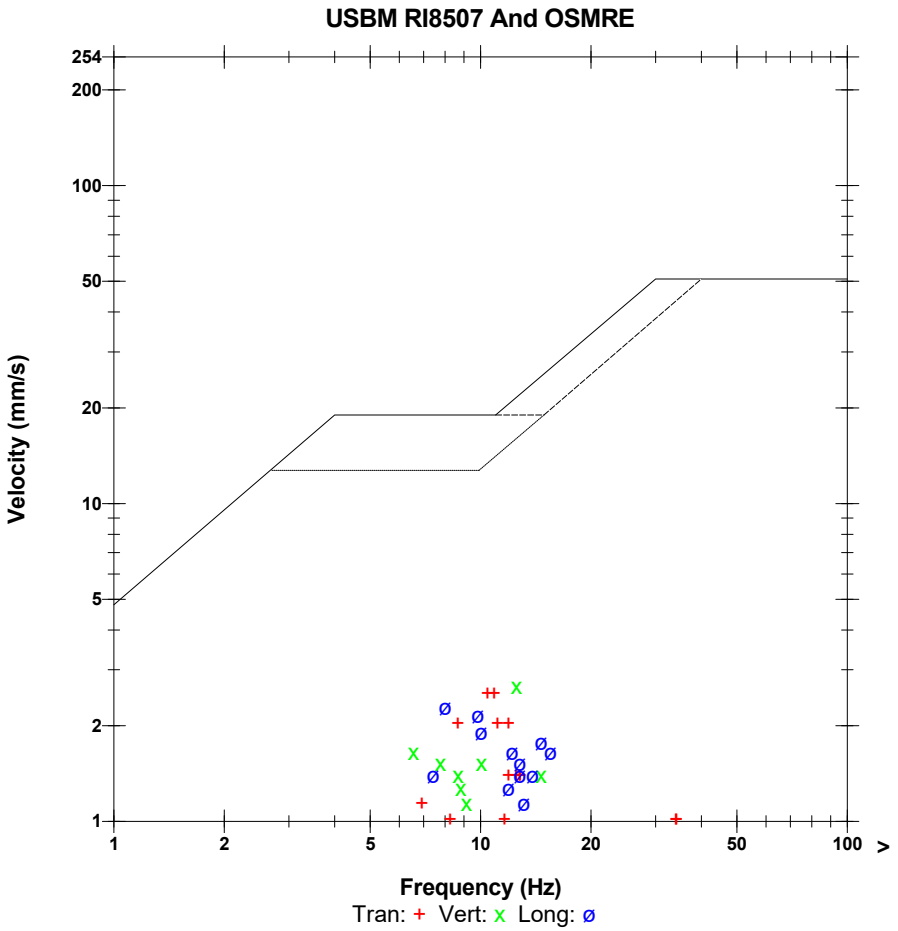
Notes
Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada
General: N.43.40245 W.79.87814

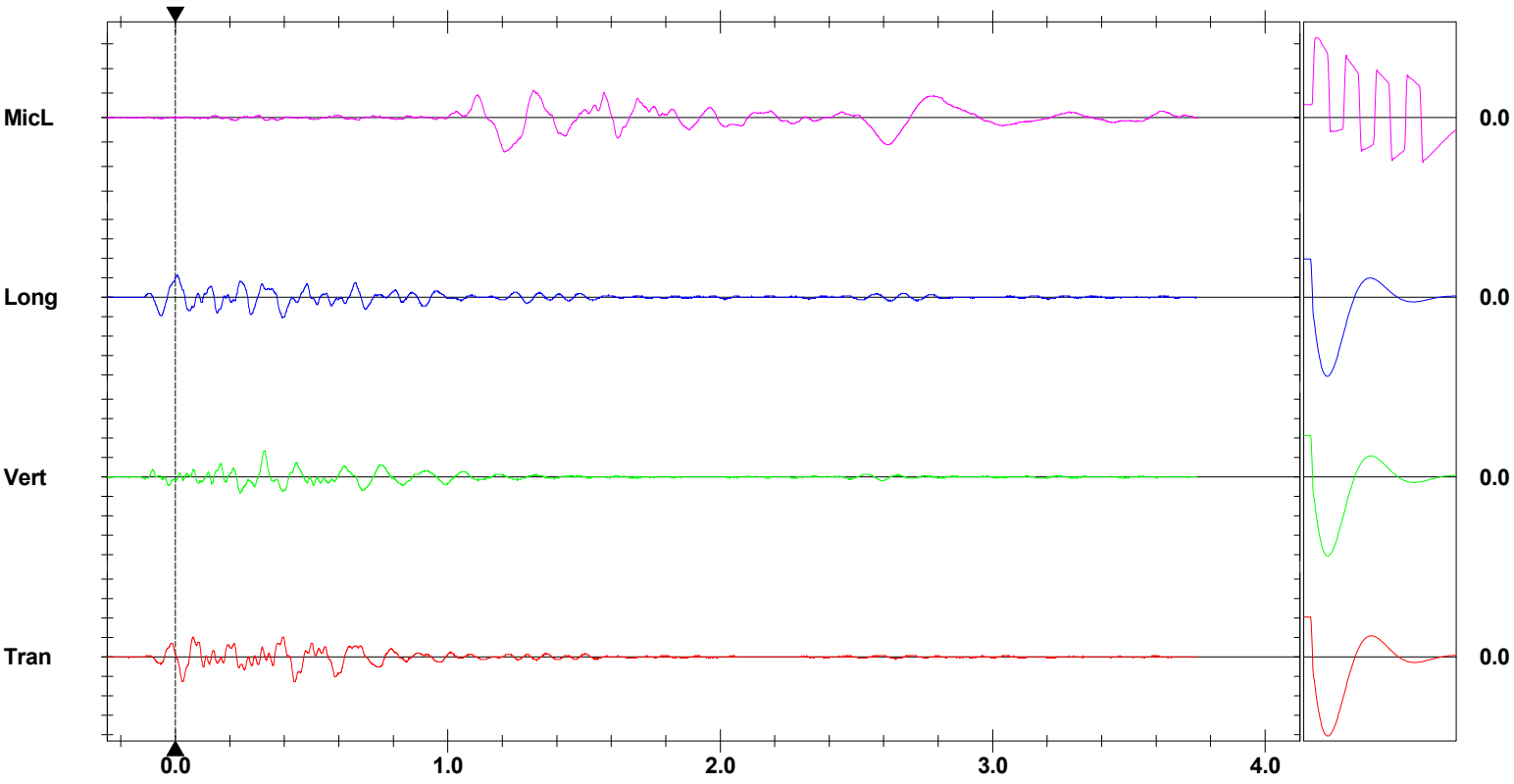
Extended Notes
Sand Bagged

Microphone	Linear Weighting
PSPL	116.9 dB(L) at 1.206 sec
ZC Freq	3.5 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 693 mv)

	Tran	Vert	Long	
PPV	2.540	2.667	2.286	mm/s
ZC Freq	11	12	8.0	Hz
Time (Rel. to Trig)	0.024	0.324	0.006	sec
Peak Acceleration	0.040	0.027	0.040	g
Peak Displacement	0.038	0.031	0.042	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.4	7.4	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 3.277 mm/s at 0.393 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time MicL at 11:56:27 June 11, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.107 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/BURLINGTON.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.5 Volts
Unit Calibration February 14, 2018 by Instantel
File Name __TEMP.EVT

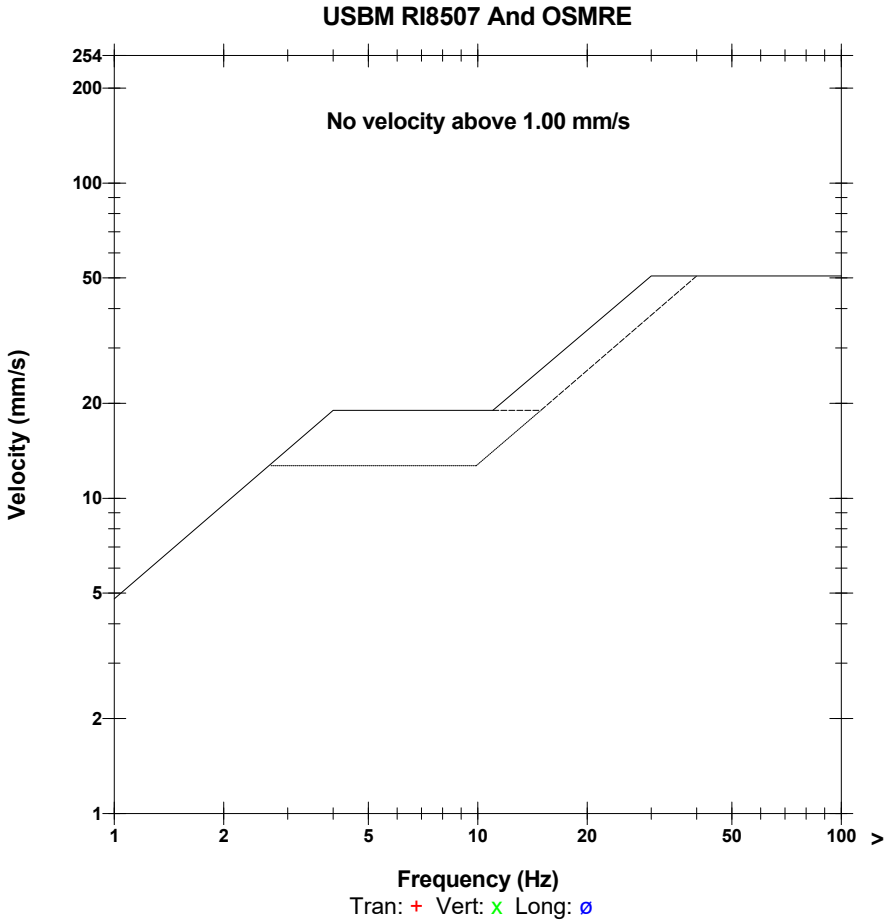
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

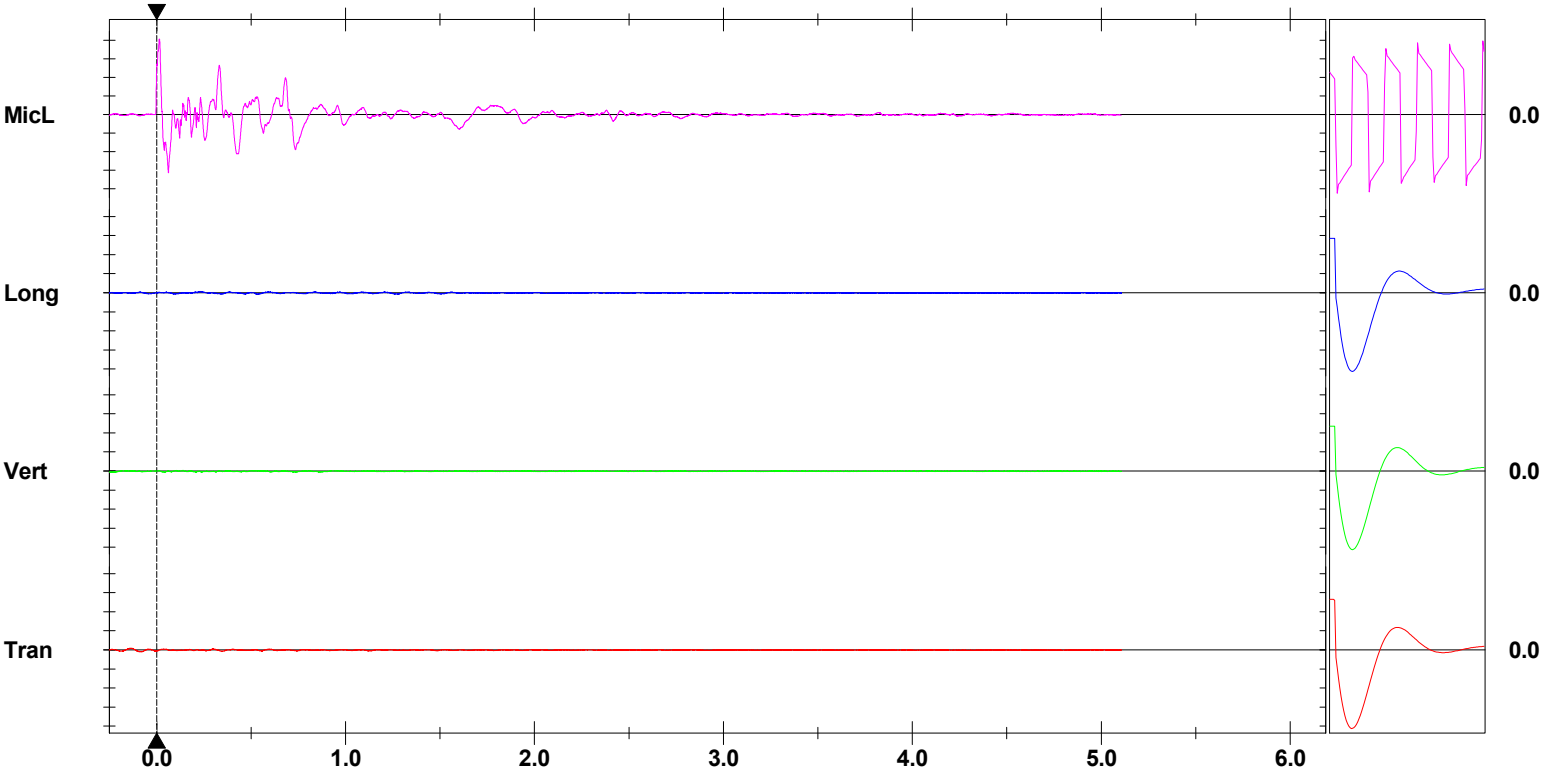
Extended Notes
N 43.31617
W 80.02664

Microphone Linear Weighting
PSPL 120.2 dB(L) at 0.015 sec
ZC Freq 13.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1331 mv)

	Tran	Vert	Long	
PPV	0.213	0.126	0.158	mm/s
ZC Freq	9.7	9.3	10.0	Hz
Time (Rel. to Trig)	-0.085	-0.241	0.533	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.004	0.004	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.5	3.3	3.6	

Peak Vector Sum 0.227 mm/s at -0.084 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Event Report

Date/Time	MicL at 11:56:29 June 11, 2018
Trigger Source	Geo: 1.500 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 1024 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	November 3, 2017 by Instantel
File Name	__TEMP.EVT
Scaled Distance	3879.2 (1226.7 m, 0.1 kg)

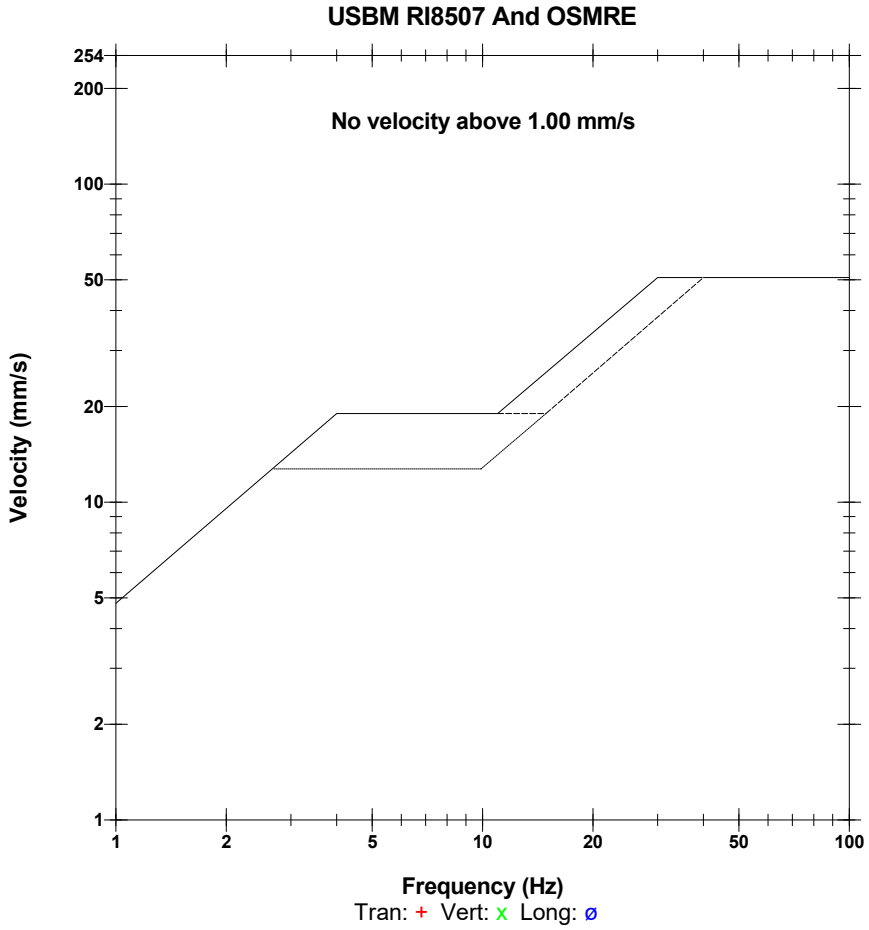
Notes
Location: South West Corner of Property
Client: Nelson Aggregates Burlington Quarry
User Name: ORICA CANADA INC.
General:

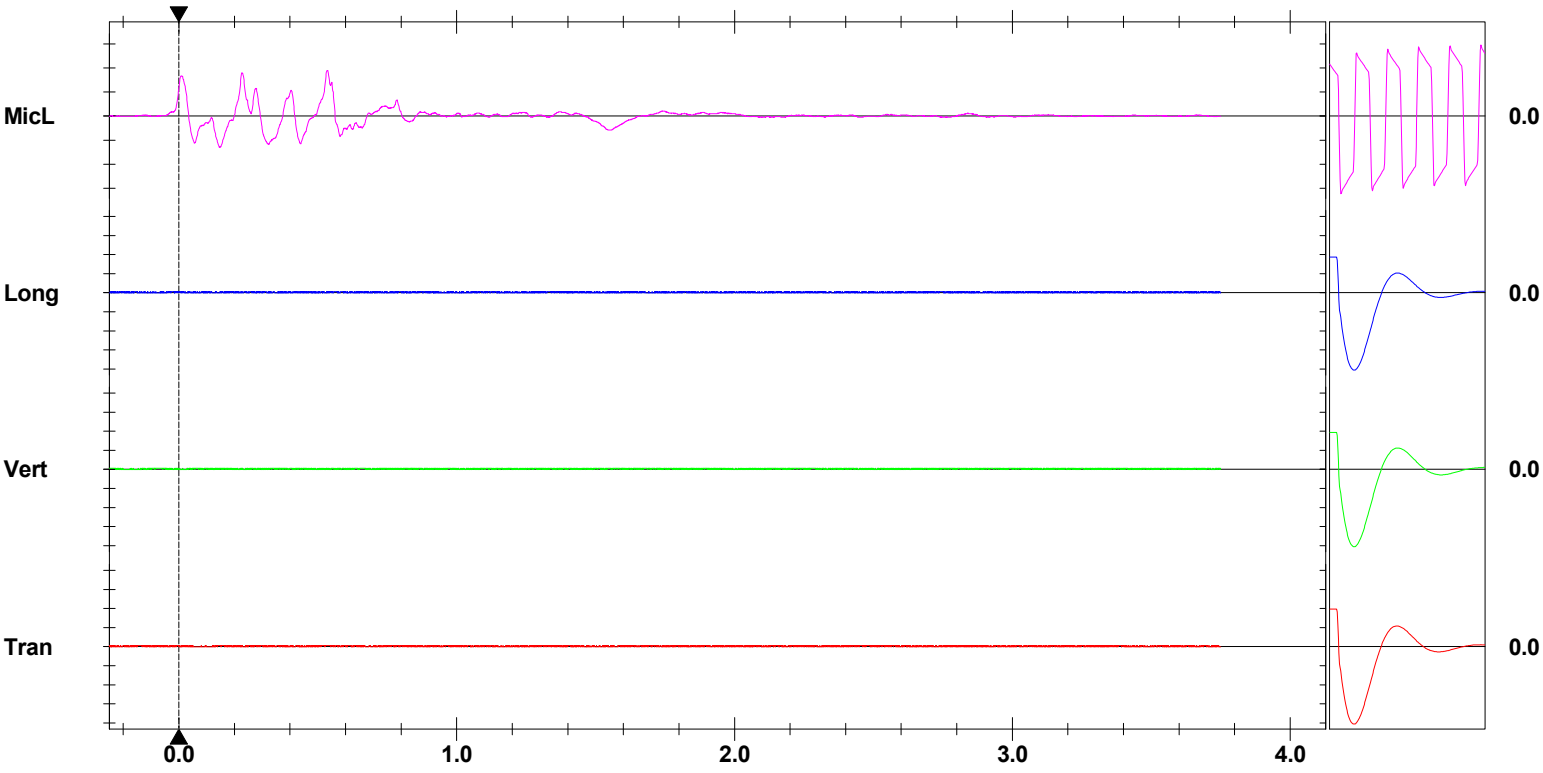
Extended Notes
43.39339 ,79.88880

Microphone	Linear Weighting
PSPL	119.6 dB(L) at 0.533 sec
ZC Freq	6.8 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 618 mv)

	Tran	Vert	Long	
PPV	0.127	0.127	0.127	mm/s
ZC Freq	N/A	N/A	>100	Hz
Time (Rel. to Trig)	-0.250	-0.250	-0.246	sec
Peak Acceleration	0.013	0.013	0.013	g
Peak Displacement	0.000	0.000	0.000	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.7	4.0	

Peak Vector Sum 0.220 mm/s at -0.244 sec
N/A: Not Applicable





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-008
P.O. #:		Orica Order #:	2349625
Blast Date:	2018-06-13	Blast Time:	11:52 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)

GPS Coordinates: 43.40407 °N Latitude (Centre of Blast) 79.88289 °W Longitude (Centre of Blast)

Wind from the: W at 10 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	X	Snow:		Inversion:	

Ceiling: 2,554 ft

Tonnes Blasted:	28,929 te	10,917 m3
Total tonnes per day:	28,929 te	NB40-06 Rate Code
Total Holes Loaded:	89 holes	
… including:	Dead Holes	
… and:	3 Helper Holes	
Helper Hole Collar:	9.0 ft avg	
# Rows Blasted:	7 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	89	=	4,450.9 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	10	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	79	main body
Bench Height:	48.0	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	50.0	ft avg

- Stone Decking -

Front Row:	5.0	ft avg
Main Body:	5.0	ft avg
# Decks:	8	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

- Charge Length -

Front Row:	38.0	ft avg
Main Body:	38.0	ft avg

- Charge Weight -

Front Row:	110.8	kg/hole
Main Body:	110.8	kg/hole
Max. per delay:	157.0	kg/delay
SD () Equation:	200.0	kg/delay
Total kg Loaded:	12,939	kg
Rock Density:	2.65	g/cc = te/m^3

- Powder Factor -

1.998 lb/yd^3	Yield PF:	0.447	kg/te (actual)
1.145 lb/yd^3	Front row:	0.256	kg/te (theoretical)
1.527 lb/yd^3	Main Body:	0.342	kg/te (theoretical)
1.472 lb/yd^3	"KPI" PF:	0.330	kg/te (theoretical)

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,790	20,940	12,850

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	3	2	25

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	187	63.6

total explosives weight in Blast (kg): 12,939

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			87
UNITRONIC 600 15M			8
UNITRONIC 600 20M			92

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE		>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		10.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Hole X-3 & G9 Could not be found once loading had been started

A-8,C-4,B-8,C-12,C-7,C-8,F-4,F-10 All Received a 5' stone deck due to incompetant rock

See Atached Load Adustment sheet for any more Changes

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-008
P.O. #:		Orica Order #:	2349625
Blast Date:	2018-06-13	Blast Time:	11:52 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40407**	**79.88286**	0.757544	1.394219
Front Row Corner	43.40417	79.88310	0.757546	1.394223
Back Row Corner	43.40397	79.88271	0.757542	1.394216
Average (Centre of Blast)	43.40407	79.88289	0.757544	1.394219

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**424.3**	m			
Post Blast Data: ppV:	**1.0**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**15.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**120.6**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**925.3**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1281.4**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(424.3)^2}{30^2} \text{ kg}$$

$$= \frac{180{,}030}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 200 kg

jim bray

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

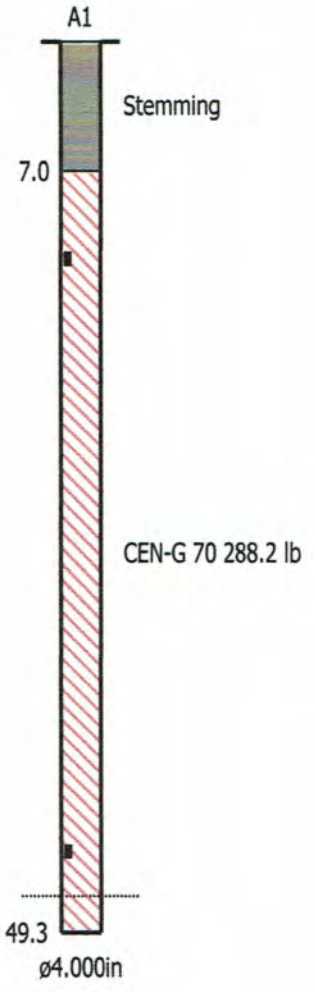
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-008
P.O. #:		Orica Order #:	
Blast Date:	6/13/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Mike der Kinderen

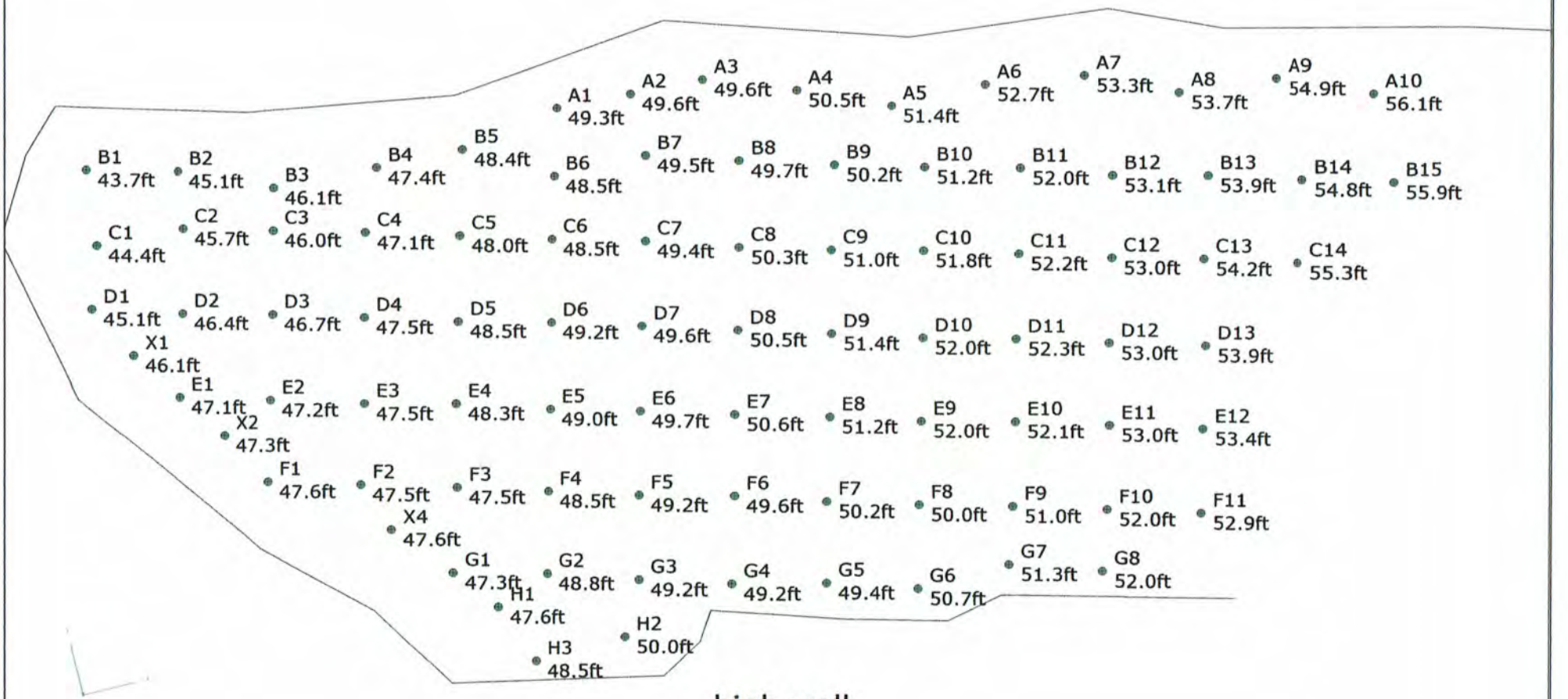
Quarry Manager: Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 89	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 4446.2ft	Blasted tonnage: 33,192S/T	

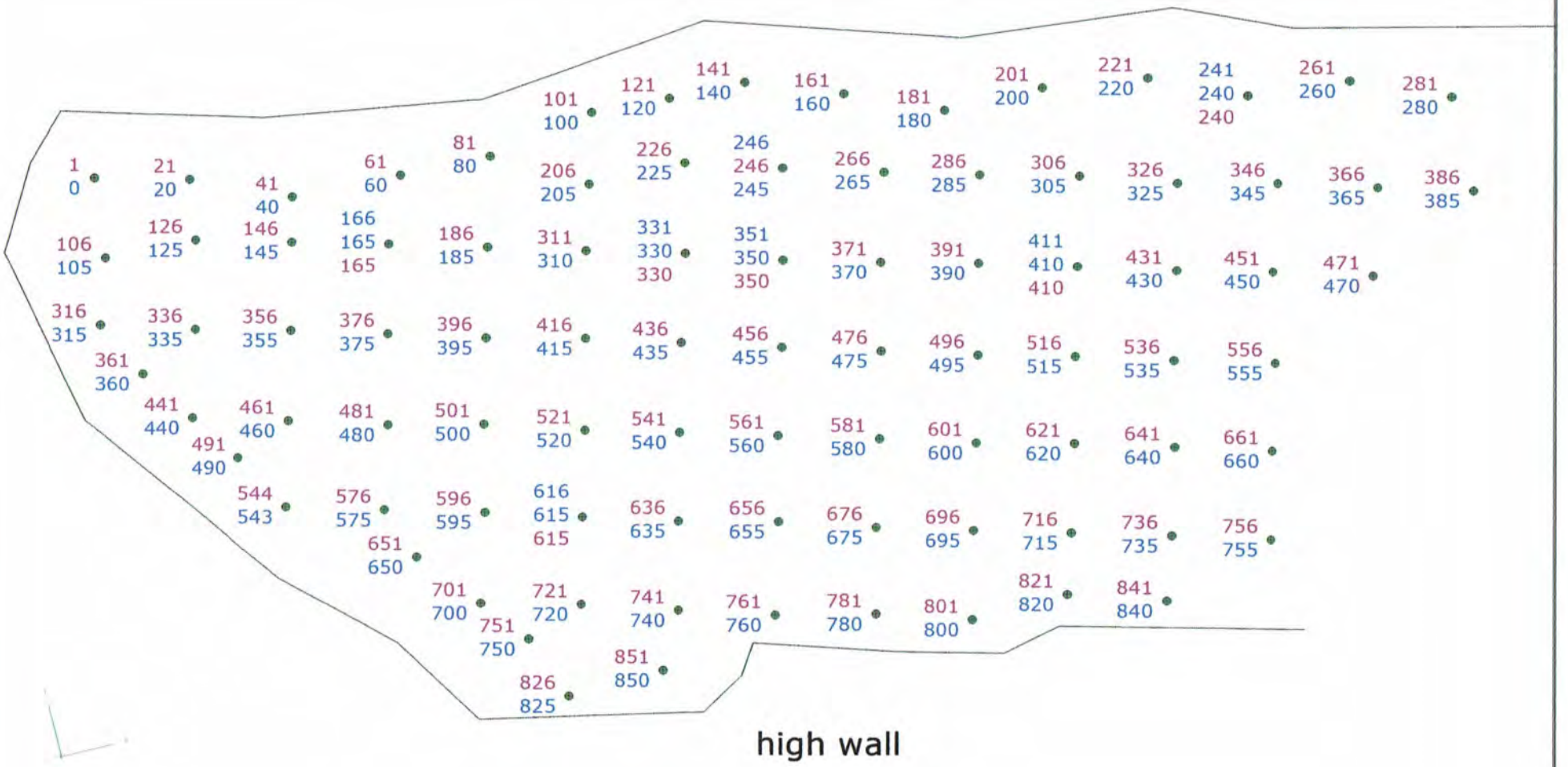


ORICA

Not to scale

SHOTPlus 5.7.1.1		6/13/2018
Mine	Burlington	
Location		
Title/author	18-008 Bottom Middle South	K George
Filename	2018-06-13 18-008 Lower Middle.spf	

Timing



Not to scale

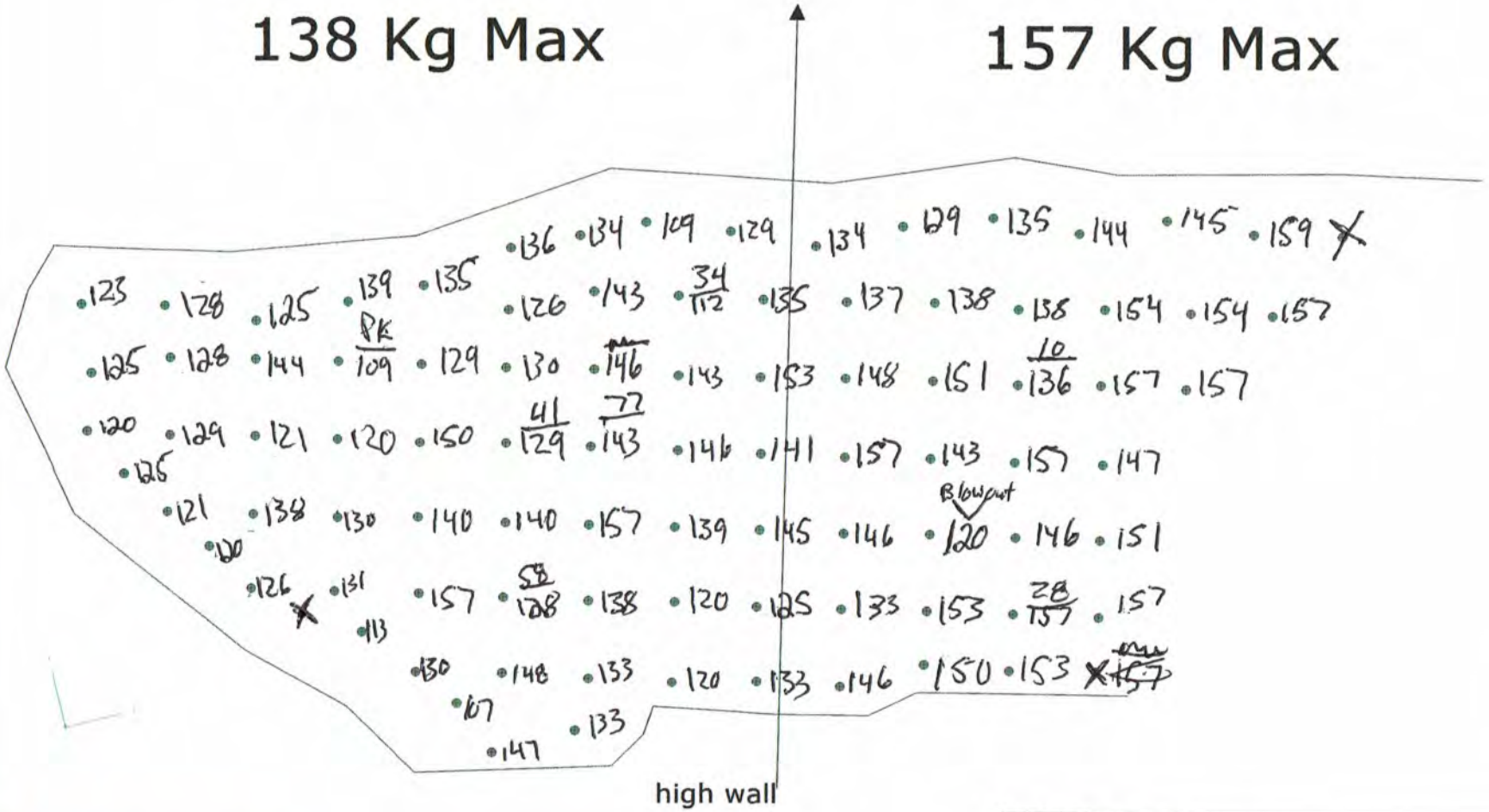
SHOTPlus 5.7.1.1		6/13/2018
Mine	Burlington	
Location		
Title/author	18-008 Bottom Middle South K George	
Filename	2018-06-13 18-008 Lower Middle.spf	

53

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 92	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 4601.0ft	Blasted tonnage: 34,239S/T	

Load Sheet



ORICA

Not to scale

SHOTPlus 5.7.1.1	6/11/2018
Mine	Burlington
Location	
Title/author	18-008 Bottom Middle South K George
Filename	2018-06-13 18-008 Lower Middle.spf

1089815

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2349625	86039399

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
13 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
13 Jun 2018	FOB Dest'n, Own Truck	F-73289	PT15013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
3	CS	X	2	1	FORTEL PRO 75X400 (3X16)	3	78.900
294	PC	X	107	187	PENTEX BC 340 (49/CS)	6	107.310
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
160	PC	X	73	87	*uni tronic 600-06.0M CU/ZC(20')80PC	2	11.680
66	PC	X	58	8	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
132	PC	X	40	92	*uni tronic 600-20M CU/ZC SPL(65')66P	2	26.928
100	PC		94	6	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		242.644 KG
					**** TOTAL PACKAGES ****	15	

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	✓ YES / OUI — NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.:

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Ryan Beyham	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Ryan Beyham	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	SIGNATURE	SIGNATURE
DATE: 13 06 18 (D/J M/M Y/A)	DATE: 13 06 18 (D/J M/M Y/A)	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Event Report

Date/Time	MicL at 11:52:09 June 13, 2018
Trigger Source	Geo: 2.000 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.25 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.4 Volts
Unit Calibration	May 3, 2017 by Instantel
File Name	__TEMP.EVT

Notes

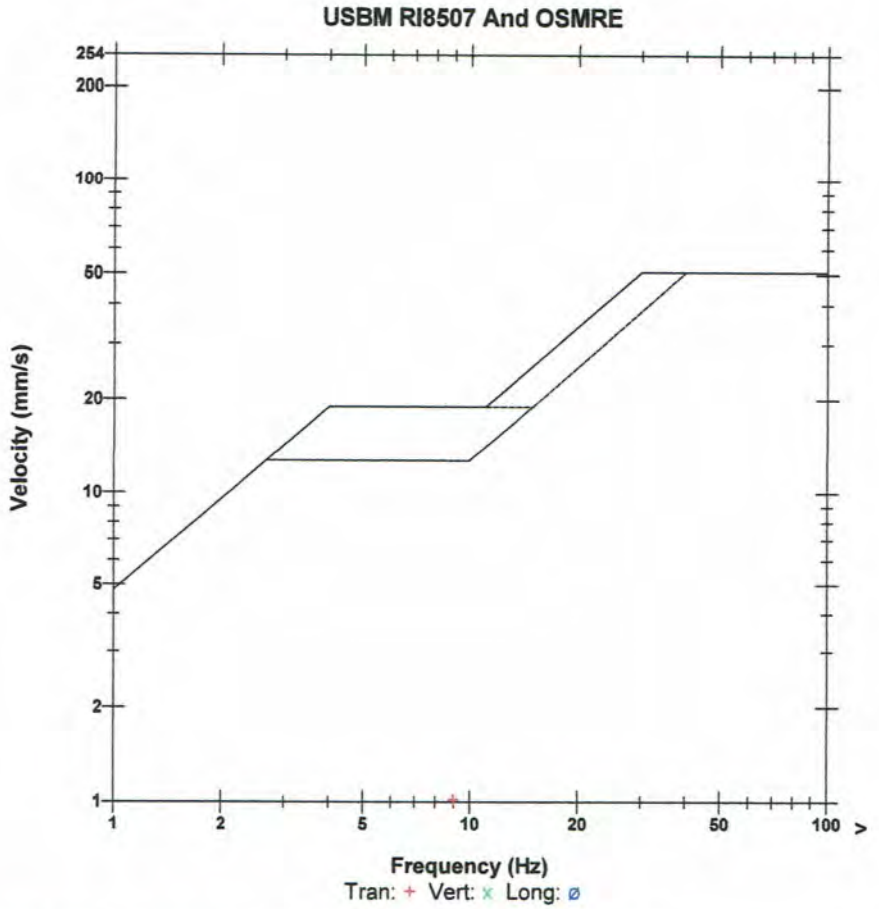
Location:	2450 2nd Line
Client:	Nelson Aggregates
User Name:	Orica Canada
General:	N.43.40245 W.79.87814

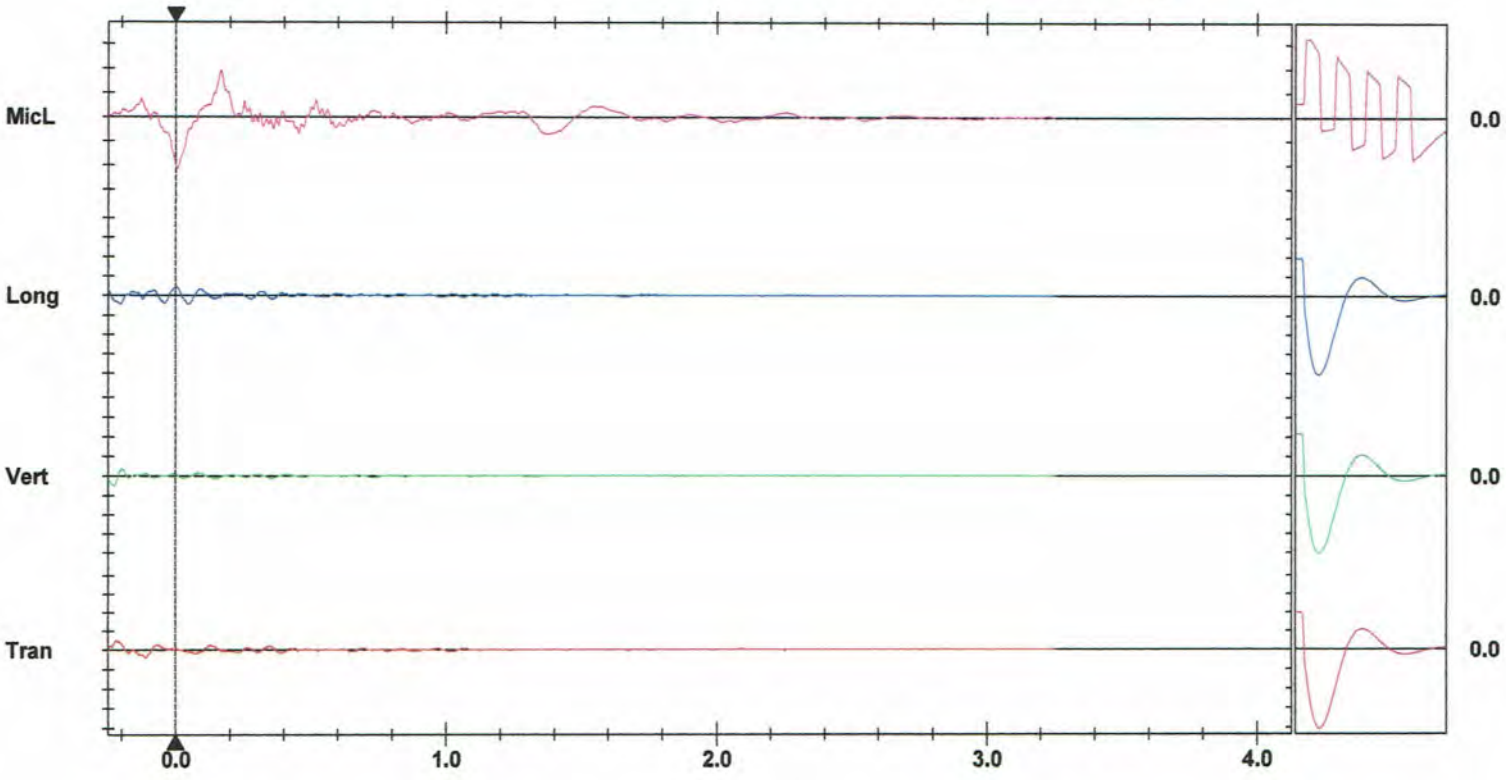
Extended Notes
Sand Bagged

Microphone	Linear Weighting
PSPL	120.6 dB(L) at 0.004 sec
ZC Freq	3.4 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 615 mv)

	Tran	Vert	Long	
PPV	1.016	1.016	0.889	mm/s
ZC Freq	9.0	15	10	Hz
Time (Rel. to Trig)	-0.223	-0.228	-0.208	sec
Peak Acceleration	0.013	0.013	0.027	g
Peak Displacement	0.017	0.012	0.014	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.4	7.4	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 1.420 mm/s at -0.228 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div

Trigger =

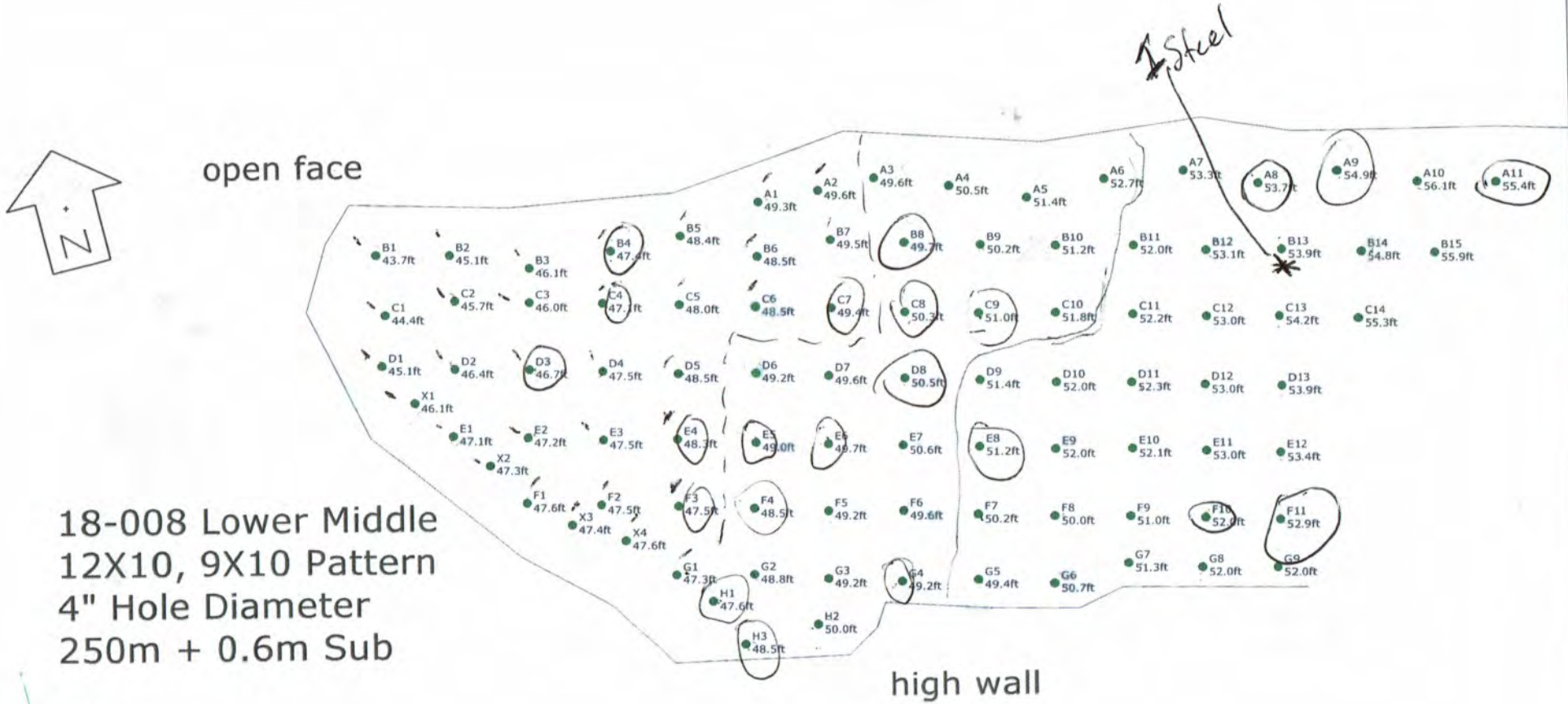
Sensor Check

613 305 0454

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 92	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 4601.0ft	Blasted tonnage: 34,239S/T	



18-008 Lower Middle
12X10, 9X10 Pattern
4" Hole Diameter
250m + 0.6m Sub

ORICA

Not to scale

SHOTPlus5Beta 5.7.3.9	06/06/2018
Mine	Burlington
Location	
Title/author	18-005 Bottom Middle South I. Dee
Filename	18-008 Lower Middle South Design F

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-06-13

Blast Number: 18-008
Orica Order #:

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)
GPS Coordinates: 43.40407 °N Latitude (Centre of Blast) 79.88289 °W Longitude (Centre of Blast)

Design te Blasted: 29,670 te
Total Holes Loaded: 92 holes
... including: Dead Holes
... and: 4 Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 8 rows

- Drilling Information -

		Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0°	# Holes: 92	=	4,600.9 ft (4 " diam)
Secondary Bit diam:	mm	0°	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:	mm	0°	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 11 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 81 main body
Bench Height: 48.0 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 50.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 43.0 ft avg
Main Body: 43.0 ft avg

- Design Charge Weight -

Front Row: 125.4 kg/hole
Main Body: 125.4 kg/hole
Max Chge Wt / delay: 170.0 kg/delay

Required kg Loaded: 12,875 kg
Rock Density: 2.65 g/cc = te/m^3

- Design Powder Factor -

Expected Yield PF: 0.434 kg/te (actual)
1.296 lb/yd^3 Front row: 0.290 kg/te (theoretical)
1.728 lb/yd^3 Main Body: 0.387 kg/te (theoretical)
1.674 lb/yd^3 "KPI" PF: 0.375 kg/te (theoretical)

Bulk Expl. Required:

		kg
		12,700

Pkgd Expl. Required:

		kg
FORTEL PRO 75X400	3	75

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	294	100.0

total explosives weight in Blast (kg): 12,875
Pkgd Prod (75 kg) % of Total kg: 0.6%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		160
UNITRONIC 600 15M		66
UNITRONIC 600 20M		132

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B. S. Expl or IS from previous Blast:

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-009
P.O. #:		Orica Order #:	2354121
Blast Date:	2018-06-25	Blast Time:	12:01 PM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)

GPS Coordinates: 43.40451 °N Latitude (Centre of Blast) 79.88425 °W Longitude (Centre of Blast)

Wind from the: SE at 10 kph Temperature: 16 to 20 °C

Clear:	x	Rain:		Overcast:	
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	25,983 te	9,805 m3
Total tonnes per day:	25,893 te	NB40-07 Rate Code
Total Holes Loaded:	99 holes	
… including:	Dead Holes	
… and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	13 rows	

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 99	=	3,692.3 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,280	17,620	9,660

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	3	0	75

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	200	68.0

total explosives weight in Blast (kg): 9,803

Pkgd Prod (75 kg) % of Total kg: 0.8%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			98
UNITRONIC 600 15M			102

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Theoretical PF (Based on a single hole)

- Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.0 ft avg
# Holes:	30 front row

- Pattern (Main Body) -

Burden:	9.0 ft avg
Spacing:	10.0 ft avg
# Holes:	69 main body
Bench Height:	35.3 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	37.3 ft avg

- Stone Decking -

Front Row:	5.0 ft avg
Main Body:	5.0 ft avg
# Decks:	2 per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75" Stone

- Charge Length -

Front Row:	25.3 ft avg
Main Body:	25.3 ft avg

- Charge Weight -

Front Row:	73.8 kg/hole
Main Body:	73.8 kg/hole
Max. per delay:	118.0 kg/delay
SD () Equation:	329.8 kg/delay
Total kg Loaded:	9,803 kg
Rock Density:	2.65 g/cc = te/m^3

- Powder Factor -

1.685 lb/yd^3	Yield PF:	0.377 kg/te (actual)
1.037 lb/yd^3	Front row:	0.232 kg/te (theoretical)
1.382 lb/yd^3	Main Body:	0.309 kg/te (theoretical)
1.356 lb/yd^3	"KPI" PF:	0.303 kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blastec

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Hole B-1 and B-2 Revieved stone decks due to voids found while loading

Hole N-5 to N-11 were not loaded because we ran out of product in our MMU

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-009
P.O. #:		Orica Order #:	2354121
Blast Date:	2018-06-25	Blast Time:	12:01 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40452**	**79.88424**	0.757552	1.394243
Front Row Corner	43.40442	79.88402	0.757550	1.394239
Back Row Corner	43.40458	79.88449	0.757553	1.394247
Average (Centre of Blast)	43.40451	79.88425	0.757552	1.394243

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**544.8**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**807.0**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1291.1**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(544.8)^2}{30^2} \text{ kg}$$

$$= \frac{296{,}807}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 330 kg

jim bray

Orica
Blaster-in-charge: *Mike der Kinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-010
P.O. #:		Orica Order #:	2359087
Blast Date:	2018-07-05	Blast Time:	11:51 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40369 °N Latitude (Centre of Blast) 79.88327 °W Longitude (Centre of Blast)

Wind from the: SW at 5 kph Temperature: 26 to 30 °C

Clear:	x	Rain:		Overcast:	
Partly Cloudy:		Snow:		Inversion:	

Ceiling 30,000 ft

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 53	=	4,133.5 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,780	21,100	12,680

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	118	40.1

total explosives weight in Blast (kg): 12,720

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			53
UNITRONIC 600 25M			16
UNITRONIC 600 30M			49

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	10.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	30,963	te	11,684 m3
Total tonnes per day:	30,963	te	NB80-01 Rate Code
Total Holes Loaded:	53	holes	
… including:		Dead Holes	
… and:		Helper Holes	
Helper Hole Collar:		ft avg	
# Rows Blasted:	3	rows	
- Pattern (Front Row)-			
Burden:	12.0	ft avg	
Spacing:	10.0	ft avg	
# Holes:	22	front row	
- Pattern (Main Body) -			
Burden:	9.0	ft avg	
Spacing:	10.0	ft avg	
# Holes:	31	main body	
Bench Height:	76.0	ft avg	
Sub-drill:	2.0	ft avg	
Hole Depth:	78.0	ft avg	
- Stone Decking -			
Front Row:	0.0	ft avg	
Main Body:	15.0	ft avg	
# Decks:	6	per blast	
- Collar Stemming -			
Front Row:	8.0	ft avg	
Main Body:	7.0	ft avg	
Material used:	.75" Stone		
- Charge Length -			
Front Row:	70.0	ft avg	
Main Body:	56.0	ft avg	
- Charge Weight -			
Front Row:	204.1	kg/hole	
Main Body:	163.3	kg/hole	
Max. per delay:	250.0	kg/delay	
SD () Equation:	212.6	kg/delay	
Total kg Loaded:	12,720	kg	
Rock Density:	2.65	g/cc = te/m^3	
- Powder Factor -			
1.835 lb/yd^3 Yield PF:	0.411	kg/te (actual)	
1.332 lb/yd^3 Front row:	0.298	kg/te (theoretical)	
1.421 lb/yd^3 Main Body:	0.318	kg/te (theoretical)	
1.391 lb/yd^3 "KPI" PF:	0.311	kg/te (theoretical)	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

While measuring the blast we discovered Hole B-4 was only at a depth of 59' (19'short of the

I told Bill White from Nelson Aggregates and he told us to prceed with loading.

Attached is a load adjustment sheet showing all the deck that were added due to voids and se

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-010
P.O. #:		Orica Order #:	2359087
Blast Date:	2018-07-05	Blast Time:	11:51 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40367**	**79.88381**	0.757537	1.394235
Front Row Corner	43.40348	79.88299	0.757534	1.394221
Back Row Corner	43.40391	79.88301	0.757541	1.394222
Average (Centre of Blast)	43.40369	79.88327	0.757537	1.394226

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**437.4**	m				
Post Blast Data: ppV:	**2.3**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**9.5**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**115.9**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**906.7**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1230.8**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(437.4)^2}{30^2} \text{ kg}$$

$$= \frac{191{,}319}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 213 kg

jim bray

Orica
Blaster-in-charge: *Mike der Kinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

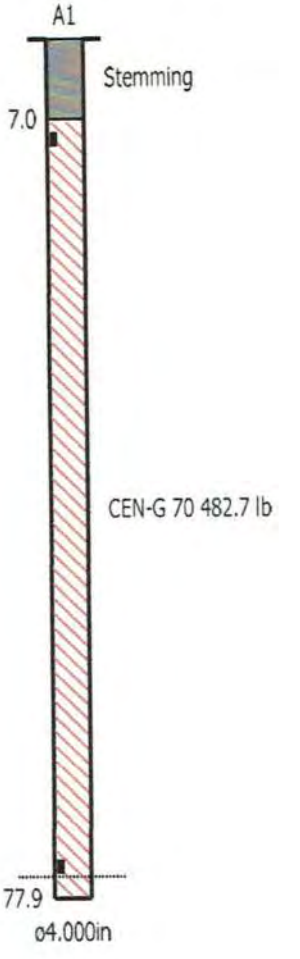
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-010
P.O. #:		Orica Order #:	
Blast Date:	7/5/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Mike der Kinderen

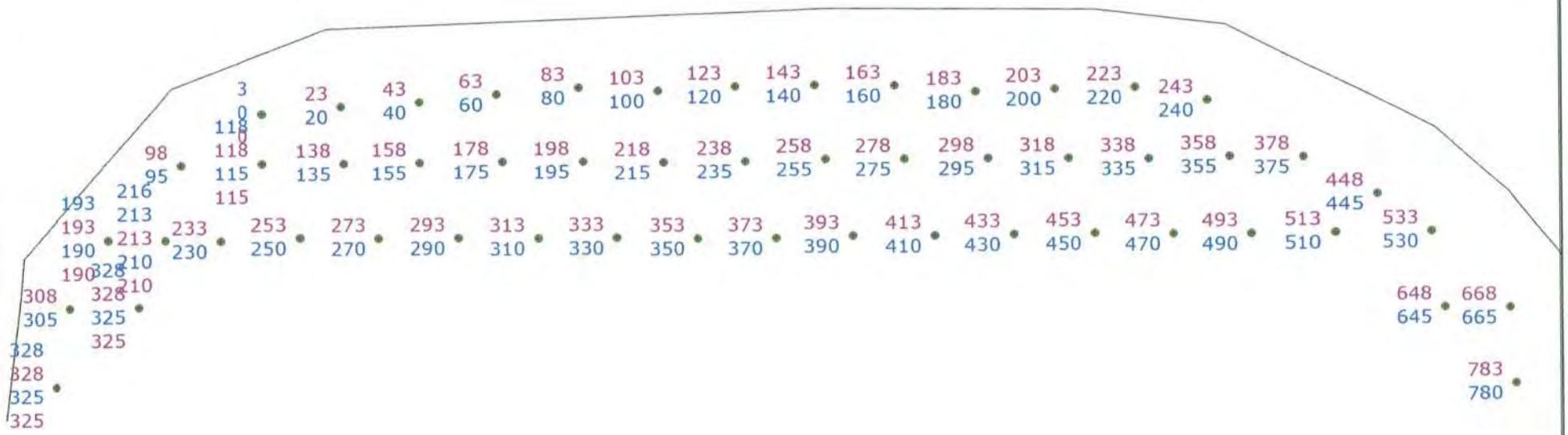
Quarry Manager: Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 4133.5ft			



Not to scale

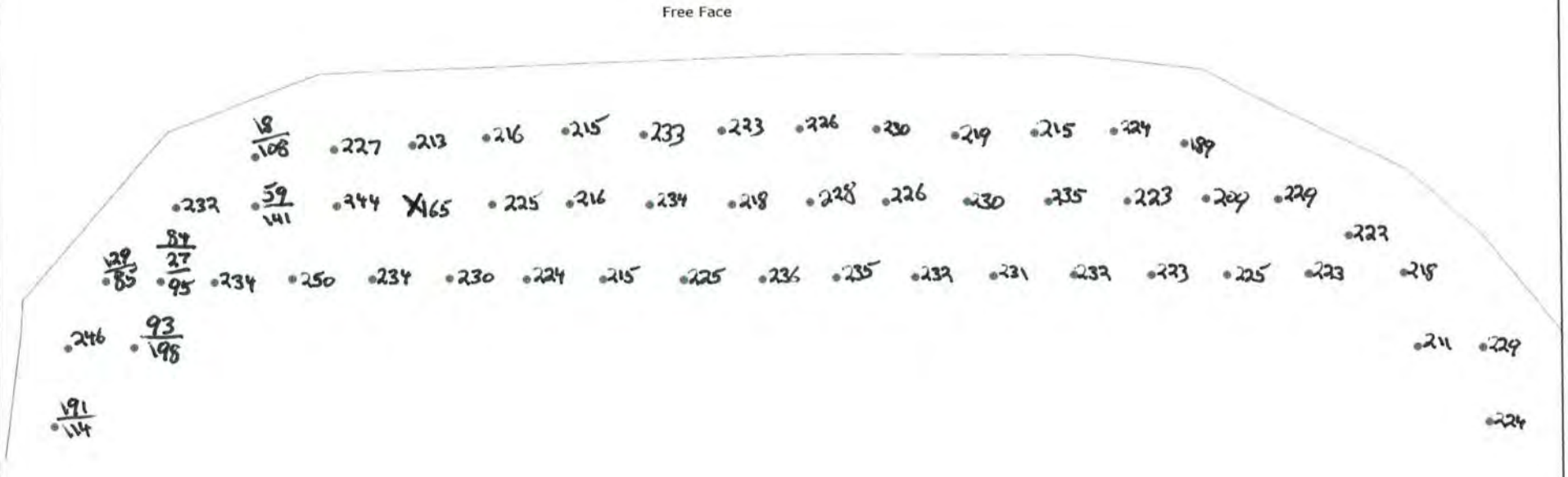
SHOTPlus 5.7.1.1		7/6/2018
Mine	Burlington	
Location		
Title/author	18-010 Upper Middle Final	
Filename	2018-07-05 18-010 Upper Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 4133.5ft			

Load Sheet 250 Kg Max



6426

=41

4025

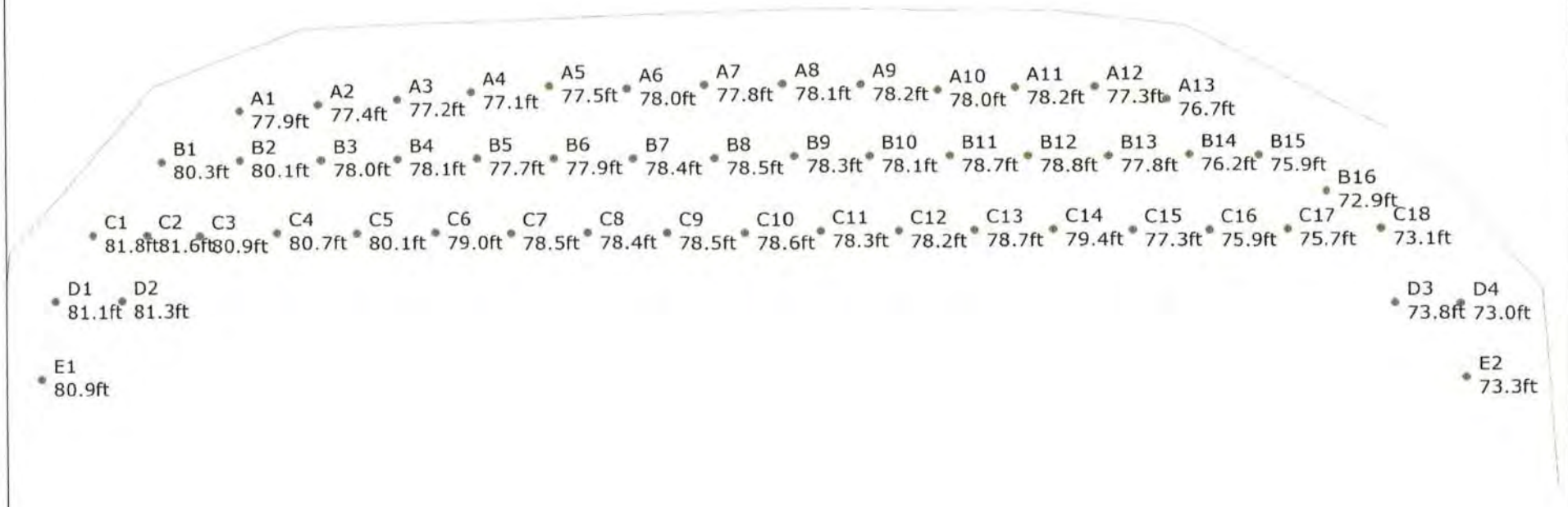
Not to scale

SHOTPlus 5.7.1.1		6/27/2018
Mine	Burlington	
Location		
Title/author	18-010 Upper Middle Final	
Filename	18-010_Upper_Middle_Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 4133.5ft			



Not to scale

SHOTPlus 5.7.1.1		7/4/2018
Mine	Burlington	
Location		
Title/author	18-010 Upper Middle Final	
Filename	2018-07-05 18-010 Upper Middle.spf	

1089976

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

GROSS / BRUT

TARE

NET

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
6.45	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2359087	86063385

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
05 Jul 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
05 Jul 2018	FOR Dest'n, Own Truck	F-73289	P712/03

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
147	PC	X	29	118	PENTEX BC 340 (49/CS)	3	53.655
80	PC	X	27	53	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
54	PC	X	38	16	*uni tronic 600-25M CU/ZC SPL(80')54P	1	13.176
72	PC	X	23	49	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
100	PC		100	Ø	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
					TOTAL GROSS WEIGHT		100.379 KG
					**** TOTAL PACKAGES ****	8	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR NUMBER 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT (YES / OUI ✓ — NO / NON)
ERAP 2-1510	1-877-561-3636	

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE
$

NETTE No. CONV PRESSAGE WT AGREEMENT NO.

FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
Orica Canada Inc.
301 rue hotel de ville
Brownsburg-Chatham, QC
J8G 3B5

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY

SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
MIKE AHAR	MIKE AHAR	

SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A
	05 07 18		05 07 18		

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Event Report

Date/Time	Long at 11:51:55 July 5, 2018
Trigger Source	Geo: 2.000 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.25 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.5 Volts
Unit Calibration	May 3, 2017 by Instantel
File Name	__TEMP.EVT

Notes

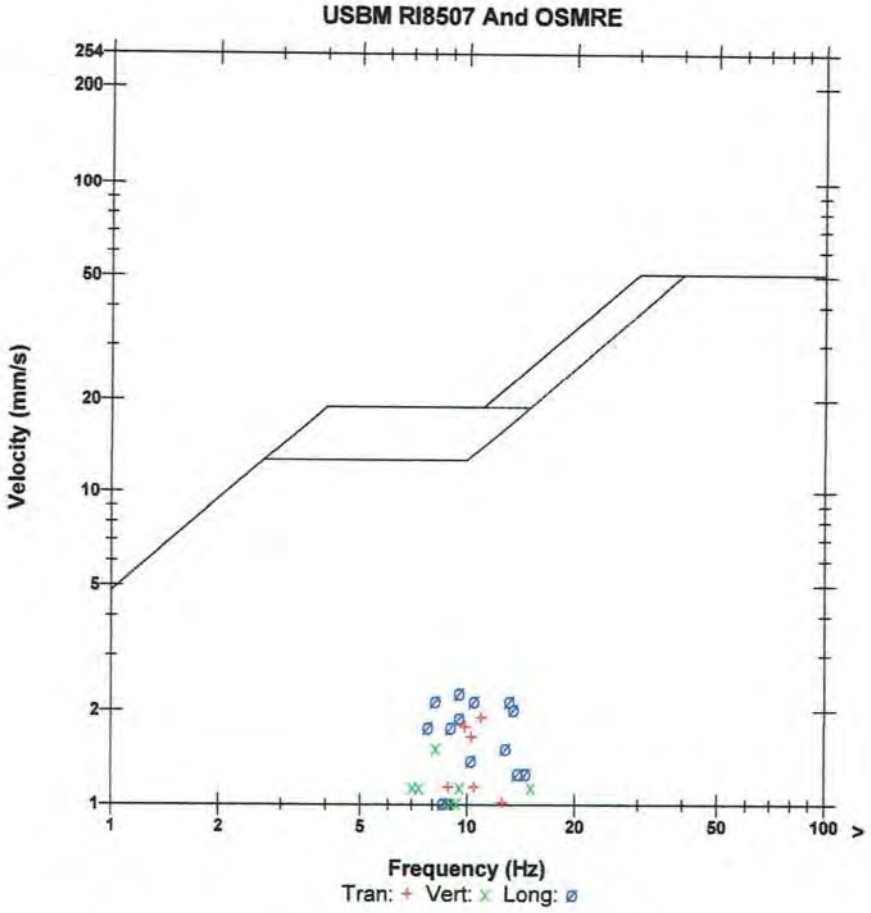
Location:	2450 2nd Line
Client:	Nelson Aggregates
User Name:	Orica Canada
General:	N.43.40245 W.79.87814

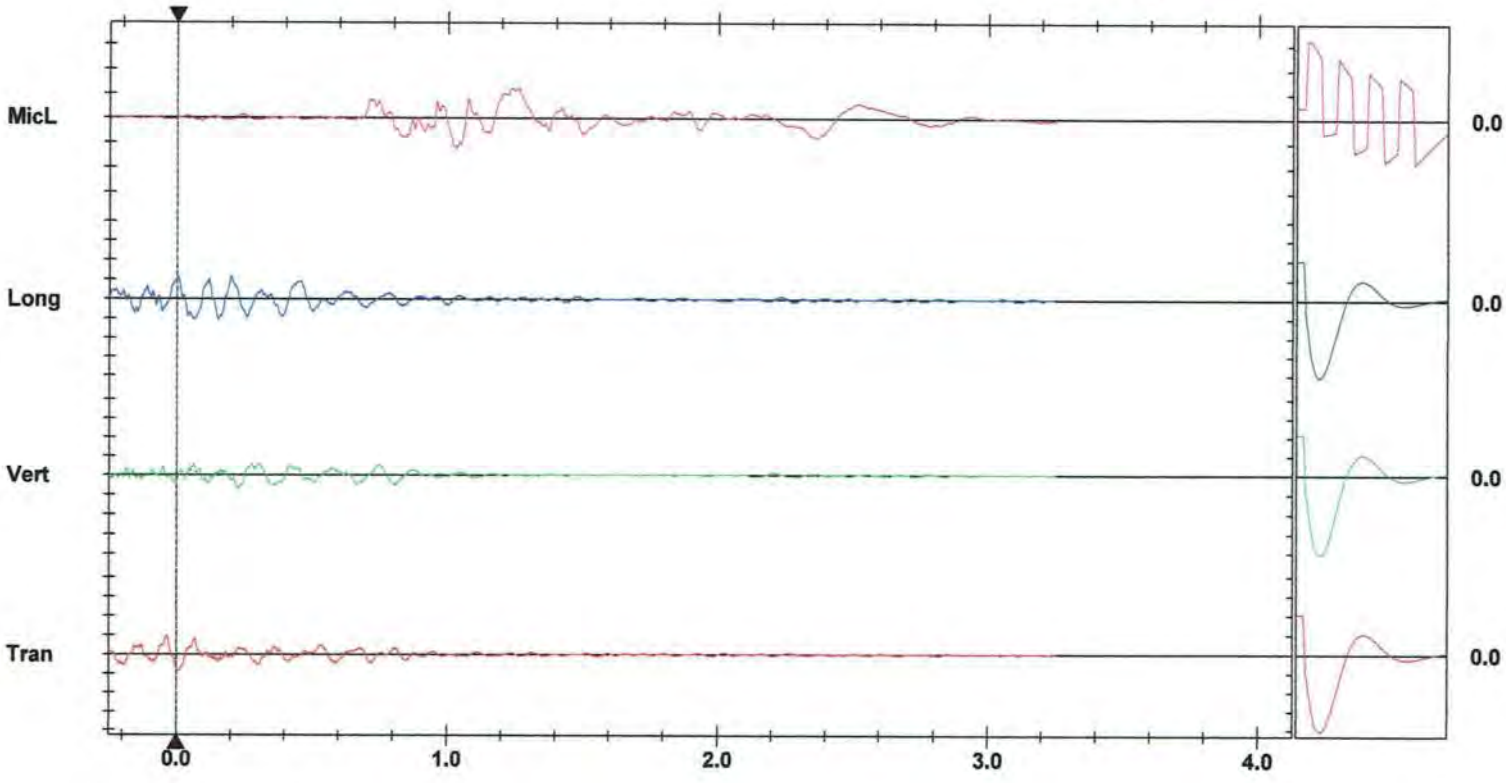
Extended Notes
Sand Bagged

Microphone	Linear Weighting
PSPL	115.9 dB(L) at 1.240 sec
ZC Freq	3.6 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 673 mv)

	Tran	Vert	Long	
PPV	1.905	1.524	2.286	mm/s
ZC Freq	11	8.1	9.5	Hz
Time (Rel. to Trig)	-0.037	0.226	0.198	sec
Peak Acceleration	0.027	0.027	0.040	g
Peak Displacement	0.028	0.029	0.046	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.2	7.4	7.5	Hz
Overswing Ratio	3.8	3.7	4.1	

Peak Vector Sum 2.823 mm/s at 0.003 sec





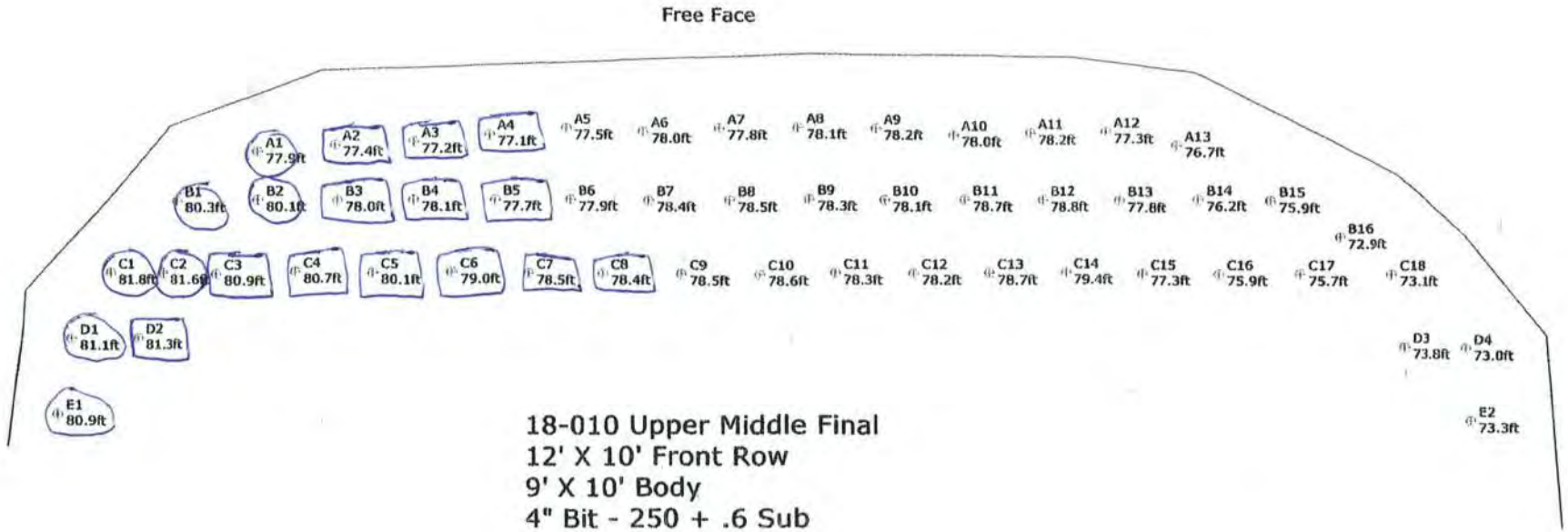
Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 4133.5ft			



ORICA

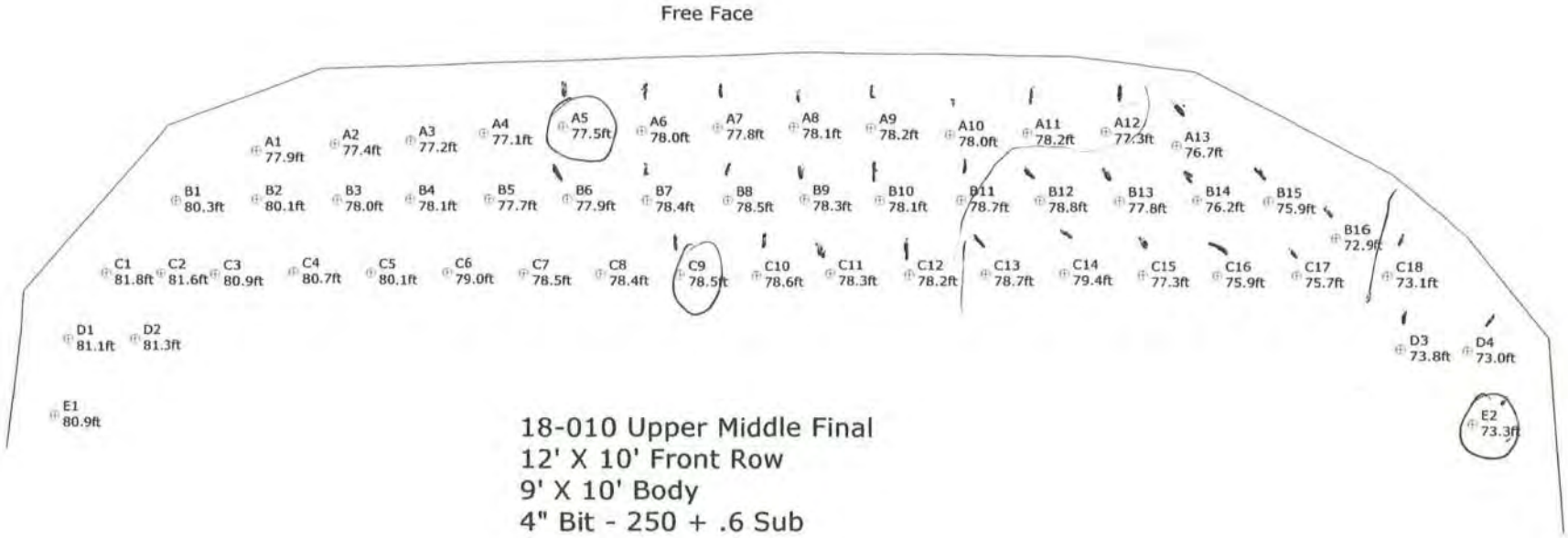
Not to scale

SHOTPlus 5.7.2.1	12/06/2018
Mine	Burlington
Location	
Title/author	18-010 Upper Middle Final
Filename	18-010 Upper Middle Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 4133.5ft			



18-010 Upper Middle Final
12' X 10' Front Row
9' X 10' Body
4" Bit - 250 + .6 Sub

Not to scale

SHOTPlus 5.7.2.1	12/06/2018
Mine	Burlington
Location	
Title/author	18-010 Upper Middle Final
Filename	18-010 Upper Middle Final.spf

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-07-05

Blast Number: 18-010
Orica Order #:

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle (Bench / Pattern)

GPS Coordinates: 43.40369 °N Latitude (Centre of Blast) 79.88327 °W Longitude (Centre of Blast)

Design te Blasted:	30,963	te
Total Holes Loaded:	53	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	3	rows

- Drilling Information -

			Angle from Vertical				Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes:	53	=	4,133.5 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0°	# Holes:		=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	22	front row

- Design Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	31	main body
Bench Height:	76.0	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	78.0	ft avg

- Design Stone Decking -

Front Row:		ft avg
Main Body:		ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

Bulk Expl. Required:		kg
		13,200

Pkgd Expl. Required:		kg

Boosters Required:	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	106	36.0

total explosives weight in Blast (kg):	13,236
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Required:	ms	# req'd
UNITRONIC 600 6M		80
UNITRONIC 600 25M		54
UNITRONIC 600 30M		36

Cord & Access. Req'd:	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row:	71.0	ft avg
Main Body:	71.0	ft avg

- Design Charge Weight -

Front Row:	207.0	kg/hole
Main Body:	207.0	kg/hole
Max Chge Wt / delay:	250.0	kg/delay

Required kg Loaded:	13,236	kg
Rock Density:	2.65	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.427	kg/te (actual)
1.351 lb/yd³	Front row:	0.303	kg/te (theoretical)
1.802 lb/yd³	Main Body:	0.403	kg/te (theoretical)
1.652 lb/yd³	"KPI" PF:	0.370	kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B. S. Expl or IS from previous Blast:

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-011
P.O. #:		Orica Order #:	2367871
Blast Date:	2018-06-20	Blast Time:	11:59 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)

GPS Coordinates: 43.40486 °N Latitude (Centre of Blast) 79.88449 °W Longitude (Centre of Blast)

Wind from the: E at 5 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	24,173 te	9,122 m3
Total tonnes per day:	te	NB40-07 Rate Code
Total Holes Loaded:	125 holes	
… including:	Dead Holes	
… and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	15 rows	

- Drilling Information -

			Angle from Vertical		Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	# Holes: 125	0°	=	3,500.0 ft (4 " diam)
Secondary Bit diam:	mm	# Holes:	0°	=	0.0 ft (" diam)
Tertiary Bit diam:	mm	# Holes:	0°	=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.0 ft avg
# Holes:	38 front row

- Pattern (Main Body) -

Burden:	9.0 ft avg
Spacing:	10.0 ft avg
# Holes:	87 main body
Bench Height:	26.0 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	28.0 ft avg

- Stone Decking -

Front Row:	5.0 ft avg
Main Body:	6.0 ft avg
# Decks:	10 per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75" Stone

- Charge Length -

Front Row:	16.0 ft avg
Main Body:	15.0 ft avg

- Charge Weight -

Front Row:	46.7 kg/hole
Main Body:	43.7 kg/hole
Max. per delay:	90.0 kg/delay
SD () Equation:	372.7 kg/delay
Total kg Loaded:	8,382 kg
Rock Density:	2.65 g/cc = te/m^3

Theoretical PF (Based on a single hole)

- Powder Factor -

1.549 lb/yd^3	Yield PF:	0.347 kg/te (actual)
0.890 lb/yd^3	Front row:	0.199 kg/te (theoretical)
1.113 lb/yd^3	Main Body:	0.249 kg/te (theoretical)
1.098 lb/yd^3	"KPI" PF:	0.246 kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,090	25,800	8,290

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	270	91.8

total explosives weight in Blast (kg): 8,382

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			123
UNITRONIC 600 9M			51
UNITRONIC 600 15M			96

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	3
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE	>/=5,000kg	<10,000kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		12.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

10 Stone decks were added to this blast due to the drill logs showing voids

The timing sheet identifies where they are as well as the drill log and load sheet.

Attached is a load adjustment sheet

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-011
P.O. #:		Orica Order #:	2367871
Blast Date:	2018-06-20	Blast Time:	11:59 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40487**	**79.88448**	0.757558	1.394247
Front Row Corner	43.40462	79.88452	0.757554	1.394248
Back Row Corner	43.40508	79.88446	0.757562	1.394247
Average (Centre of Blast)	43.40486	79.88449	0.757558	1.394247

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**579.2**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**780.7**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1323.3**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(579.2)^2}{30^2} \text{ kg}$$

$$= \frac{335{,}473}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 373 kg

jim bray

Orica
Blaster-in-charge: *Mike der Kinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

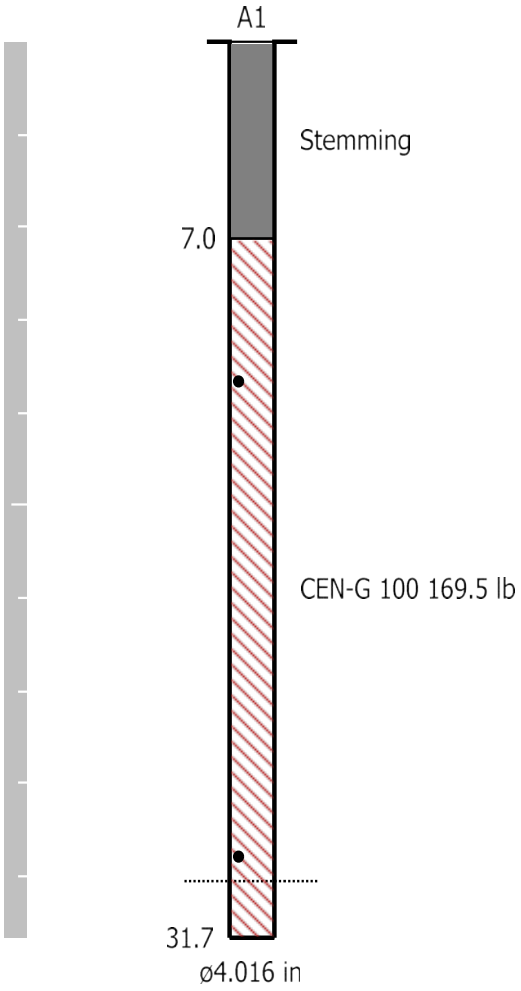
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-011
P.O. #:		Orica Order #:	2367871
Blast Date:	7/30/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



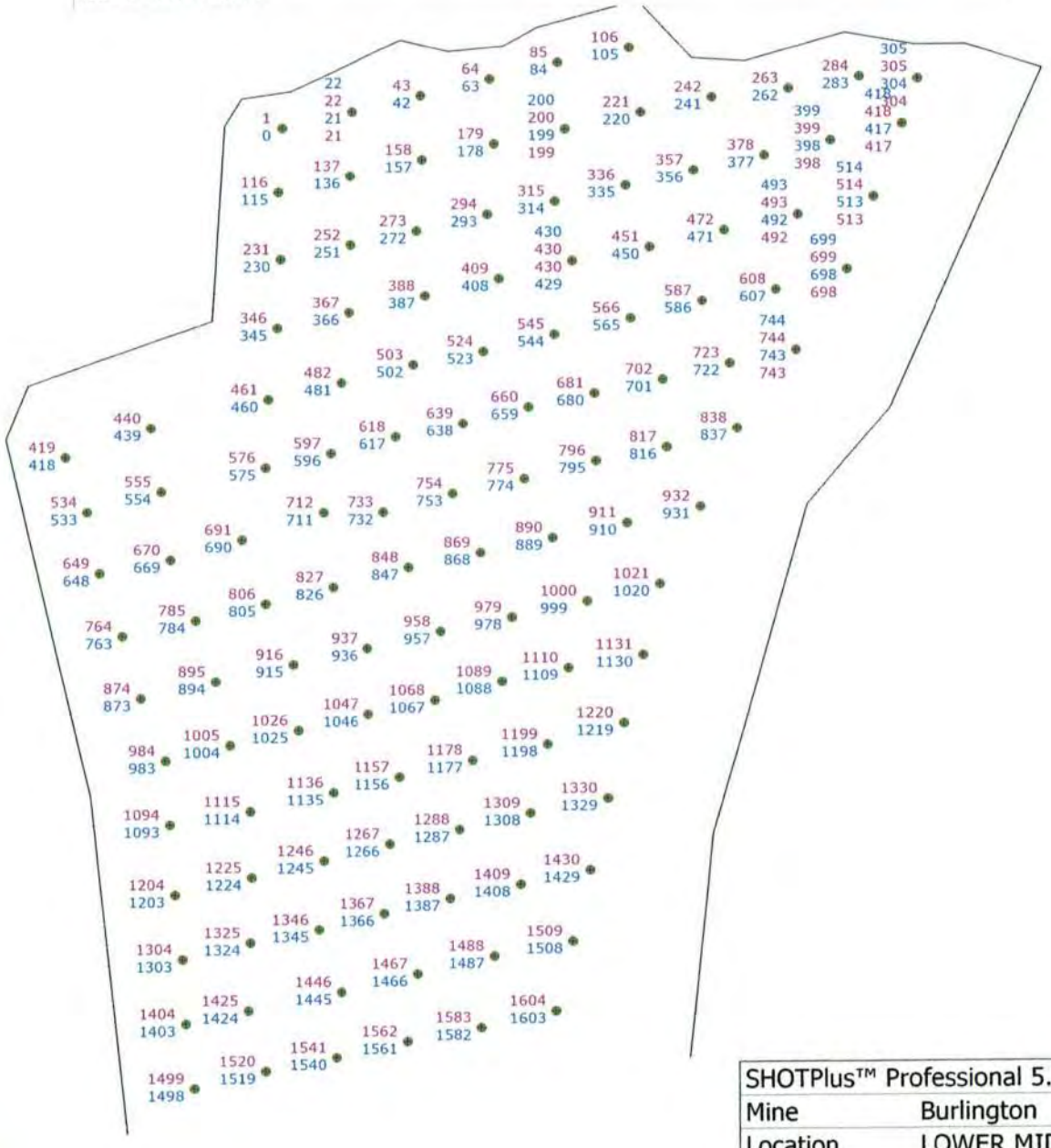
Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 5.9ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 125	Hole angle: 0.0°
Total drilled: 3500.1ft			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SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 5.9ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 125	Hole angle: 0.0°
Total drilled: 3500.1ft			

80 KG Max

65KG Max

18-011 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diamteter
250m Elevation + 0.6m Subdrill

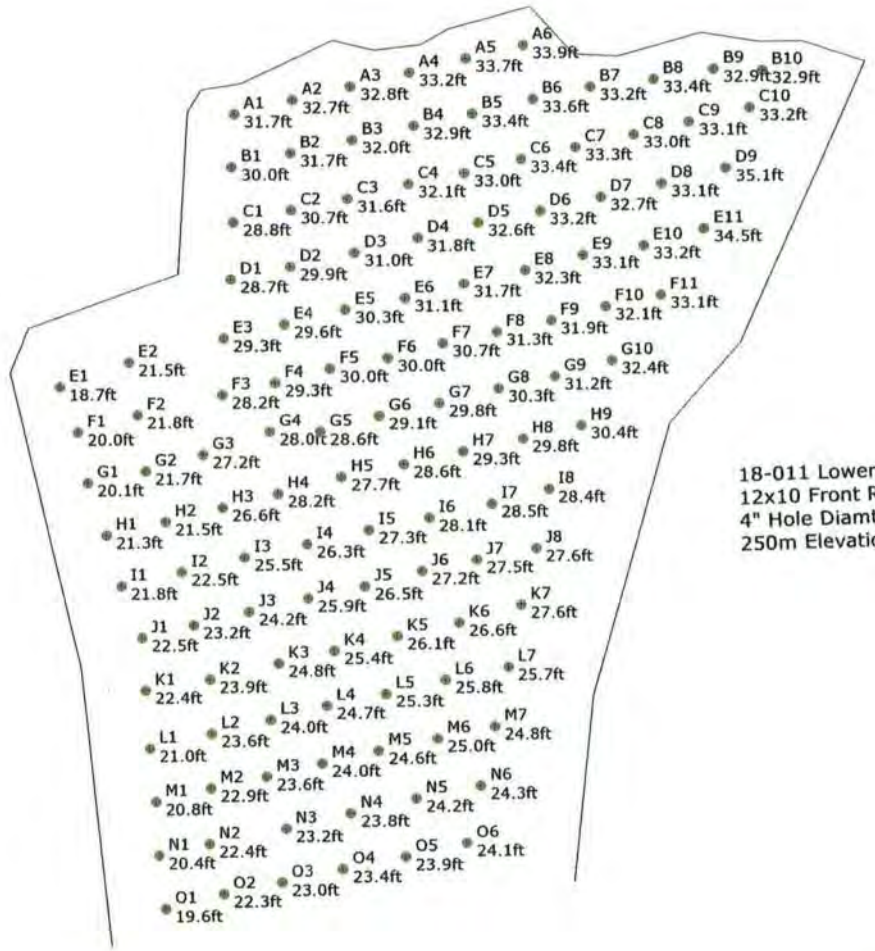
Not to scale

SHOTPlus™ Professional 5.7.3.0		7/27/2018
Mine	Burlington	
Location	LOWER MIDDLE	
Title/author	DESIGN 18-011 LOWER MIDDLE	
Filename	Blast_18-011_Lower_Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 5.9ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 125	Hole angle: 0.0°
Total drilled: 3500.1ft			



18-011 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diamteter
250m Elevation + 0.6m Subdrill

ORICA

Not to scale

SHOTPlus™ Professional 5.7.3.0		7/30/2018
Mine	Burlington	
Location	LOWER MIDDLE	
Title/author	DESIGN 18-011 LOWER MIDDLE	
Filename	2018-07-30 18-011 Lower Middle.spf	

1090217

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
6:55	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2367871	86087520

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
30 Jul 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
30 Jul 2018	FOB Dest'n, Own Truck	F-73289	18230

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
294	PC	X	24	270	PENTEX BC 340 (49/CS)	6	107.310
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
184	PC	X	61	123	*uni tronic 600-06.0M CU/ZC(20')80PC	3	13.432
60	PC	X	9	51	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
102	PC	X	6	96	*uni tronic 600-15M C/Z SPL(50')66PC	2	17.442
131	PC	X	131	0	*uni tronic 600-20M CU/ZC SPL(65')66P	2	26.724
100	PC		97	3	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		177.328 KG
					**** TOTAL PACKAGES ****	15	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ✓ NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV PRESSAGE / WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: K. Platt	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: K. Platt	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE: K Platt	SIGNATURE: K Platt	SIGNATURE
DATE: 30 7 18 (D/J M/M Y/A)	DATE: 30 7 18 (D/J M/M Y/A)	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-07-30

Blast Number: 18-011
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)

GPS Coordinates: 43.40486 °N Latitude (Centre of Blast) 79.88449 °W Longitude (Centre of Blast)

Design te Blasted: 24,173 te
Total Holes Loaded: 125 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 15 rows

- Drilling Information -

		Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0°	# Holes: 125	=	3,500.0 ft (4 " diam)
Secondary Bit diam:	mm	0°	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:	mm	0°	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 38 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes 87 main body
Bench Height: 26.0 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 28.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 21.0 ft avg
Main Body: 21.0 ft avg

- Design Charge Weight -

Front Row: 61.2 kg/hole
Main Body: 61.2 kg/hole
Max Chge Wt / delay: 80.0 kg/delay

Required kg Loaded: 10,085 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.417 kg/te (actual)
1.168 lb/yd³ Front row: 0.262 kg/te (theoretical)
1.558 lb/yd³ Main Body 0.349 kg/te (theoretical)
1.532 lb/yd³ "KPI" PF: 0.343 kg/te (theoretical)

Bulk Expl. Required:		kg
CENTRA GOLD 70		10,000

Pkgd Expl. Required:		kg
E113 75X400		

Boosters Required:	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	250	85.0

total explosives weight in Blast (kg): 10,085
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:	ms	# req'd
UNITRONIC 600 6M		125
UNITRONIC 600 15M		125

Cord & Access. Req'd:	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

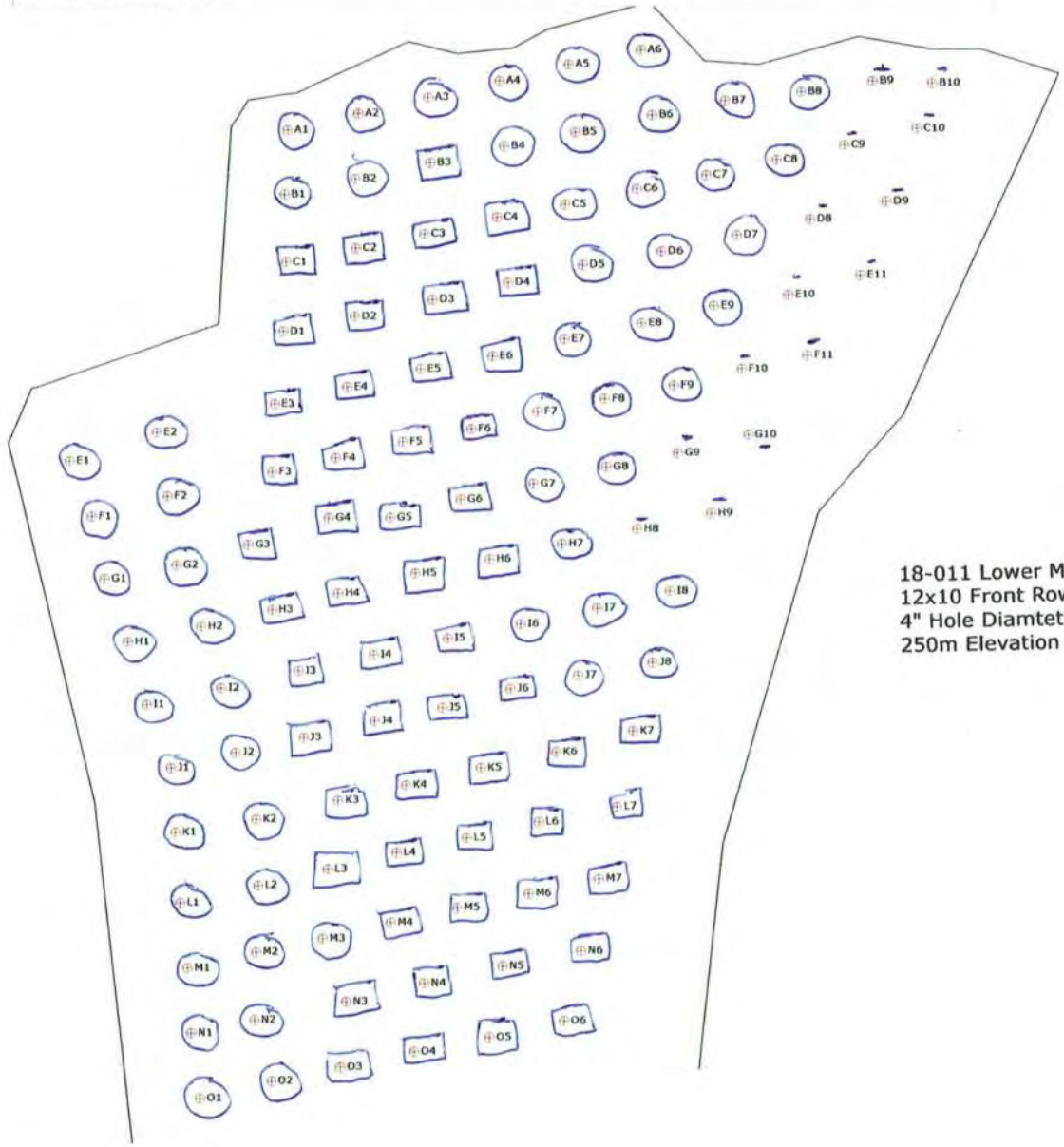
GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B. S. Expl or I.S from previous Blast

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 5.9ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 125	Hole angle: 0.0°
Total drilled: 3500.1ft			



18-011 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diamteter
250m Elevation + 0.6m Subdrill

ORICA

Not to scale

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-012
P.O. #:		Orica Order #:	2370307
Blast Date:	2018-08-03	Blast Time:	11:52 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40371 °N Latitude (Centre of Blast) 79.88291 °W Longitude (Centre of Blast)

Wind from the: at 0 kph Temperature: 16 to 20 °C

Clear:		Rain:		Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 24,791 ft

Tonnes Blasted:	27,176 te	10,255 m3
Total tonnes per day:	27,176 te	NB80-01 Rate Code
Total Holes Loaded:	47 holes	
… including:		Dead Holes
… and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	3 rows	

- Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.0 ft avg
# Holes:	17 front row

- Pattern (Main Body) -

Burden:	9.0 ft avg
Spacing:	10.0 ft avg
# Holes:	30 main body
Bench Height:	76.4 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	78.4 ft avg

- Stone Decking -

Front Row:	10.0 ft avg
Main Body:	10.0 ft avg
# Decks:	6 per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75" Stone

- Charge Length -

Front Row:	61.4 ft avg
Main Body:	61.4 ft avg

- Charge Weight -

Front Row:	179.0 kg/hole
Main Body:	179.0 kg/hole
Max. per delay:	265.0 kg/delay
SD () Equation:	187.2 kg/delay
Total kg Loaded:	11,076 kg
Rock Density:	2.65 g/cc = te/m^3

- Powder Factor -

Yield PF:	0.408 kg/te	(actual)
Front row:	0.260 kg/te	(theoretical)
Main Body:	0.347 kg/te	(theoretical)
"KPI" PF:	0.318 kg/te	(theoretical)

Theoretical PF (Based on a single hole)

1.820	lb/yd^3
1.162	lb/yd^3
1.550	lb/yd^3
1.421	lb/yd^3

Yield Powder Factor (kg Loaded / te Blasted)

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	46	=	3,606.6 ft (4 " diam)
Secondary Bit diam:	127.0	mm	0 °	# Holes:	1	=	78.4 ft (5 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,800	22,760	11,040

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	106	36.0

total explosives weight in Blast (kg): 11,076

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 9M			45
UNITRONIC 600 25M			25
UNITRONIC 600 30M			36

Cord & Accessories:

	U of M	# used
MINI STEM PLUGS - 6015 (4")	units	12
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE		>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours		6.0
HELPER HOURS	Enter total Helper man-hours		11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

3 Siesmographs set up

Holes D-1,D2 and E1 were not loaded due to lean burden on profiles

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-012
P.O. #:		Orica Order #:	2370307
Blast Date:	2018-08-03	Blast Time:	11:52 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40369**	**79.88291**	0.757537	1.394220
Front Row Corner	43.40351	79.88288	0.757534	1.394219
Back Row Corner	43.40392	79.88295	0.757541	1.394220
Average (Centre of Blast)	43.40371	79.88291	0.757538	1.394220

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**410.5**	m			
Post Blast Data: ppV:	**2.4**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**7.2**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**115.0**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**934.1**	m			
Post Blast Data: ppV:	**0.1**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**7.1**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**116.4**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1243.6**	m			
Post Blast Data: ppV:	**0.1**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**7.4**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**117.1**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(410.5)^2}{30^2} \text{ kg}$$

$$= \frac{168{,}510}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 187 kg

jim bray

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-013
P.O. #:		Orica Order #:	2374191
Blast Date:	2018-08-14	Blast Time:	10:54 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40146 °N Latitude (Centre of Blast) 79.88807 °W Longitude (Centre of Blast)

Wind from the: S at 5 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling 30,420 ft

Tonnes Blasted:	17,069 te	6,441 m3
Total tonnes per day:	17,069 te	NF-15 Rate Code
Total Holes Loaded:	182 holes	
… including:	10 Dead Holes	
… and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	11 rows	

- Drilling Information -

			Angle from Vertical		Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	# Holes:	182	=	1,820.0 ft (4 " diam)
Secondary Bit diam:	mm	# Holes:	0	=	0.0 ft (" diam)
Tertiary Bit diam:	mm	# Holes:	0	=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	18 front row

- Pattern (Main Body) -

Burden:	11.5 ft avg
Spacing:	11.5 ft avg
# Holes:	164 main body
Bench Height:	10.0 ft avg
Sub-drill:	0.0 ft avg
Hole Depth:	10.0 ft avg

- Stone Decking -

Front Row:	ft avg
Main Body:	ft avg
# Decks:	per blast

- Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75" Stone

- Charge Length -

Front Row:	3.0 ft avg
Main Body:	3.0 ft avg

- Charge Weight -

Front Row:	8.7 kg/hole
Main Body:	8.7 kg/hole
Max. per delay:	16.0 kg/delay
SD () Equation:	545.1 kg/delay
Total kg Loaded:	1,272 kg
Rock Density:	2.65 g/cc = te/m^3

Theoretical PF (Based on a single hole)

- Powder Factor -

0.333 lb/yd^3	Yield PF:	0.075 kg/te (actual)
0.394 lb/yd^3	Front row:	0.088 kg/te (theoretical)
0.394 lb/yd^3	Main Body:	0.088 kg/te (theoretical)
0.394 lb/yd^3	"KPI" PF:	0.088 kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blastec

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,500	26,290	1,210

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	182	61.9

total explosives weight in Blast (kg): 1,272

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			2
EXEL HANDIDET 9m		25/500	182
CONNECTADET 9M		25 ms	4
CONNECTADET 12M		42 ms	44

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	1
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-013
P.O. #:		Orica Order #:	2374191
Blast Date:	2018-08-14	Blast Time:	10:54 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40115**	**79.88796**	0.757493	1.394308
Front Row Corner	43.40147	79.88808	0.757499	1.394310
Back Row Corner	43.40176	79.88818	0.757504	1.394312
Average (Centre of Blast)	43.40146	79.88807	0.757498	1.394310

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**811.0**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**700.4**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**900.7**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(700.4)^2}{30^2} \text{ kg}$$

$$= \frac{490{,}560}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 545 kg

jim bray

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

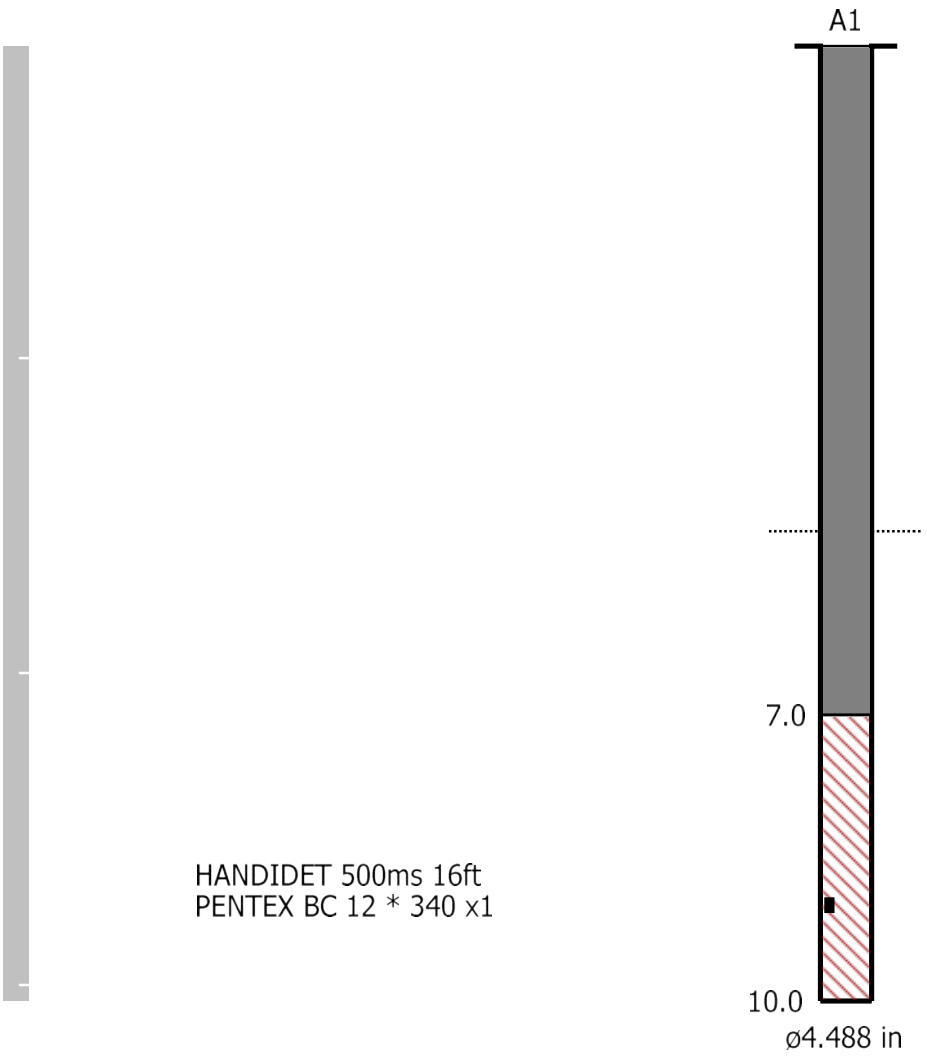
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-013
P.O. #:		Orica Order #:	2374191
Blast Date:	8/9/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

Quarry Manager: Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 8.2ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 182	Hole angle: 0.0°
Total drilled: 1819.9ft			

Blasted and Backfilled

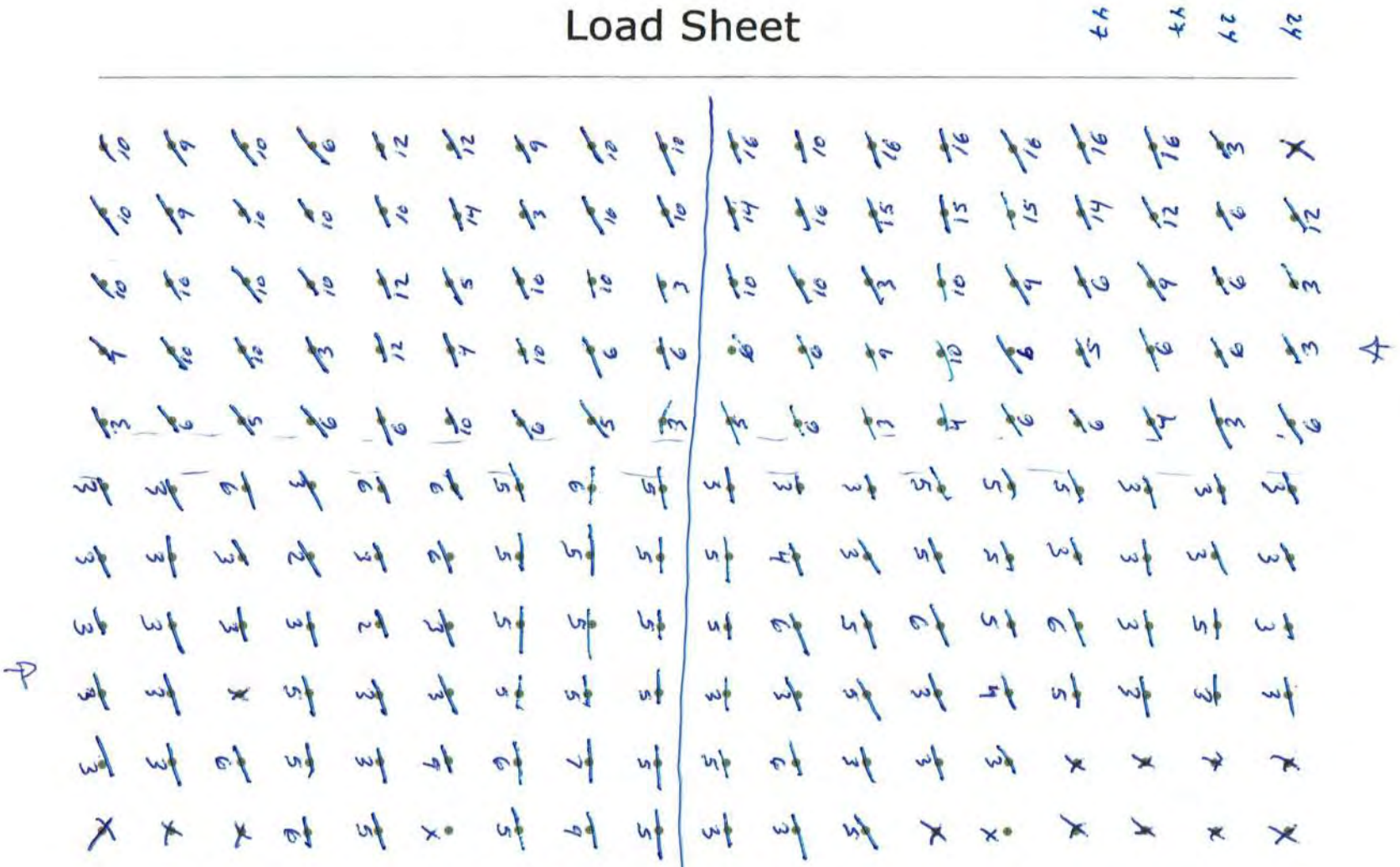
Blast 18-013 Floor
4" Hole
11.5 X 11.5

SHOTPlus™ Professional 5.7.3.0		8/14/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	2018-08-14 18-013 Floor.spf	

ORICA

Not to scale

Load Sheet



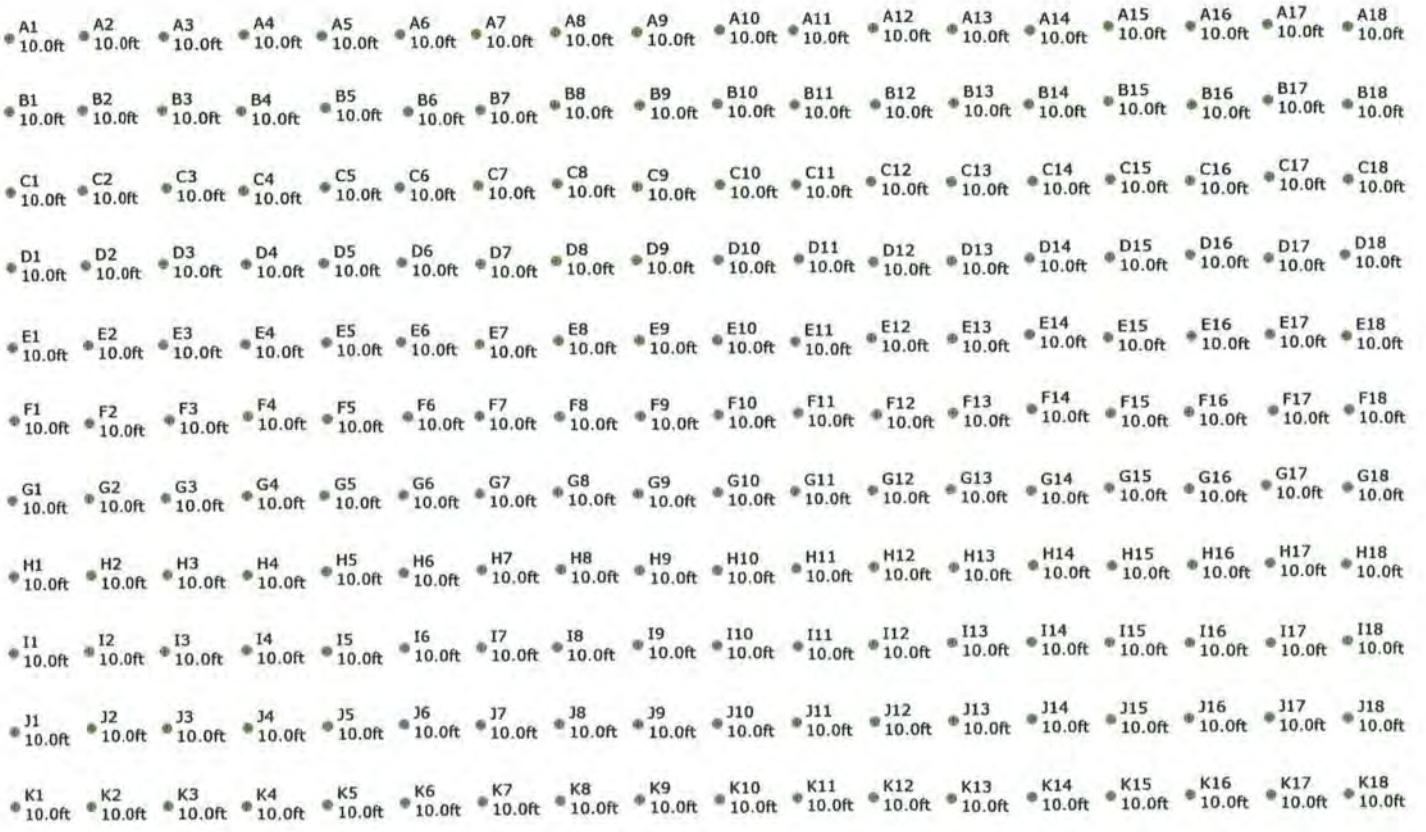
Blast 18-013 Floor
4" Hole
11.5 X 11.5

ORICA

Not to scale

SHOTPlus™ Professional 5.7.3.0		8/7/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	Timing.spf	

Blasted and Backfilled



Blast 18-013 Floor
4" Hole
11.5 X 11.5

ORICA

Not to scale

SHOTPlus™ Professional 5.7.3.0		8/7/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	Timing.spf	

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

1090420

Bill of Lading / Connaissement

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
7	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2374191	86102967

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
14 Aug 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
14 Aug 2018	FOB Dest'n, Own Truck	F-73289	

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
					NET EXPLOSIVES QUANTITY: 83.718 KG		
245	PC	X	63	182	PENTEX BC 340 (49/CS)	5	89.425
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
18	PC	X	16	2	*uni tronic 600-06.0M CU/ZC(20')80PC	1	1.314
100	PC		100	0	MINI STEM PLUGS - PART #74853		0.700
260	PC	X	78	182	EXEL HANDIDET 9M 25/500(30') 65/CS	4	26.260
50	PC	X	50	0	EXEL HANDIDET 12M 25/500(40') 50/CS	1	6.150
27	PC	X	23	4	EXEL Connectadet 9M 25MS (30 FT) 65/CS	1	2.619
50	PC	X	6	44	EXEL Connectadet 12M 42MS (40 FT) 50/CS	1	6
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		138.308 KG
					**** TOTAL PACKAGES ****	14	

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	✓ YES / OUI ___ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.:

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Neil Kwast	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Neil Kwast	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE D/J M/M Y/A: 14 08 18	SIGNATURE:	DATE D/J M/M Y/A: 14 08 18	SIGNATURE	DATE D/J M/M Y/A

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-08-09

Blast Number: 18-013
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40146 °N Latitude (Centre of Blast) 79.88807 °W Longitude (Centre of Blast)

Design te Blasted:	19,650	te
Total Holes Loaded:	198	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	11	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 198	=	1,980.0 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	38	front row

- Design Pattern (Main Body) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes	160	main body
Bench Height:	10.0	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	10.0	ft avg

- Design Stone Decking -

Front Row:		ft avg
Main Body:		ft avg

- Design Collar Stemming -

Front Row:	6.0	ft avg
Main Body:	6.0	ft avg
Material used:	.75" Stone	

- Design Charge Length -

Front Row:	4.0	ft avg
Main Body:	4.0	ft avg

- Design Charge Weight -

Front Row:	11.7	kg/hole
Main Body:	11.7	kg/hole
Max Chge Wt / delay:	20.0	kg/delay

Required kg Loaded:	3,567	kg
Rock Density:	2.65	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.182	kg/te (actual)
0.525 lb/yd³	Front row:	0.118	kg/te (theoretical)
0.525 lb/yd³	Main Body:	0.118	kg/te (theoretical)
0.525 lb/yd³	"KPI" PF:	0.118	kg/te (theoretical)

Bulk Expl. Required:

		kg
CENTRA GOLD 70		3,500

Pkgd Expl. Required:

		kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	198	67.3

total explosives weight in Blast (kg):	3,567
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		6
EXEL HANDIDET 9m	25/500	198
EXEL HANDIDET 12m	25/500	50
CONNECTADET 9M	25 ms	50
CONNECTADET 12M	42 ms	

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-014
P.O. #:		Orica Order #:	2380811
Blast Date:	2018-08-30	Blast Time:	11:55 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40372 °N Latitude (Centre of Blast) 79.88278 °W Longitude (Centre of Blast)

Wind from the: NE at 5 kph Temperature: 16 to 20 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	31,778 te	11,992 m3
Total tonnes per day:	31,778 te	NB80-01 Rate Code
Total Holes Loaded:	58 holes	
… including:		Dead Holes
… and:	3	Helper Holes
Helper Hole Collar:	60.0 ft avg	
# Rows Blasted:	3 rows	

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 50	=	3,859.1 ft (4 " diam)
Secondary Bit diam:	127.0	mm	0 °	# Holes: 8	=	617.4 ft (5 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,770	20,690	13,080

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	154	52.4

total explosives weight in Blast (kg): 13,132

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			50
UNITRONIC 600 9M			4
UNITRONIC 600 20M			22
UNITRONIC 600 25M			6
UNITRONIC 600 30M			72

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	15.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	
3D LASER PROFILE	Enter hours	
BORETRACK	Enter hours	
TECHNICAL BLAST DESIGN	(per day) Enter # of days	

Theoretical PF (Based on a single hole)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	24	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	34	main body
Bench Height:	75.2	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	77.2	ft avg

- Stone Decking -

Front Row:	8.4	ft avg
Main Body:	9.8	ft avg
# Decks:	`19	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

- Charge Length -

Front Row:	61.8	ft avg
Main Body:	60.4	ft avg

- Charge Weight -

Front Row:	180.1	kg/hole
Main Body:	176.1	kg/hole
Max. per delay:	307.0	kg/delay
SD () Equation:	178.7	kg/delay
Total kg Loaded:	13,132	kg
Rock Density:	2.65	g/cc = te/m^3

- Powder Factor -

1.846 lb/yd^3	Yield PF:	0.413	kg/te (actual)
1.189 lb/yd^3	Front row:	0.266	kg/te (theoretical)
1.549 lb/yd^3	Main Body:	0.347	kg/te (theoretical)
1.429 lb/yd^3	"KPI" PF:	0.320	kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blastec

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

3 Helpers requested due to the amount of voids located on drill log and stone decking require

Holes A3,A7,B5,B8,C8,C12 All measured short in depth by an average of 12'.

Bill White from Nelson Burlington said we have to blast it, the drill wont be back until Sept.4, 2

3 Siesmographs supplied and set-up

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-014
P.O. #:		Orica Order #:	2380811
Blast Date:	2018-08-30	Blast Time:	11:55 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40374**	**79.88277**	0.757538	1.394217
Front Row Corner	43.40351	79.88279	0.757534	1.394218
Back Row Corner	43.40392	79.88277	0.757541	1.394217
Average (Centre of Blast)	43.40372	79.88278	0.757538	1.394217

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**401.0**	m				
Post Blast Data: ppV:	**3.7**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**12.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**113.3**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**943.9**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1249.2**	m				
Post Blast Data: ppV:	**2.0**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**2.5**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**93.2**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(401)^2}{30^2} \text{ kg}$$

$$= \frac{160{,}801}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 179 kg

jim bray

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

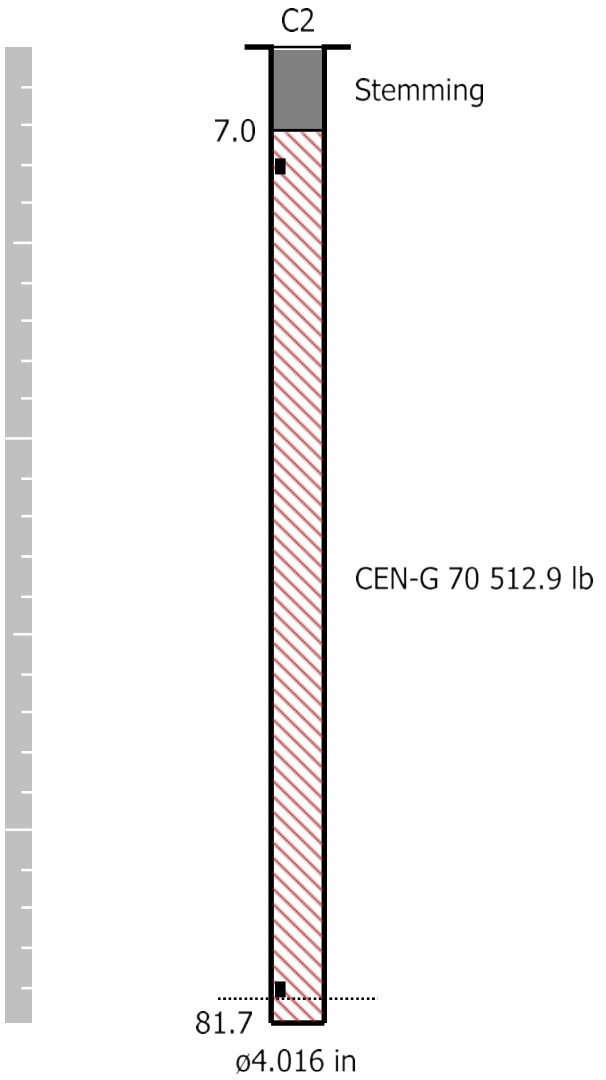
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-014
P.O. #:		Orica Order #:	2380811
Blast Date:	8/30/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



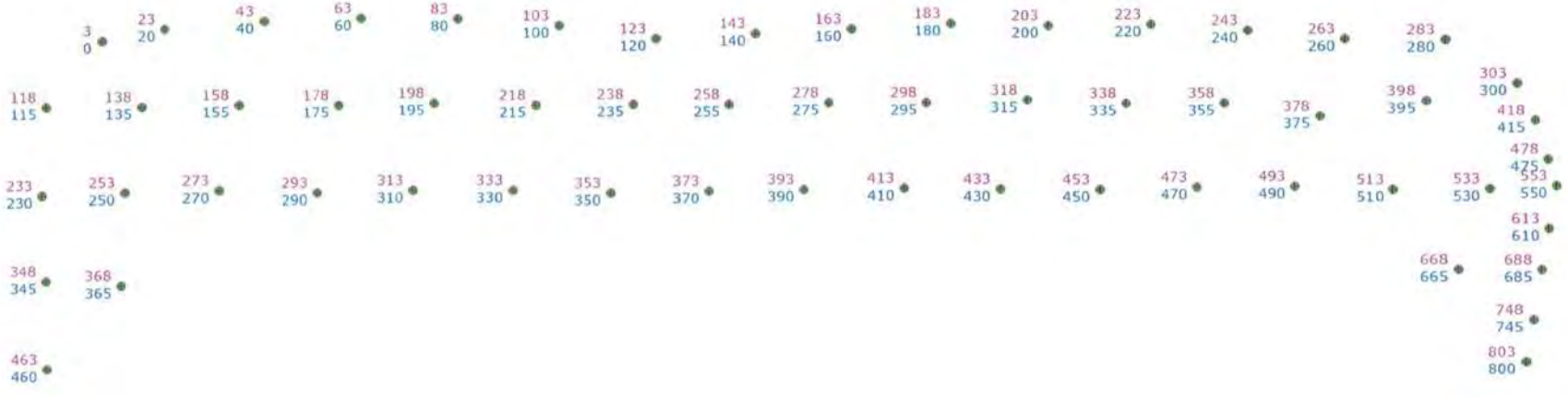
Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.2ft	Spacing: 10.2ft	Subdrill: 2.0ft	Stemming: 6.9ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 58	Hole angle: 0.0°
Total drilled: 4476.5ft			



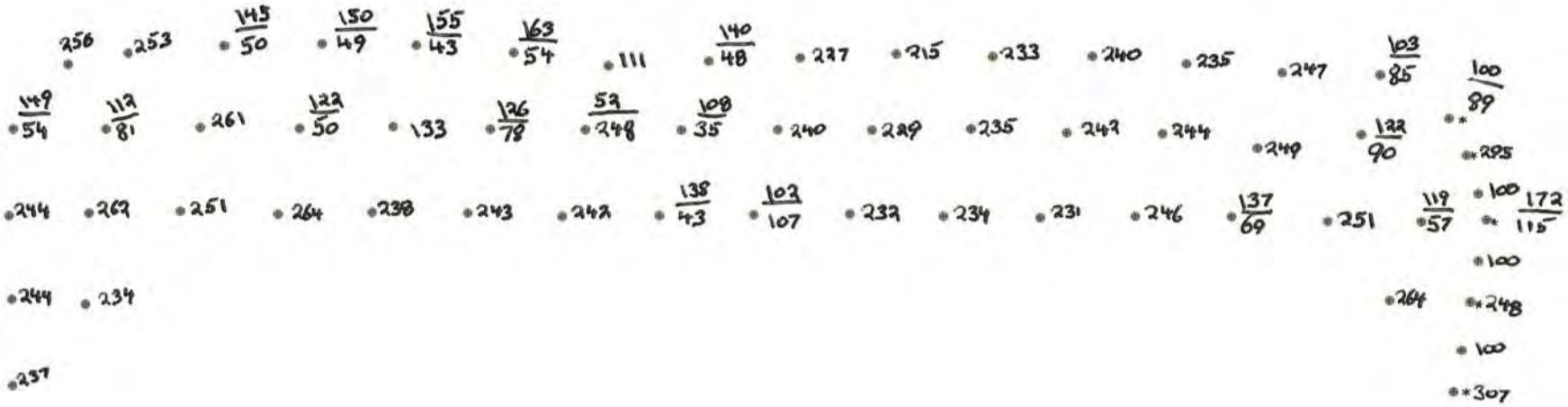
Not to scale

SHOTPlus™ Professional 5.7.3.0	8/16/2018
Mine	Burlington
Location	UPPER MIDDLE
Title/author	Design 18-013 UPPER MIDDLE Partial Final
Filename	Design_18-014_UPPER_MIDDLE_Final.spf

Blast Summary Data

Burden: 9.2ft	Spacing: 10.2ft	Subdrill: 2.0ft	Stemming: 6.9ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 58	Hole angle: 0.0°
Total drilled: 4476.5ft			

Load Sheet
4" 270kg Max
5" 350Kg Max



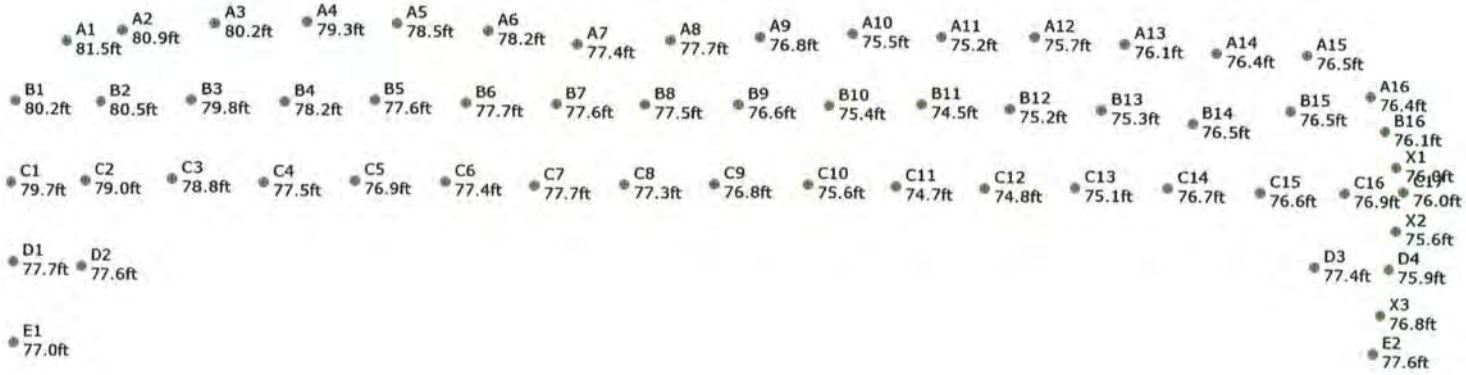
Not to scale

SHOTPlus™ Professional 5.7.3.0		8/29/2018
Mine	Burlington	
Location	UPPER MIDDLE	
Title/author	Design 18-013 UPPER MIDDLE Partial Final	
Filename	2018-08-00 18-014 Upper Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.2ft	Spacing: 10.2ft	Subdrill: 2.0ft	Stemming: 6.9ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 58	Hole angle: 0.0°
Total drilled: 4476.5ft			



Not to scale

SHOTPlus™ Professional 5.7.3.0		8/29/2018
Mine	Burlington	
Location	UPPER MIDDLE	
Title/author	Design 18-013 UPPER MIDDLE Partial Final	
Filename	2018-08-00 18-014 Upper Middle.spf	

1090563

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	645 AM
TIME OUT / HEURE SORTIE	12.30 PM
ORDER NUMBER / N° DE COMMANDE	2380811
B/L NUMBER / N° DE CONNAISSEMENT	86120203

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
30 Aug 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
30 Aug 2018	FOB Dest'n, Own Truck	F-73289	PT15013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG / MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
245	PC	X	91	154	PENTEX BC 340 (49/CS)	5	89.425
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	30	50	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
60	PC	X	56	4	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
66	PC	X	44	22	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
54	PC	X	48	6	*uni tronic 600-25M CU/ZC SPL(80')54P	1	13.176
72	PC	X	0	72	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
100	PC		90	10	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		155.493 KG
					**** TOTAL PACKAGES ****	12	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	✓ YES / OUI ___ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Ryan Beaham	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Ryan Beaham	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE: 30 08 18 (D/J M/M Y/A)	SIGNATURE: 30 08 18 (D/J M/M Y/A)	SIGNATURE / DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Event Report

Date/Time	Tran at 12:17:50 August 30, 2018
Trigger Source	Geo: 1.500 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.758 sec (Auto=4Sec) at 2048 sps
Operator/Setup:	Operator/Nelson Agg.mmb

Serial Number	UM6859 V 10-89 Micromate ISEE
Battery Level	3.7 Volts
Unit Calibration	December 22, 2017 by Instantel
File Name	UM6859_20180830121750.IDFW

Notes

Location:	SouthWest Corner Of Property
Client:	Nelson Aggregates
User Name:	Orica Canada
General:	Burlington

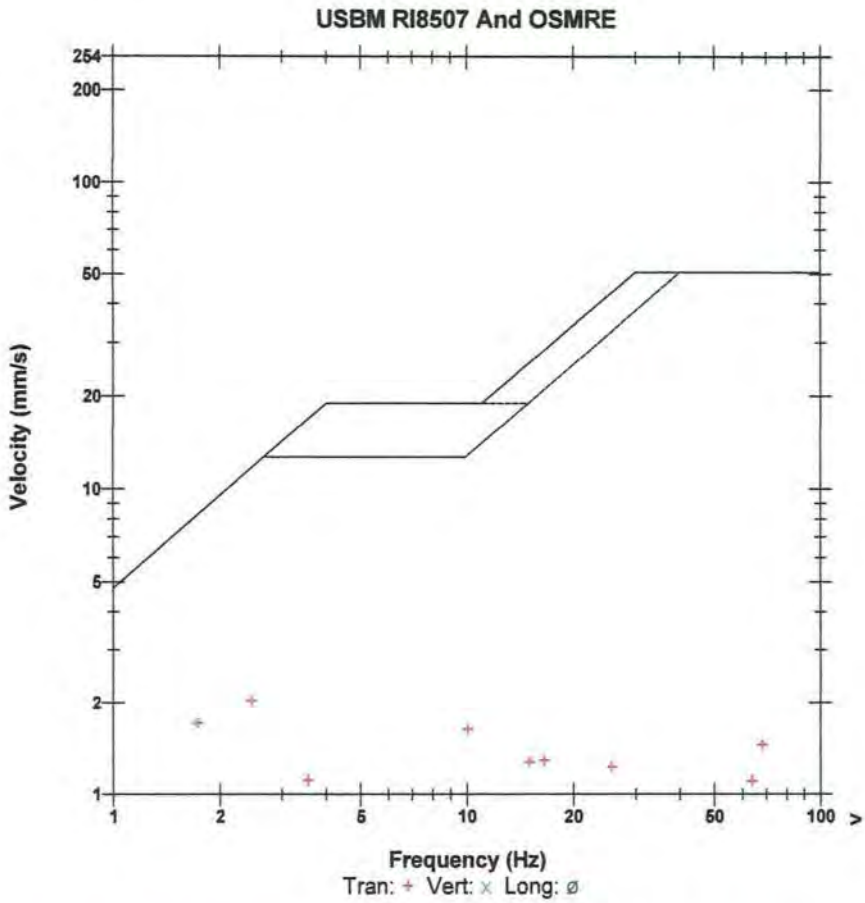
Extended Notes

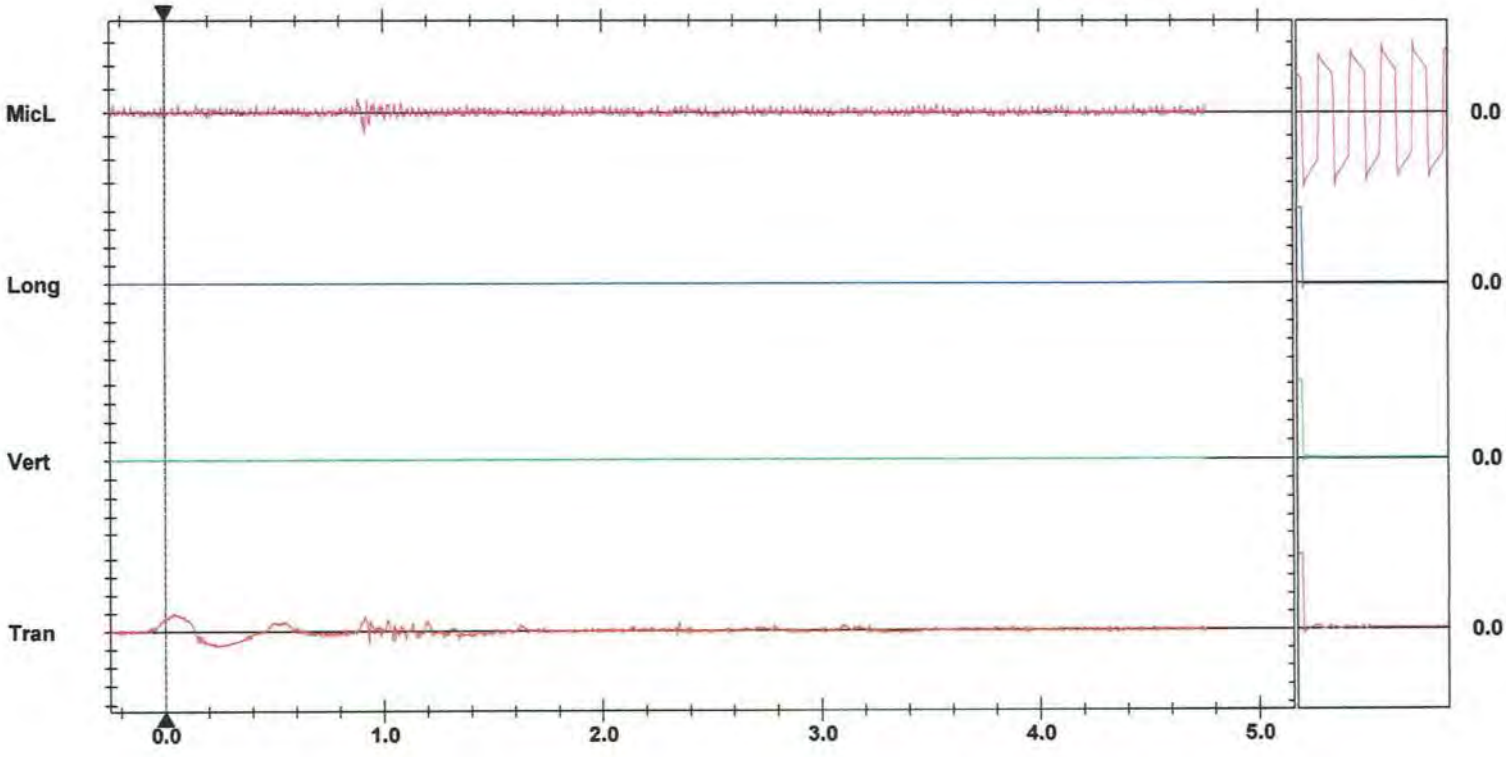
Sand Bagged
43.39339-79.88880

Microphone	Linear Weighting
PSPL	93.2 dB(L) at 0.916 sec
ZC Freq	22 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1334 mv)

	Tran	Vert	Long	
PPV	2.041	0.110	0.055	mm/s
ZC Freq	2.5	68	>200	Hz
Time (Rel. to Trig)	0.044	0.822	4.283	sec
Peak Acceleration	0.142	0.012	0.008	g
Peak Displacement	0.152	0.000	0.000	mm
Sensor Check	Check	Check	Check	
Frequency	20.9	1024.0	1024.0	Hz
Overswing Ratio	1.2	0.0	0.0	

Peak Vector Sum 2.041 mm/s at 0.044 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 1.000 pa.(L)/div

Sensor Check

Trigger =

Event Report

Date/Time	Tran at 11:55:00 August 30, 2018
Trigger Source	Geo: 1.500 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.25 sec (Auto=3Sec) at 1024 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.1 Volts
Unit Calibration	November 3, 2017 by Instantel
File Name	__TEMP.EVT
Scaled Distance	5850.2 (1850.0 m, 0.1 kg)

Notes

Location:	2450 2nd Line
Client:	Nelson Aggregate
User Name:	Orica Canada
General:	Burlington

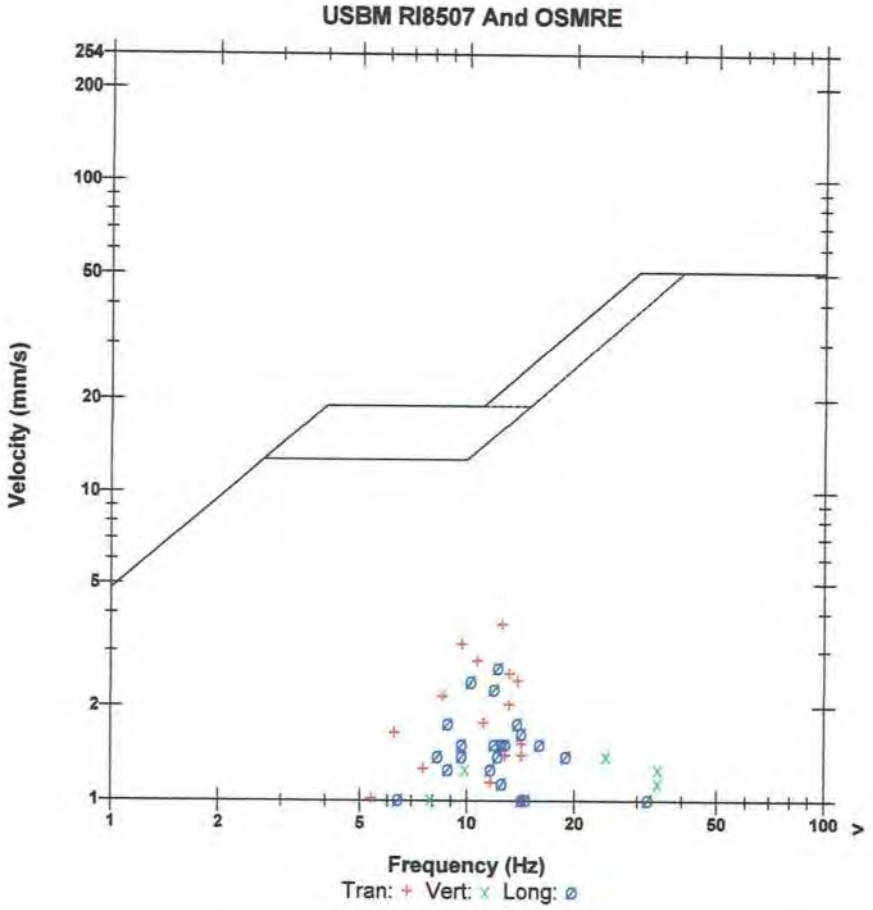
Extended Notes

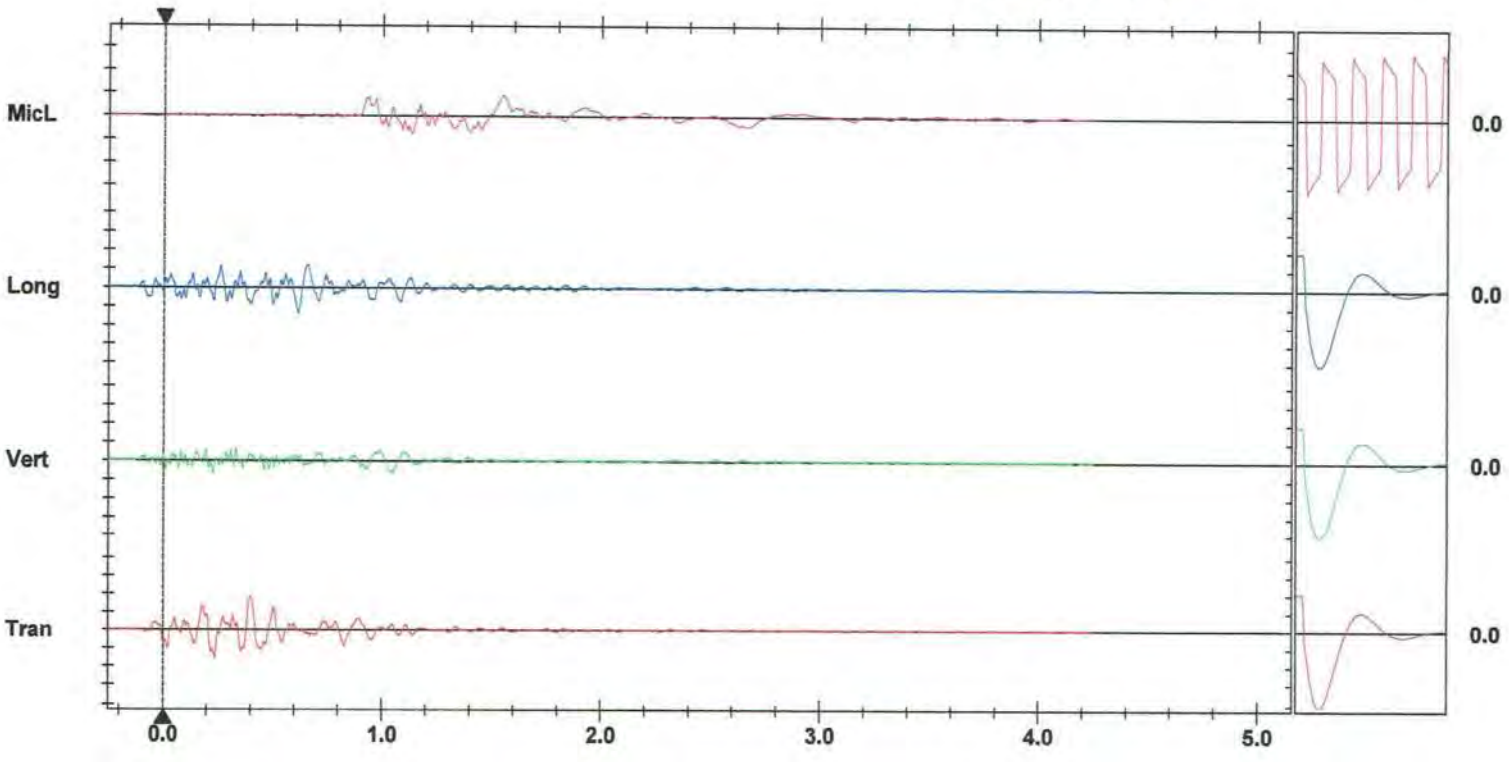
Sand Bagged
43.40245-79.87814

Microphone	Linear Weighting
PSPL	113.3 dB(L) at 1.545 sec
ZC Freq	3.0 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 558 mv)

	Tran	Vert	Long	
PPV	3.683	1.397	2.667	mm/s
ZC Freq	12	24	12	Hz
Time (Rel. to Trig)	0.395	0.229	0.614	sec
Peak Acceleration	0.053	0.040	0.040	g
Peak Displacement	0.050	0.022	0.037	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.6	4.0	

Peak Vector Sum 4.139 mm/s at 0.396 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div

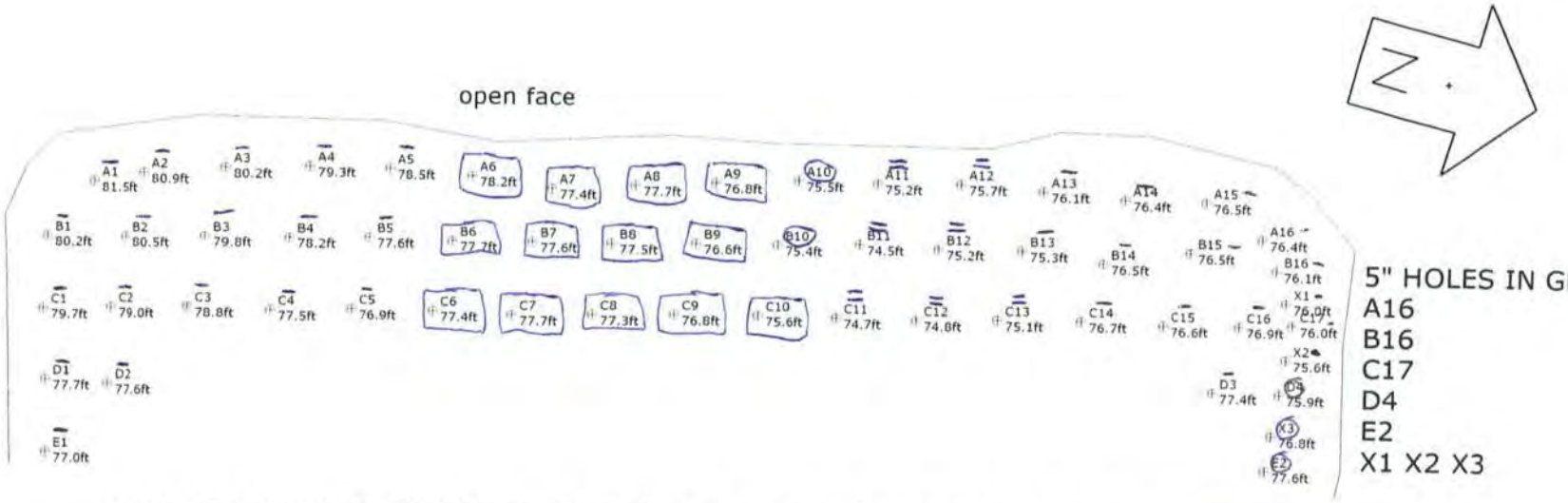
Trigger = ▶——◀

Sensor Check

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.2ft	Spacing: 10.2ft	Subdrill: 2.0ft	Stemming: 6.9ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 58	Hole angle: 0.0°
Total drilled: 4476.5ft			



5" HOLES IN GREEN
A16
B16
C17
D4
E2
X1 X2 X3

Design 18-013 UPPER MIDDLE Final- 4" Blast Hole 12x10 9x10 274 and 250 + .6 SUB ELEV

ORICA

Scale 1:275

SHOTPlus 5.7.0.8	8/7/2018
Mine	Burlington
Location	UPPER MIDDLE
Title/author	Design 18-013 UPPER MIDDLE Partial Final
Filename	Design 18-013 UPPER MIDDLE Partial.spf

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-08-30

Blast Number: 18-014
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Pit#)

GPS Coordinates: 43.40372 °N Latitude (Centre of Blast) 79.88278 °W Longitude (Centre of Blast)

Design te Blasted: 31,778 te
Total Holes Loaded: 58 holes
... including: Dead Holes
... and: 3 Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 3 rows

- Drilling Information -

		Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0 °	# Holes: 50	=	3,859.1 ft (4 " diam)
Secondary Bit diam:	127.0 mm	0 °	# Holes: 8	=	617.4 ft (5 " diam)
Tertiary Bit diam:	mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 24 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes 34 main body
Bench Height: 75.2 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 77.2 ft avg

- Design Stone Decking -

Front Row: 5.0 ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 65.2 ft avg
Main Body: 70.2 ft avg

- Design Charge Weight -

Front Row: 190.1 kg/hole
Main Body: 204.6 kg/hole
Max Chge Wt / delay: 240.0 kg/delay

Required kg Loaded: 13,539 kg
Rock Density: 2.65 g/cc = te/m^3

- Design Powder Factor -

Expected Yield PF: 0.426 kg/te (actual)
1.254 lb/yd^3 Front row: 0.281 kg/te (theoretical)
1.800 lb/yd^3 Main Body: 0.403 kg/te (theoretical)
1.618 lb/yd^3 "KPI" PF: 0.362 kg/te (theoretical)

Bulk Expl. Required:	kg
CENTRA GOLD 70	13,500

Pkgd Expl. Required:	kg

Boosters Required:	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	116	39.4

total explosives weight in Blast (kg): 13,539
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:	ms	# req'd
UNITRONIC 600 6M		58
UNITRONIC 600 15M		
UNITRONIC 600 30M		58

Cord & Access. Req'd:	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

3 Helpers

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-015
P.O. #:		Orica Order #:	2384839
Blast Date:	2018-09-10	Blast Time:	11:49 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40084 °N Latitude (Centre of Blast) 79.88808 °W Longitude (Centre of Blast)

Wind from the: E at 15 kph Temperature: 11 to 15 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 1,324 ft

Tonnes Blasted:	22,269 te	8,404 m3
Total tonnes per day:	22,269 te	NF-15 Rate Code
Total Holes Loaded:	204 holes	
… including:		Dead Holes
… and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	9 rows	

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 204	=	2,244.0 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	31,670	29,370	2,300

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	235	79.9

total explosives weight in Blast (kg): 2,380

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			2
EXEL HANDIDET 9m		25/500	235
CONNECTADET 9M		25 ms	11 X
CONNECTADET 9M		42 ms	34

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE	>/=2,000kg	<5,000kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		16.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

- Pattern (Front Row)-

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	20	front row

- Pattern (Main Body) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	184	main body
Bench Height:	11.0	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	11.0	ft avg

- Stone Decking -

Front Row:		ft avg
Main Body:		ft avg
# Decks:		per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

- Charge Length -

Front Row:	4.0	ft avg
Main Body:	4.0	ft avg

- Charge Weight -

Front Row:	11.7	kg/hole
Main Body:	11.7	kg/hole
Max. per delay:	30.0	kg/delay
SD () Equation:	629.5	kg/delay
Total kg Loaded:	2,380	kg
Rock Density:	2.65	g/cc = te/m^3

- Powder Factor -

0.477 lb/yd^3	Yield PF:	0.107	kg/te (actual)
0.477 lb/yd^3	Front row:	0.107	kg/te (theoretical)
0.477 lb/yd^3	Main Body:	0.107	kg/te (theoretical)
0.477 lb/yd^3	"KPI" PF:	0.107	kg/te (theoretical)

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

3 Helpers needed due to the number of holes and conditions

31 additional primers were needed because the primary was stuck and would not pull into product.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-015
P.O. #:		Orica Order #:	2384839
Blast Date:	2018-09-10	Blast Time:	11:49 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40083**	**79.88805**	0.757487	1.394310
Front Row Corner	43.40067	79.88858	0.757485	1.394319
Back Row Corner	43.40102	79.88760	0.757491	1.394302
Average (Centre of Blast)	43.40084	79.88808	0.757487	1.394310

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**823.6**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**1.5**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**124**	dB	

2450 2nd Line (set to 124DB trigger due to continious truck traffic)

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**752.7**	m				
Post Blast Data: ppV:	**0.1**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**7.5**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**118.0**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**831.0**	m				
Post Blast Data: ppV:	**Not**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Set**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Up**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property (Only require 2 Siesmographs for floor blasts)

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(752.7)^2}{30^2} \text{ kg}$$

$$= \frac{566{,}557}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 630 kg

jim bray

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

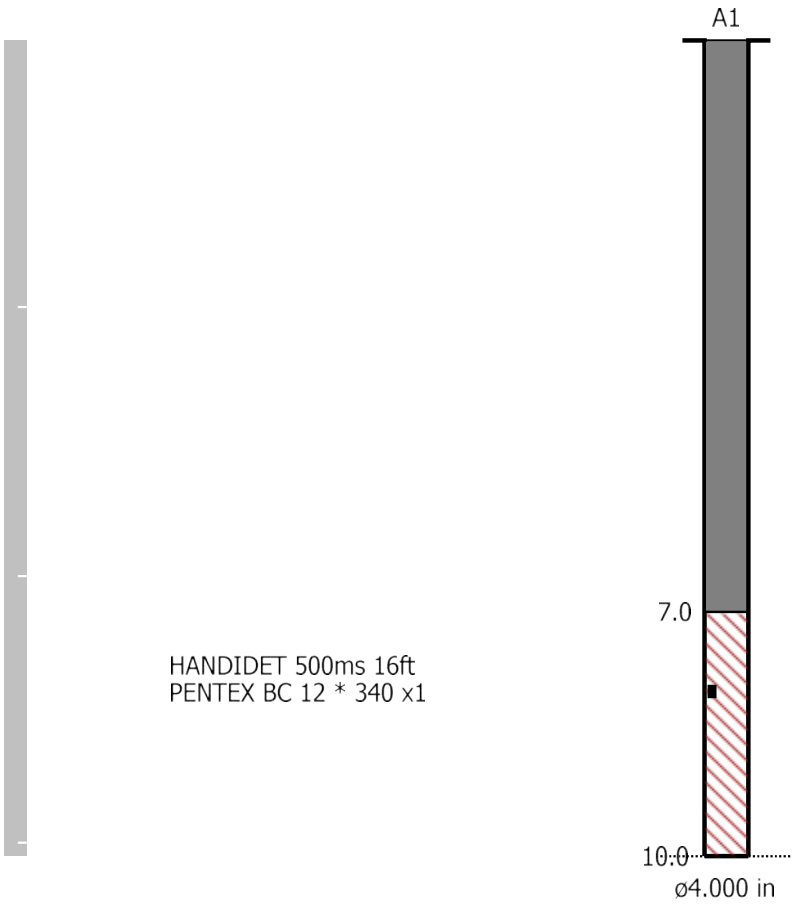
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-015
P.O. #:		Orica Order #:	2384839
Blast Date:	9/10/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

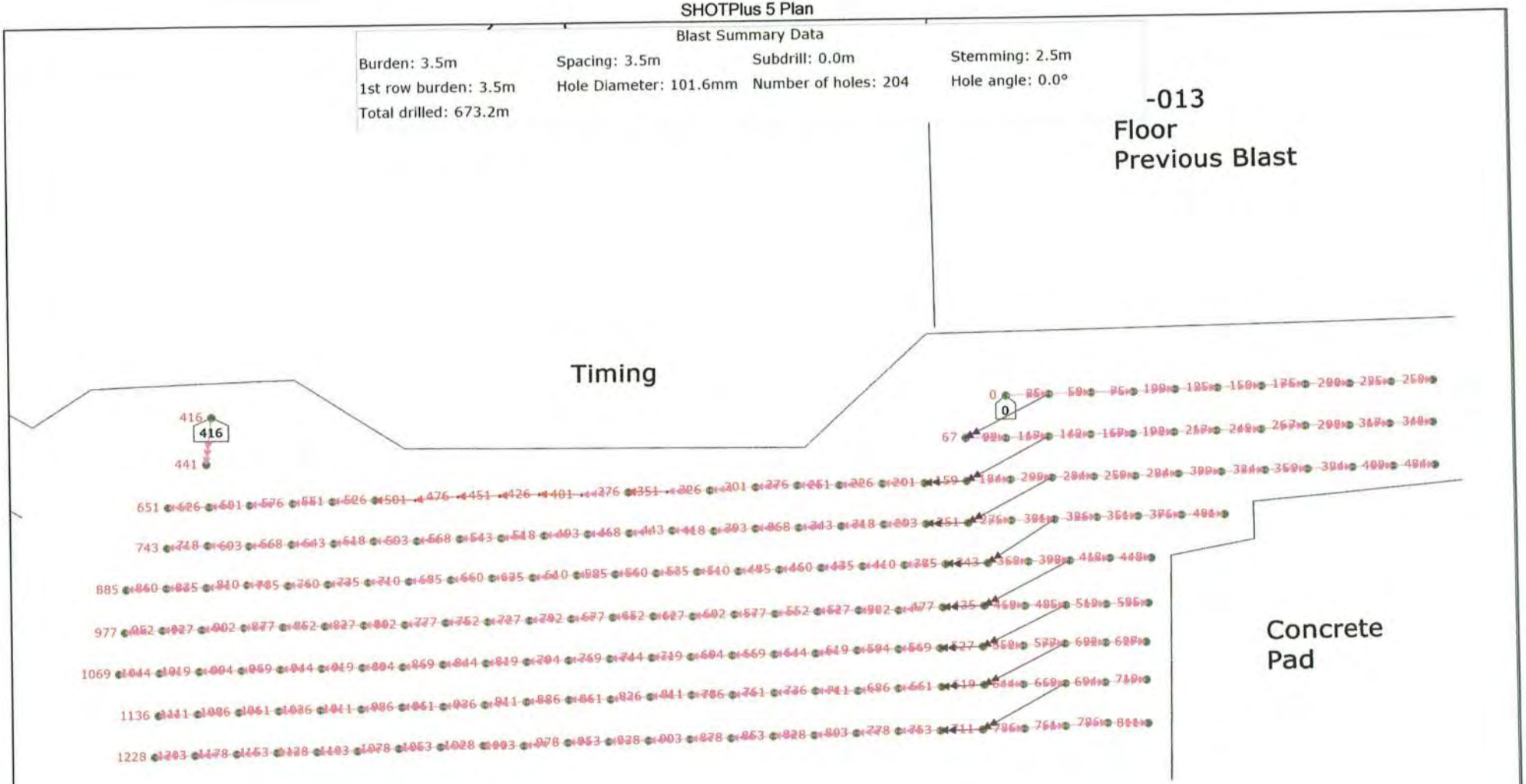
Quarry Manager: Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 3.5m	Spacing: 3.5m	Subdrill: 0.0m	Stemming: 2.5m
1st row burden: 3.5m	Hole Diameter: 101.6mm	Number of holes: 204	Hole angle: 0.0°
Total drilled: 673.2m			



Not to scale

SHOTPlus™ Professional 5.7.3.0		9/10/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	18-015 Floor Final Not timed.spf	

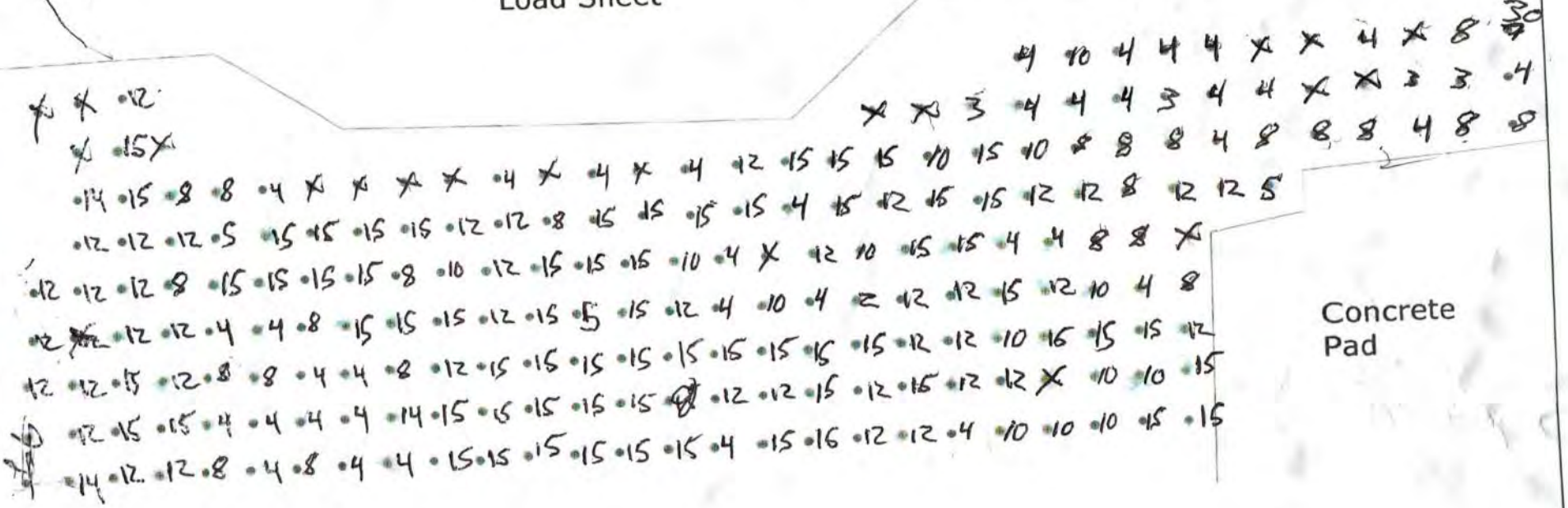
SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 8.2ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 218	Hole angle: 0.0°
Total drilled: 2360.2ft			

8-013
loor
Previous Blast

Load Sheet



Concrete Pad

DRILL TO SHALE

ORICA

Not to scale

SHOTPlus™ Professional 5.7.3.0		9/9/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	18-015 Floor Final.spf	

Event Report

Date/Time	MicL at 11:49:28 September 10, 2018
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.03 sec (Auto=5Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/BURLINGTON.MMB

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.6 Volts
Unit Calibration	February 14, 2018 by Instantel
File Name	UM6857_20180910114928.IDFW

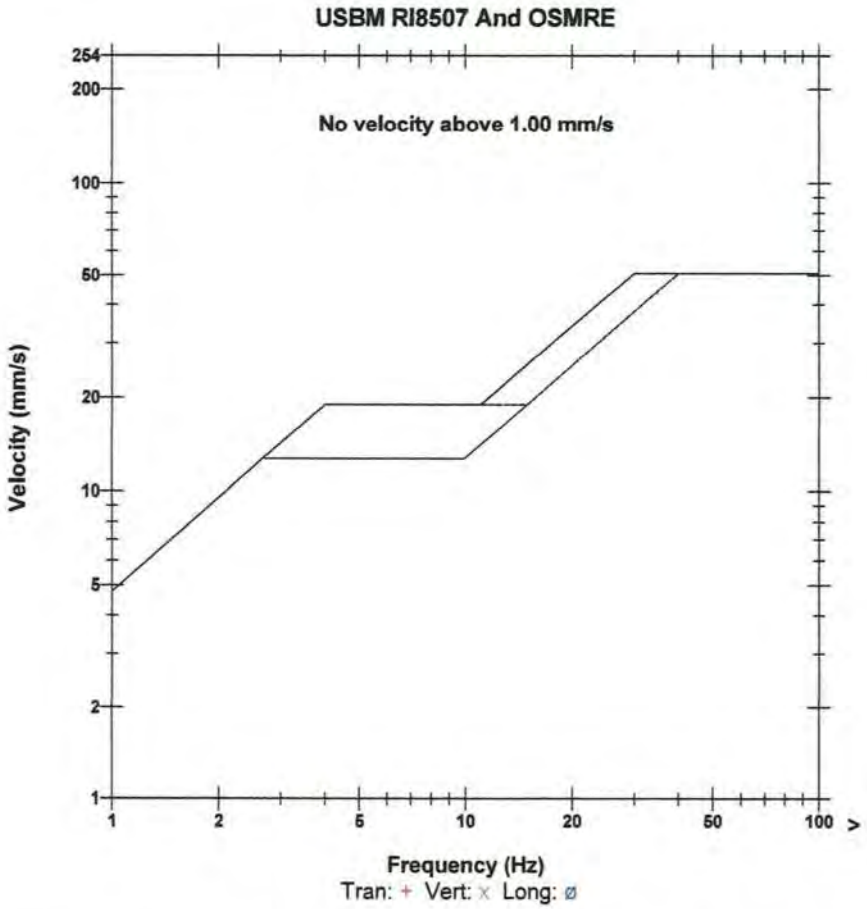
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

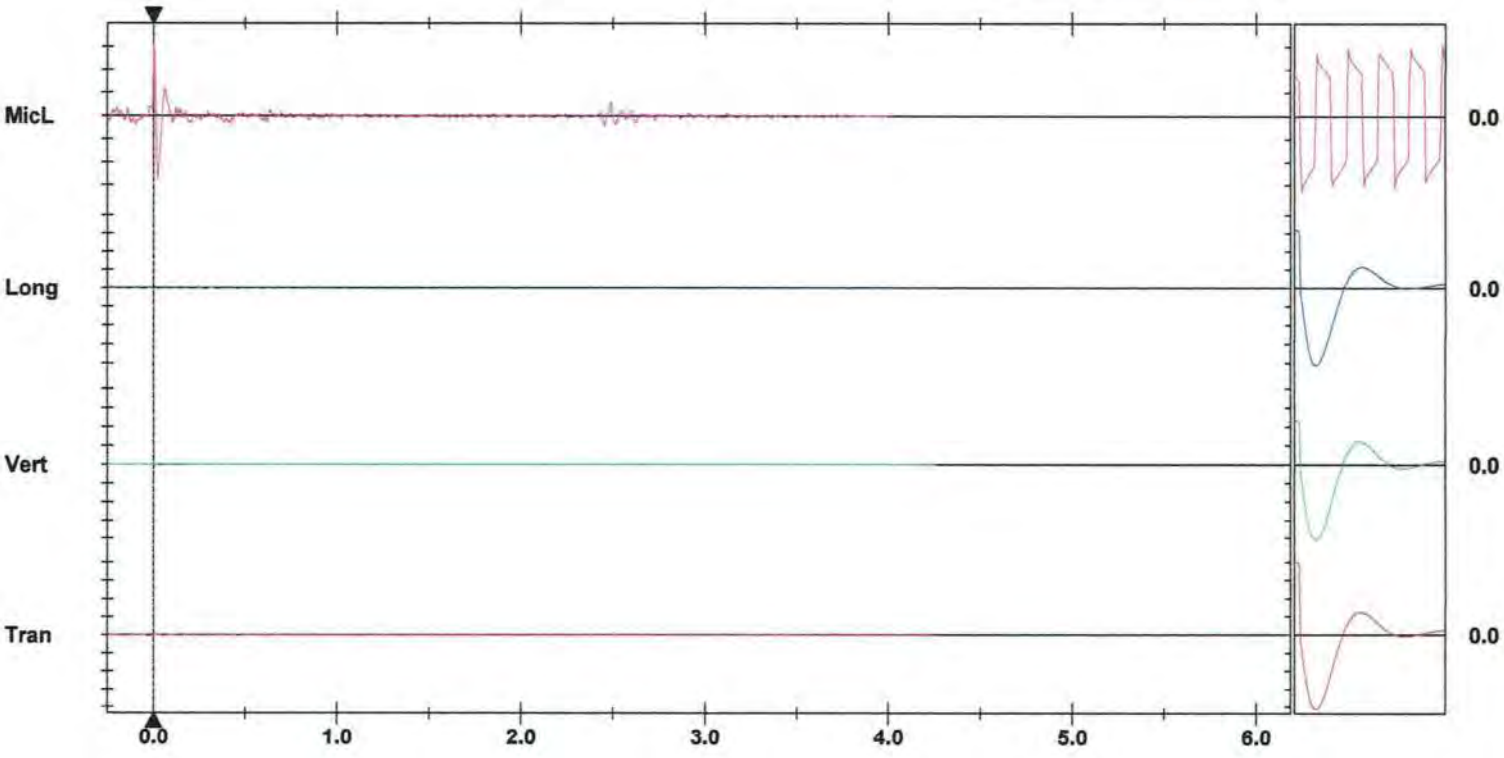
Extended Notes
N 43.31617
W 80.02664

Microphone	Linear Weighting
PSPL	118.0 dB(L) at 0.001 sec
ZC Freq	11.1 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 1457 mv)

	Tran	Vert	Long	
PPV	0.110	0.110	0.110	mm/s
ZC Freq	11.6	27	16.0	Hz
Time (Rel. to Trig)	-0.020	0.049	0.026	sec
Peak Acceleration	0.010	0.010	0.012	g
Peak Displacement	0.001	0.001	0.010	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.5	7.3	Hz
Overswing Ratio	3.3	3.4	3.6	

Peak Vector Sum 0.136 mm/s at 0.049 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

1090658

Bill of Lading / Connaissement

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	6 45AM
TIME OUT / HEURE SORTIE	
ORDER NUMBER / N° DE COMMANDE	2384839
B/L NUMBER / N° DE CONNAISSEMENT	36129828

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
10 Sep 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
10 Sep 2018	FOB Dest'n, Own Truck	F-73289	AT15013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
					NET EXPLOSIVES QUANTITY: 100.426 KG		
294	PC	X	59	235	PENTEX BC 340 (49/CS)	6	107.310
1	PC		0	1	Harness Wire Duplex (6 pack) 400m	1	5.840
30	PC	X	28	2	*uni tronic 600-06.0M CU/ZC(20')80PC	1	2.190
100	PC		100	0	MINI STEM PLUGS - PART #74853		0.700
325	PC	X	90	235	EXEL HANDIDET 9M 25/500(30') 65/CS	5	32.825
65	PC	X	59	6	EXEL Connectadet 9M 25MS (30 FT) 65/CS	1	6.305
65	PC	X	31	34	EXEL Connectadet 9M 42MS (30 FT) 65/CS	1	6.370
10	PC	X	10	0	EXEL Connectadet 12M 42MS (40 FT) 50/CS	1	1.080
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		162.620 KG
					**** TOTAL PACKAGES ****	16	

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	✓ YES / OUI ___ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: K. KLATT	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: K. KLATT	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE: K Klatt	SIGNATURE: K Klatt	SIGNATURE
DATE: 10 9 18 (D/J M/M Y/A)	DATE: 10 9 18 (D/J M/M Y/A)	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-09-10

Blast Number: 18-015
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40084 °N Latitude (Centre of Blast) 79.88808 °W Longitude (Centre of Blast)

Design te Blasted: 22,329 te
Total Holes Loaded: 225 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: rows

- Drilling Information -

			Angle from Vertical				Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes:	225	=	2,250.0 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0°	# Holes:		=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 20 front row

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 205
Bench Height: 10.0 ft avg
Sub-drill: 0.0 ft avg
Hole Depth: 10.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 3.0 ft avg
Main Body: 3.0 ft avg

- Design Charge Weight -

Front Row: 8.7 kg/hole
Main Body: 8.7 kg/hole
Max Chge Wt / delay: 12.0 kg/delay

Required kg Loaded: 2,957 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.132 kg/te (actual)
0.394 lb/yd³ Front row: 0.088 kg/te (theoretical)
0.394 lb/yd³ Main Body: 0.088 kg/te (theoretical)
0.000 lb/yd³ "KPI" PF: 0.000 kg/te (theoretical)

Bulk Expl. Required:

		kg
CENTRA GOLD 70		2,880

Pkgd Expl. Required:

		kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	225	76.5

total explosives weight in Blast (kg): 2,957
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		6
EXEL HANDIDET 9m	25/500	225
CONNECTADET 12M	42 ms	36

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services Req'd:

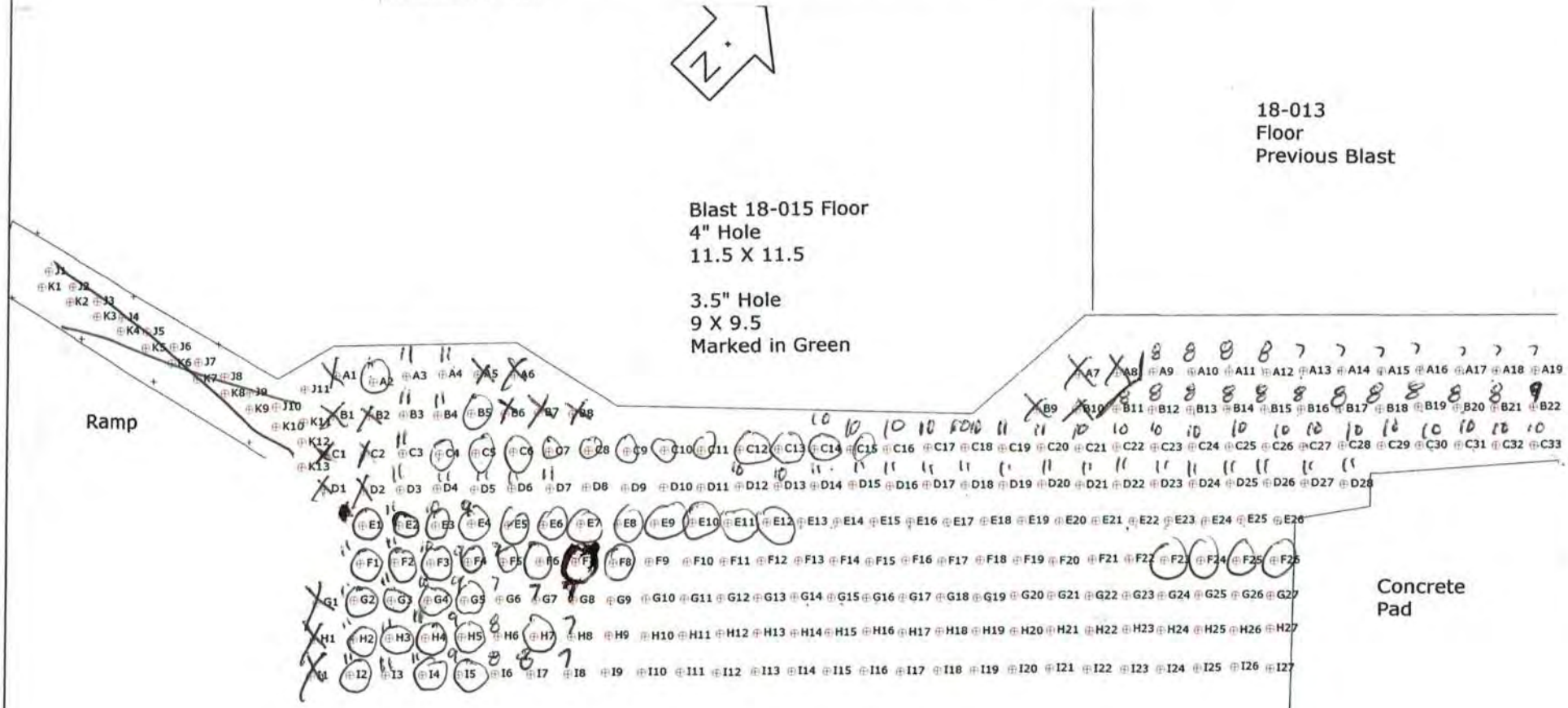
GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

SHOTPlus 5 Plan

Blast Summary Data

Burden: 3.5m	Spacing: 3.5m	Subdrill: 0.0m	Stemming: 2.5m
1st row burden: 3.5m	Hole Diameter: 101.6mm	Number of holes: 259	Hole angle: 0.0°
Total drilled: 789.4m			



DRILL TO SHALE

ORICA

Not to scale

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-018
P.O. #:		Orica Order #:	2390035
Blast Date:	2018-09-21	Blast Time:	12:34 PM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40052 °N Latitude (Centre of Blast) 79.88765 °W Longitude (Centre of Blast)

Wind from the: SW at 15 kph Temperature: 26 to 30 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	38,483 te	14,522 m3
Total tonnes per day:	38,483 te	NF-14 Rate Code
Total Holes Loaded:	345 holes	
… including:		Dead Holes
… and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	21 rows	

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:		
Primary Bit diam:	101.6	mm	0°	# Holes:	345	= 3,877.8 ft	(4	" diam)
Secondary Bit diam:		mm	0°	# Holes:		= 0.0 ft	(	" diam)
Tertiary Bit diam:		mm	0°	# Holes:		= 0.0 ft	(	" diam)

- Pattern (Front Row)-

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	26	front row

- Pattern (Main Body) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	319	main body
Bench Height:	11.2	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	11.2	ft avg

- Stone Decking -

Front Row:		ft avg
Main Body:		ft avg
# Decks:		per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

- Charge Length -

Front Row:	4.2	ft avg
Main Body:	4.2	ft avg

- Charge Weight -

Front Row:	12.4	kg/hole
Main Body:	12.4	kg/hole
Max. per delay:	30.0	kg/delay
SD () Equation:	709.0	kg/delay
Total kg Loaded:	3,969	kg
Rock Density:	2.65	g/cc = te/m³

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

0.461 lb/yd³	Yield PF:	0.103	kg/te (actual)
0.495 lb/yd³	Front row:	0.111	kg/te (theoretical)
0.495 lb/yd³	Main Body:	0.111	kg/te (theoretical)
0.495 lb/yd³	"KPI" PF:	0.111	kg/te (theoretical)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	30,490	26,640	3,850

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	349	118.7

total explosives weight in Blast (kg): 3,969

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			349

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	2
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE	>/=2,000kg	<5,000kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		18.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Unitronic detonators were used due to a shortage of non-electronic detonators.

The rate code will show use of non-electronic detonators, therefore no additional cost will be incured by the customer

4 holes received a seondary primers because the bottom primer was stuck

additional helper due to number of hole and difficulty of blast

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-018
P.O. #:		Orica Order #:	2390035
Blast Date:	2018-09-21	Blast Time:	12:34 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40053**	**79.88773**	0.757482	1.394304
Front Row Corner	43.40099	79.88756	0.757490	1.394301
Back Row Corner	43.40004	79.88767	0.757474	1.394303
Average (Centre of Blast)	43.40052	79.88765	0.757482	1.394303

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**798.8**	m		
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at: **1.5**	mm/s
frequency:	**Not**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at: **124**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**801.6**	m		
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**Not**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at: **115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**799.3**	m		
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**Not**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Set-up**	dB	Trigger set at: **115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(798.8)^2}{30^2} \text{ kg}$$

$$= \frac{638{,}081}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 709 kg

jim bray

Orica
Blaster-in-charge: *Mike der Kinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

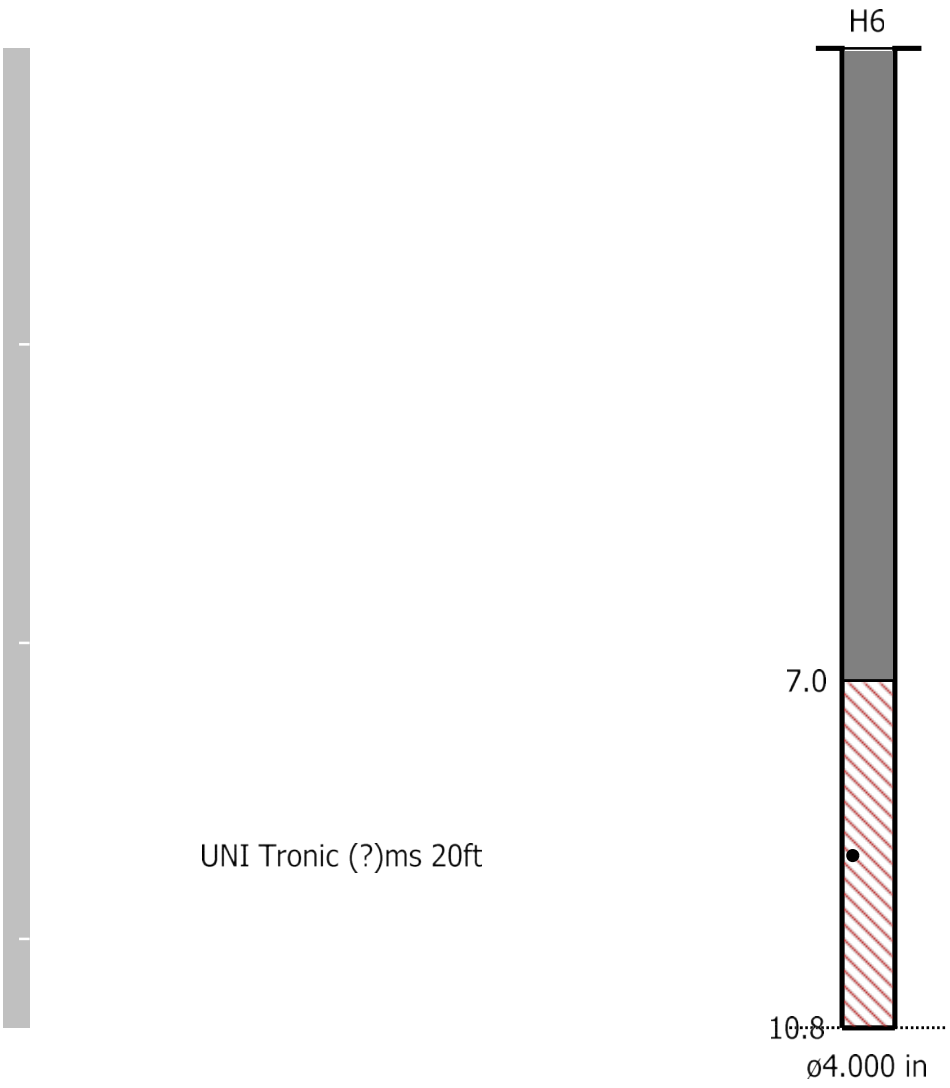
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-018
P.O. #:		Orica Order #:	2390035
Blast Date:	9/21/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Bill White

Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Not to scale

SHOTPlus™ Professional 5.7.3.0		9/20/2018
Mine	Burlington	
Location		
Title/author	18-018 Floor I. Deemert	
Filename	18-018_Floor_Design_Final.spf	

1090791

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
06:45	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2390035	86143198

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
21 Sep 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
21 Sep 2018	FOB Dest'n, Own Truck	F-73289	18230

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG / MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
392	PC	X	43	349	PENTEX BC 340 (49/CS)	8	143.080
3	PC		1	2	Harness Wire Duplex (6 pack) 400m	1	8.760
400	PC	X	51	349	*uni tronic 600-06.0M CU/ZC(20')80PC	5	29.200
60	PC	X	60	0	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
100	PC		100	0	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		187.620 KG
					**** TOTAL PACKAGES ****	15	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ✓ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV / PRESSAGE / WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: K. PLATT	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: K. PLATT	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE: K. Platt	DATE: 21 9 18 (D/J M/M Y/A)	SIGNATURE: K. Platt
DATE: 21 9 18 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

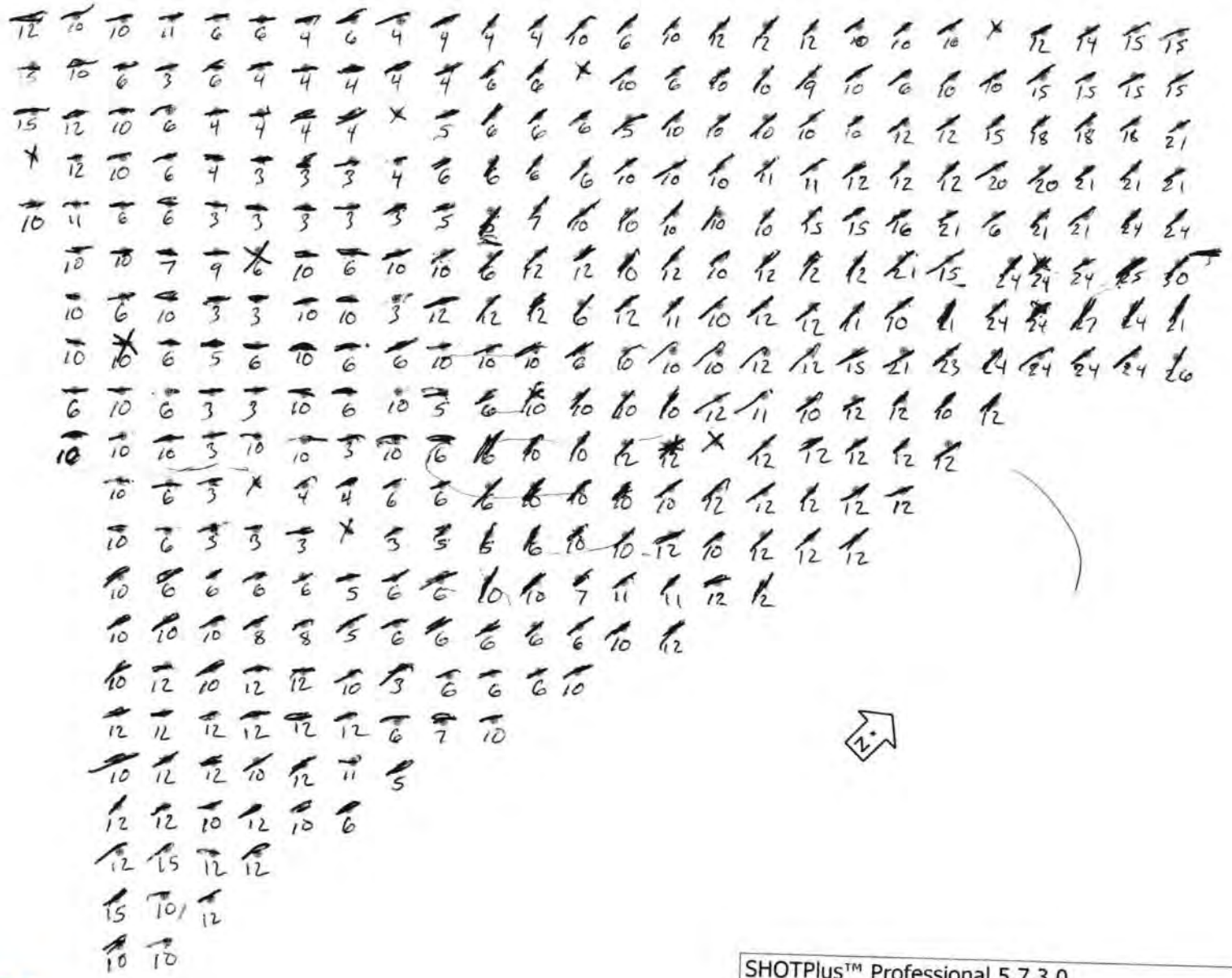
SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

SHOTPlus 5 Plan

Open Face
Load Sheet 16 Kg Max

Previous Blast

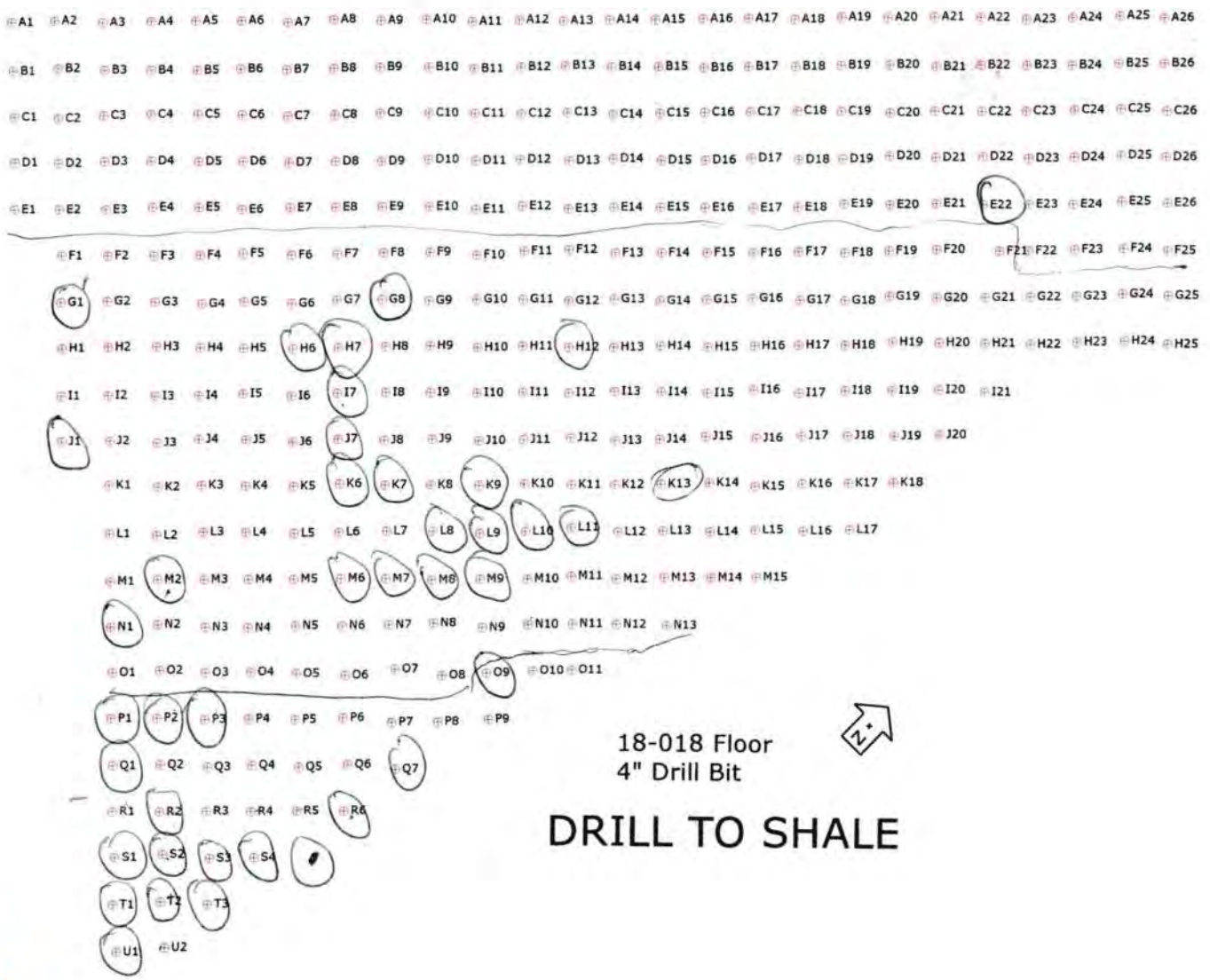


Not to scale

SHOTPlus™ Professional 5.7.3.0		9/20/2018
Mine	Burlington	
Location		
Title/author	18-018 Floor I. Deemert	
Filename	18-018_Floor_Design_Final.spf	

Open Face

Blast 18-015 Floor
Previous Blast



18-018 Floor
4" Drill Bit

DRILL TO SHALE

ORICA

Not to scale

P5-6 4.5'OB F4 7'OB F5 7'OB F6 7'OB
Q4 7'OB P4 6'OB

GODRICH ENGINEERING®

SHOT DIAGRAM

Client:

Job:

Date:

1 foot into the Shale
134 holes Footage-1531'
in shot so far

Driller:

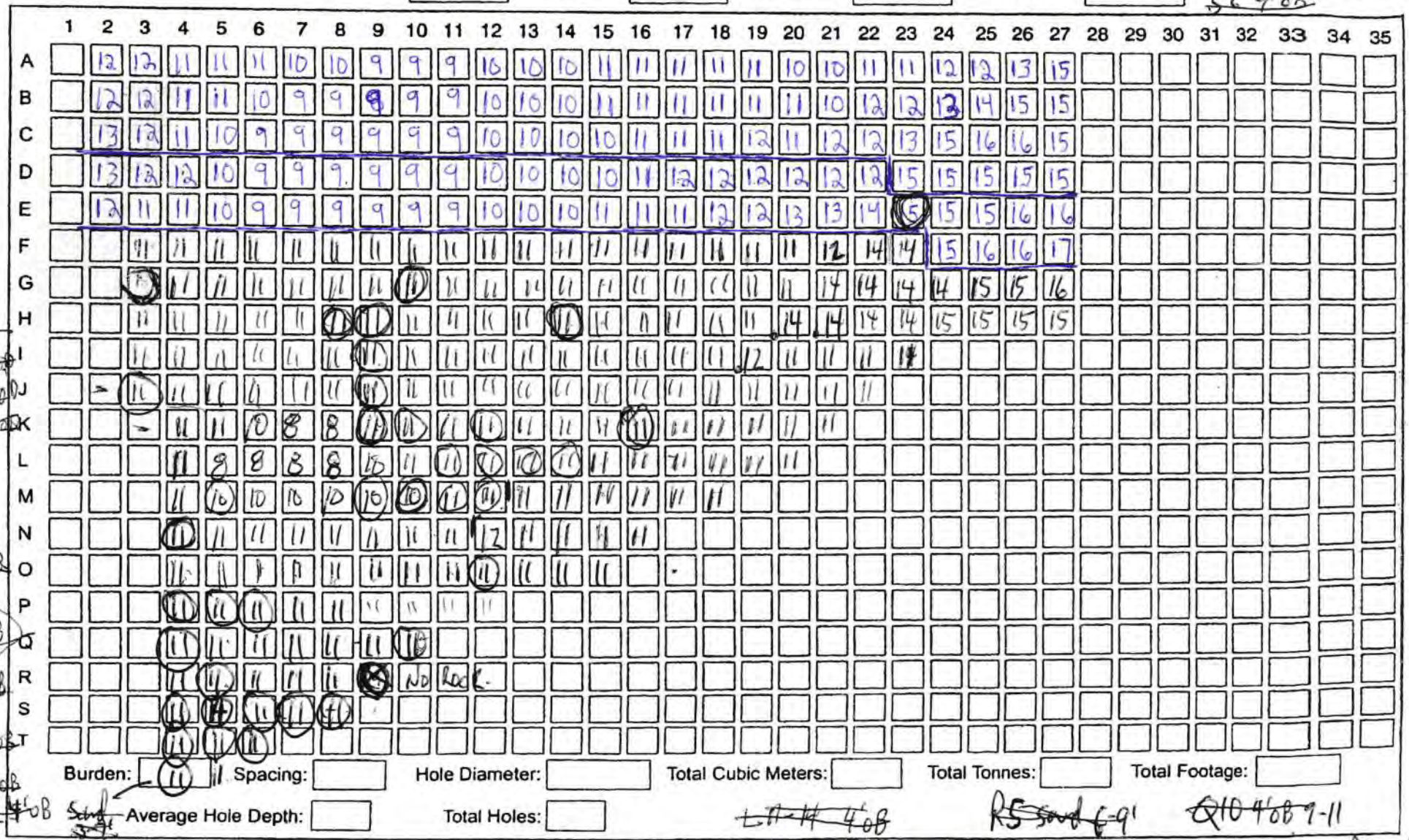
Blast Num:

Employee:

~~P6 6'OB~~ ~~S74.5'OB~~ S74.5OB

GPS Coordinates GPS LF: GPS RF: GPS LR: GPS RR:

~~S5 9'OB~~ ~~S84.5OB~~ S5 9'OB



~~B5 6'OB~~
~~K12 9'OB~~
~~K10 8'OB~~
~~K9 8'OB~~
~~N4 5'OB~~
~~M6 5'OB~~
~~S4 7'OB~~
~~M4 4'OB~~
~~M10 5'OB~~
~~M11-12 4'OB~~

Burden: Spacing: Hole Diameter: Total Cubic Meters: Total Tonnes: Total Footage:

Sand Average Hole Depth: Total Holes:

~~L11-14 4'OB~~ R5 ~~Sand~~ 6-9' ~~Q10 4OB 9-11~~

~~G5 6'OB~~ ~~H14 6'OB~~ ~~H8 7B H9 6OB~~

Shot Notes E23-9'-15'-Fractured ~~K16 7'OB~~ ~~G10 7~~ 7.5 R9 4OB 9-11

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-09-21

Blast Number: 18-018
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: enter data on p2 °N Latitude (Centre of Blast) enter data on p2 °W Longitude (Centre of Blast)

Design te Blasted:	39,153	te
Total Holes Loaded:	351	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	21	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 351	=	3,945.2 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	26	front row

- Design Pattern (Main Body) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	325	main body
Bench Height:	11.2	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	11.2	ft avg

- Design Stone Decking -

Front Row:		ft avg
Main Body:		ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

- Design Charge Length -

Front Row:	4.2	ft avg
Main Body:	4.2	ft avg

- Design Charge Weight -

Front Row:	12.4	kg/hole
Main Body:	12.4	kg/hole
Max Chge Wt / delay:	16.0	kg/delay

Required kg Loaded:	10,119	kg
Rock Density:	2.65	g/cc = te/m³

Bulk Expl. Required:

		kg
CENTRA GOLD 70		10,000

Pkgd Expl. Required:

		kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	351	119.3

total explosives weight in Blast (kg):	10,119
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		351

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Powder Factor -

	Expected Yield PF:	0.258	kg/te (actual)
0.495 lb/yd³	Front row:	0.111	kg/te (theoretical)
0.495 lb/yd³	Main Body:	0.111	kg/te (theoretical)
0.495 lb/yd³	"KPI" PF:	0.111	kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-017
P.O. #:		Orica Order #:	2394470
Blast Date:	2018-10-02	Blast Time:	12:02 PM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40374 °N Latitude (Centre of Blast) 79.88268 °W Longitude (Centre of Blast)

Wind from the: SW at 5 kph Temperature: 11 to 15 °C

		x		x	
Clear:		Rain:	x	Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 751 ft

Tonnes Blasted:	26,868 te	10,139 m3
Total tonnes per day:	26,868 te	NB80-01 Rate Code
Total Holes Loaded:	48 holes	
… including:		Dead Holes
… and:	2	Helper Holes
Helper Hole Collar:	50.0 ft avg	
# Rows Blasted:	3 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	48	=	3,763.4 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	19	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	29	main body
Bench Height:	76.4	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	78.4	ft avg

- Stone Decking -

Front Row:	10.0	ft avg
Main Body:	10.0	ft avg
# Decks:	6	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

- Charge Length -

Front Row:	61.4	ft avg
Main Body:	61.4	ft avg

- Charge Weight -

Front Row:	179.0	kg/hole
Main Body:	179.0	kg/hole
Max. per delay:	265.0	kg/delay
SD () Equation:	172.7	kg/delay
Total kg Loaded:	11,427	kg
Rock Density:	2.65	g/cc = te/m^3

Theoretical PF (Based on a single hole)

- Powder Factor -

1.900 lb/yd^3	Yield PF:	0.425	kg/te (actual)
1.162 lb/yd^3	Front row:	0.260	kg/te (theoretical)
1.550 lb/yd^3	Main Body:	0.347	kg/te (theoretical)
1.421 lb/yd^3	"KPI" PF:	0.318	kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blastec

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,740	22,350	11,390

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	108	36.7

total explosives weight in Blast (kg): 11,427

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			45
UNITRONIC 600 25M			26
UNITRONIC 600 30M			36
UNITRONIC 600 15M			1

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		0.0
BULK TRUCK CHARGE		>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

3 Siesmographs set up

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-017
P.O. #:		Orica Order #:	2394470
Blast Date:	2018-10-02	Blast Time:	12:02 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40371**	**79.88267**	0.757538	1.394216
Front Row Corner	43.40358	79.88266	0.757535	1.394215
Back Row Corner	43.40393	79.88271	0.757541	1.394216
Average (Centre of Blast)	43.40374	79.88268	0.757538	1.394216

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**394.2**	m			
Post Blast Data: ppV:	**5.3**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**7.6**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**114.2**	dB	Trigger set at:	**124**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**951.1**	m			
Post Blast Data: ppV:	**0.2**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**7.1**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**121.6**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1253.8**	m			
Post Blast Data: ppV:	**0.5**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**7.3**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**123.5**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(394.2)^2}{30^2} \text{ kg}$$

$$= \frac{155{,}394}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 173 kg

jim bray

Orica
Blaster-in-charge: Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

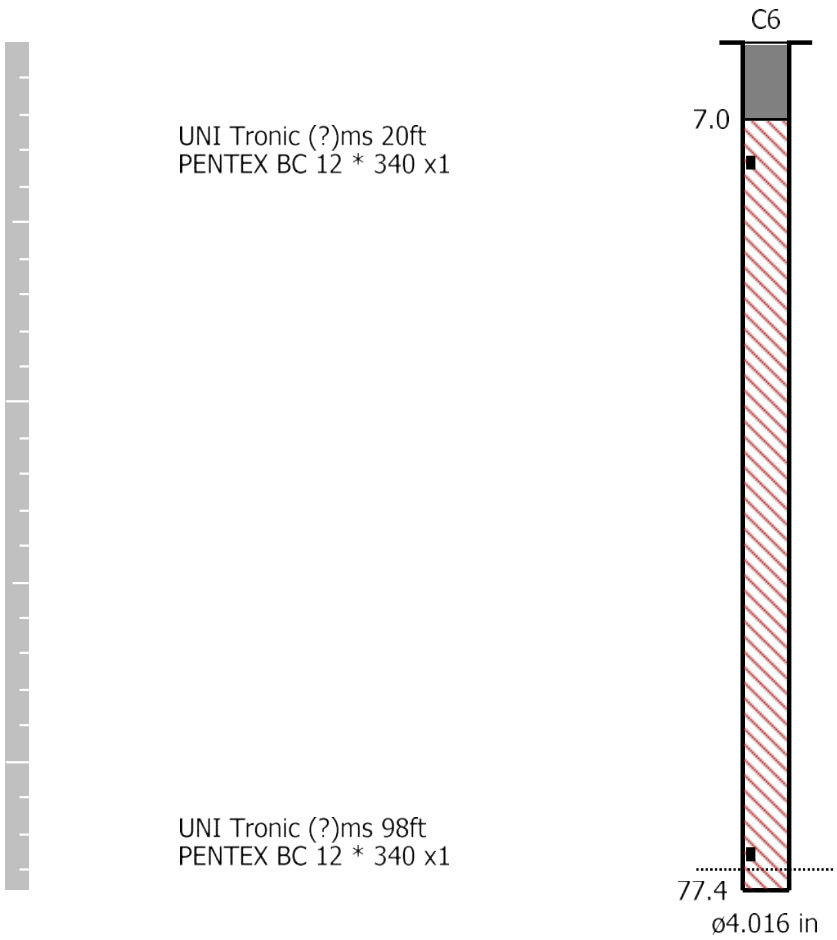
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-017
P.O. #:		Orica Order #:	2394470
Blast Date:	10/2/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Bill White

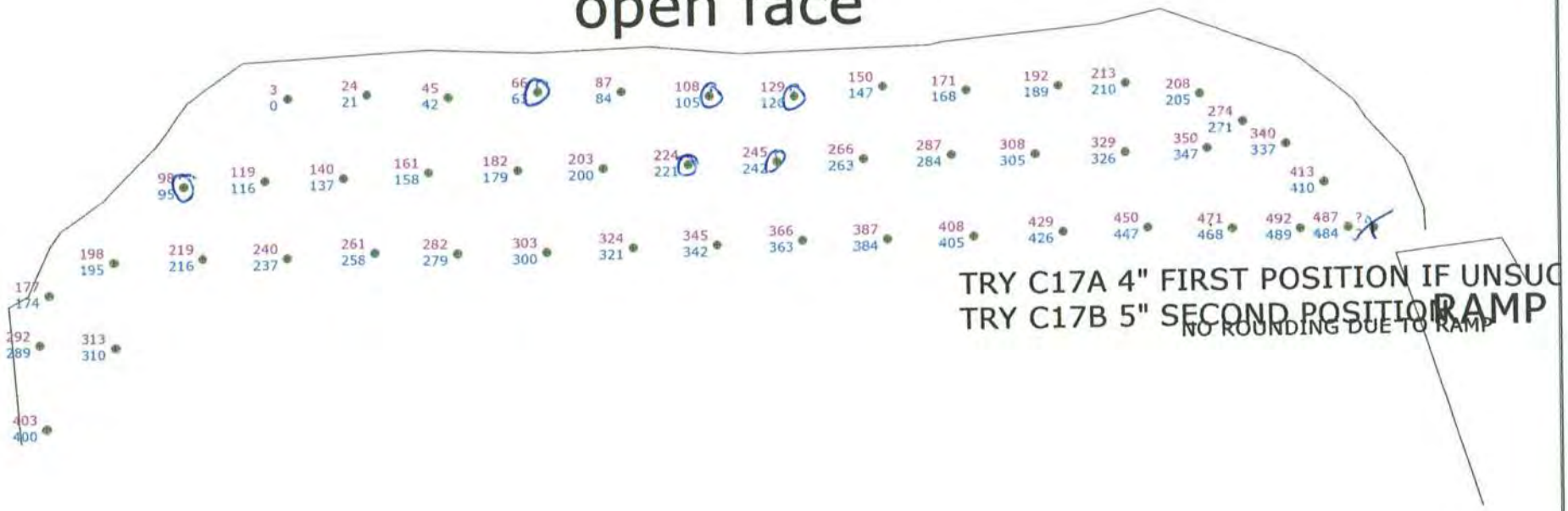
Signature required, indicating sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 49	Hole angle: 0.0°
Total drilled: 3733.8ft			

open face



ORICA

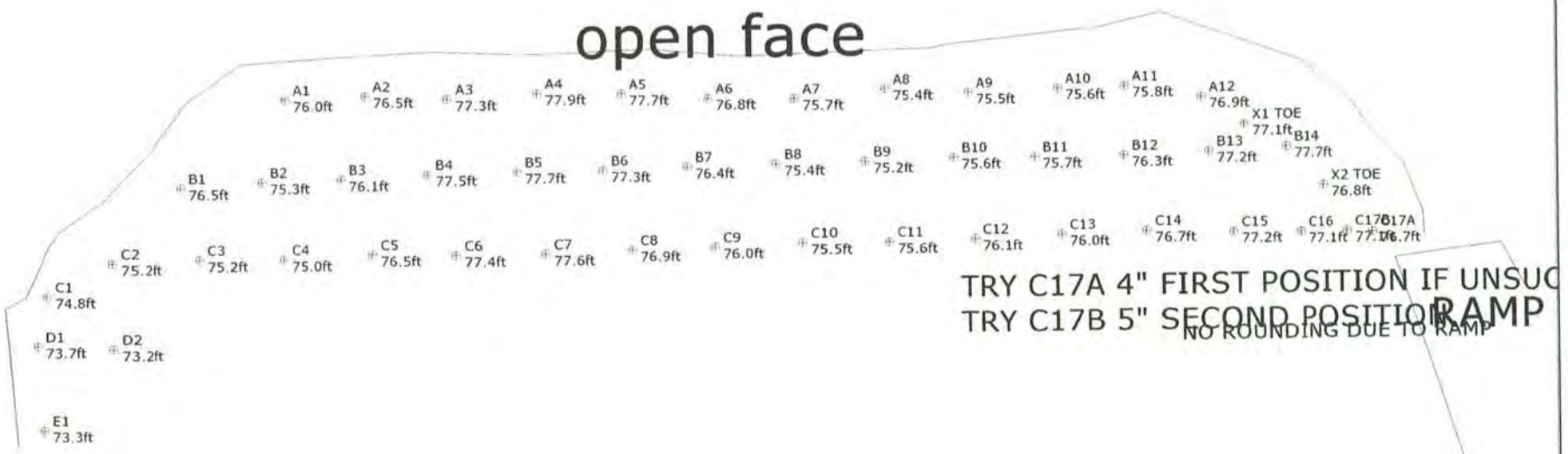
Not to scale

SHOTPlus™ Professional 5.7.3.0		10/1/2018
Mine	Burlington	
Location	UPPER MIDDLE NO ROUNDING ON NORTH	
Title/author	Design 18-017 UPPER MIDDLE	
Filename	2018-10-02 18-017 Upper Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 49	Hole angle: 0.0°
Total drilled: 3733.8ft			



ORICA

Not to scale

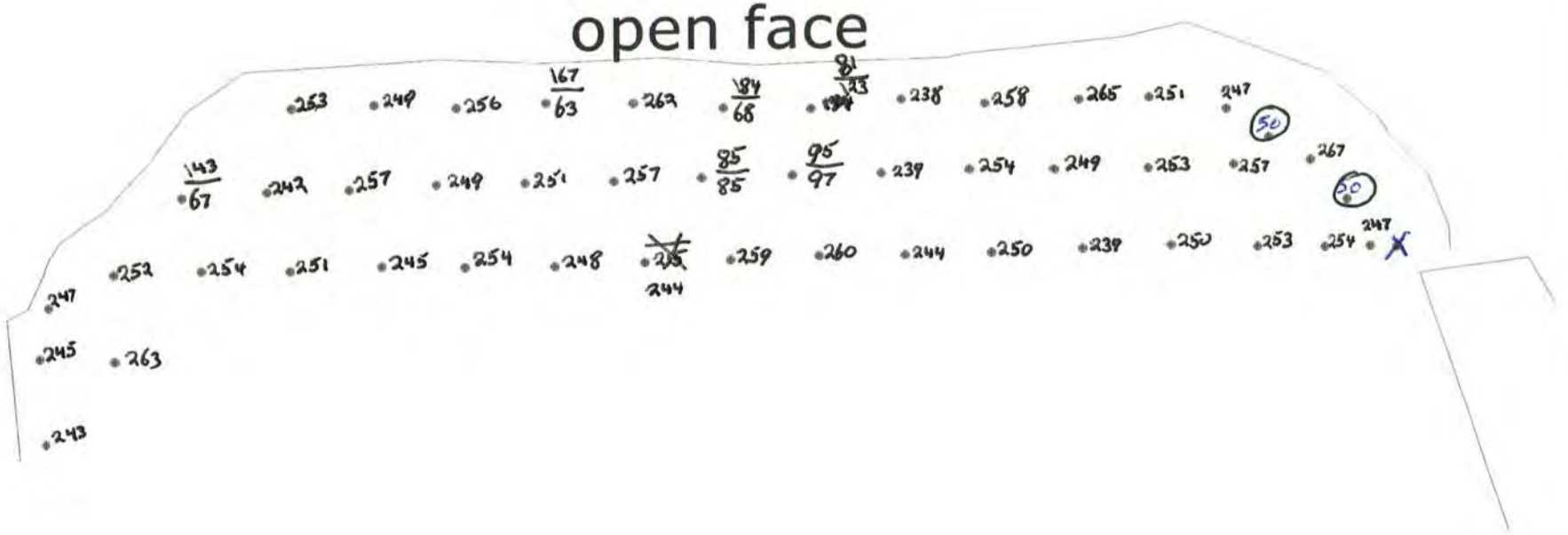
SHOTPlus™ Professional 5.7.3.0	9/17/2018
Mine	Burlington
Location	UPPER MIDDLE NO ROUNDING ON NORTH
Title/author	Design 18-017 UPPER MIDDLE
Filename	Design_18-017_UPPER_MIDDLE_Fnl.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 49	Hole angle: 0.0°
Total drilled: 3733.8ft			

Load Sheet
240 Kg Max
open face



Not to scale

SHOTPlus™ Professional 5.7.3.0	9/28/2018
Mine	Burlington
Location	UPPER MIDDLE NO ROUNDING ON NORTH
Title/author	Design 18-017 UPPER MIDDLE
Filename	Design_18-017_UPPER_MIDDLE_Fnl.spf

1090892

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE
11:54	

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2394470	36154431

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
02 Oct 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
02 Oct 2018	FOB Dest'n, Own Truck	F-73289	PT18230

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
147	PC	X	39	108	PENTEX BC 340 (49/CS)	3	53.655
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	35	45	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
66	PC	X	65	1	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
54	PC	X	28	26	*uni tronic 600-25M CU/ZC SPL(80')54P	1	13.176
~~36~~	PC	X	0	36	*uni tronic 600-30M C/Z SPL(100')36P	1	8.820
~~30~~ 100	PC				MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		99.317 KG
					**** TOTAL PACKAGES ****	8	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES

PALLETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	YES / OUI ✓ NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE
$

NETTE No. CONV
PRESSAGE
WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY

SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
JEFF NORWELL	JEFF NORWELL	

SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A	SIGNATURE	DATE D/J M/M Y/A
	2-10-18		2-10-18		

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Event Report

Date/Time	MicL at 12:02:29 October 2, 2018
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.308 sec (Auto=5Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/BURLINGTON.MMB

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.6 Volts
Unit Calibration	February 14, 2018 by Instantel
File Name	UM6857_20181002120229.IDFW

Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

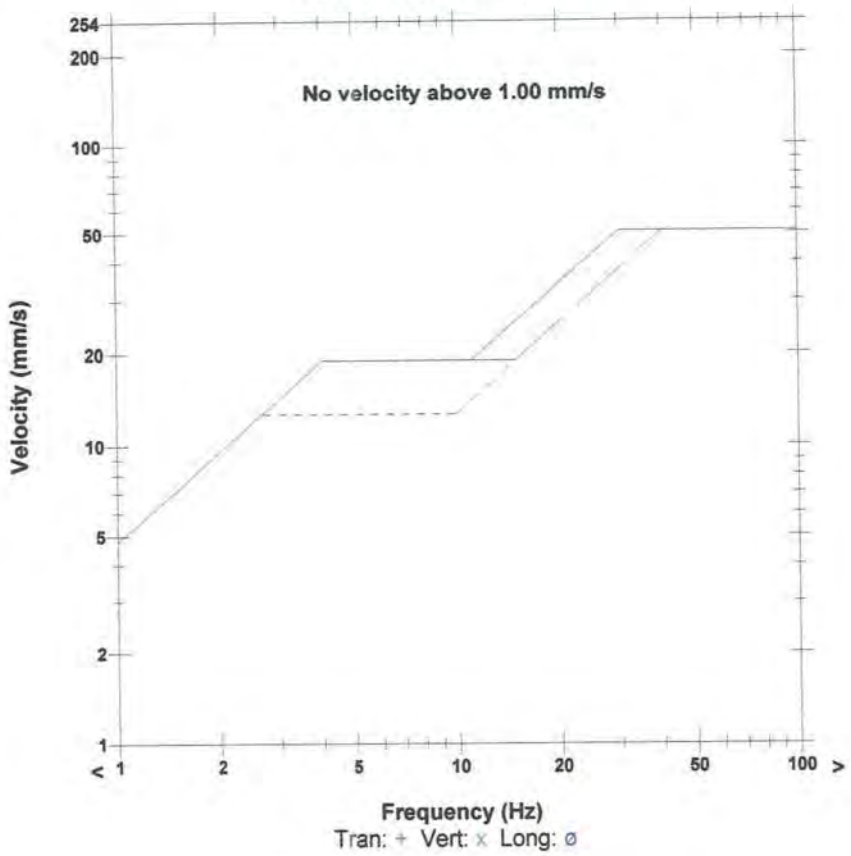
Extended Notes
N 43.31617
W 80.02664

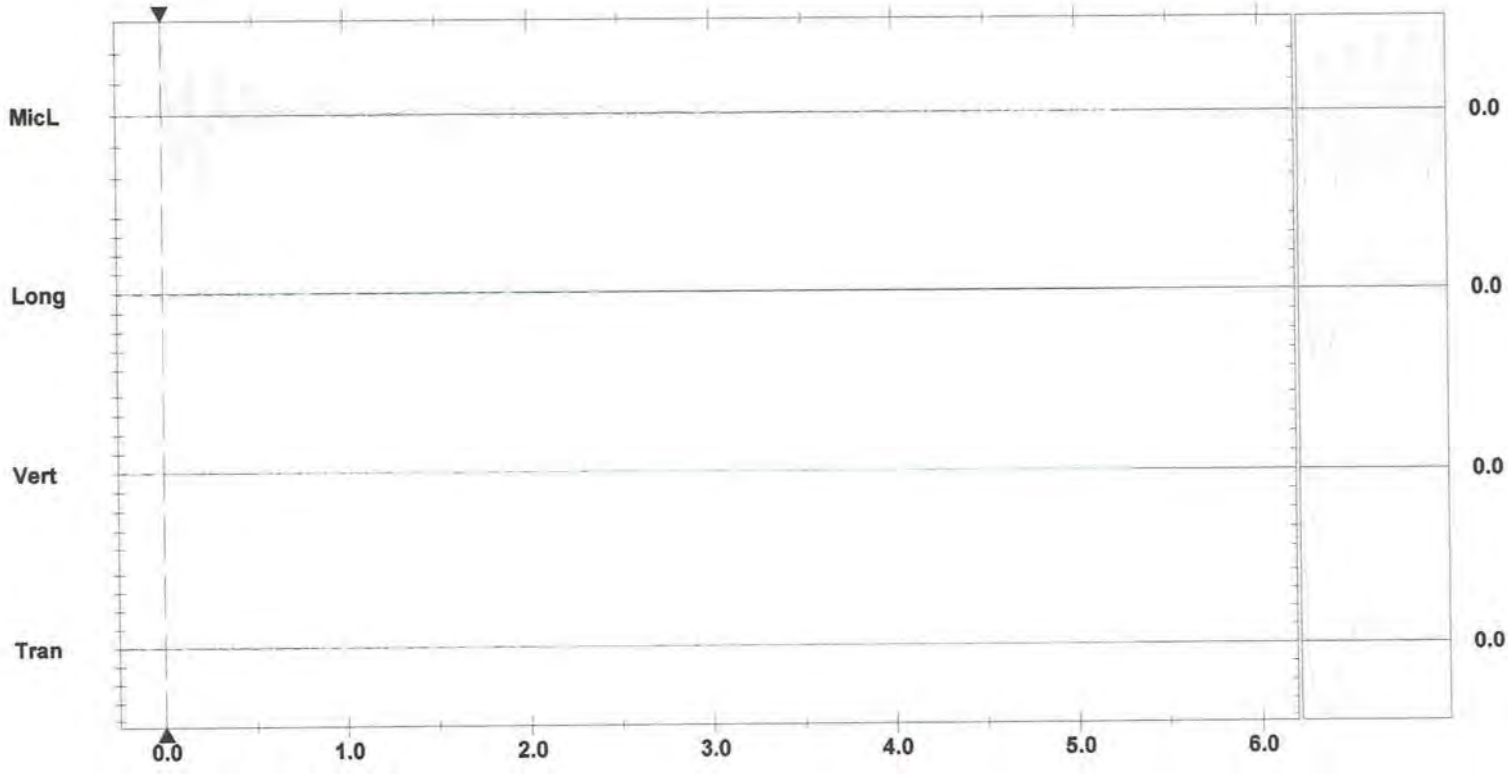
Microphone	Linear Weighting
PSPL	121.6 dB(L) at 0.202 sec
ZC Freq	4.3 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1470 mv)

	Tran	Vert	Long	
PPV	0.150	0.189	0.205	mm/s
ZC Freq	16.5	17.1	7.9	Hz
Time (Rel. to Trig)	0.407	0.215	0.388	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.002	0.002	0.013	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.3	3.4	3.6	

Peak Vector Sum 0.214 mm/s at 0.394 sec

USBM RI8507 And OSMRE





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div

Sensor Check

Trigger = ▶——◀

Event Report

Date/Time	Long at 12:02:24 October 2, 2018
Trigger Source	Geo: 2.000 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.3 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

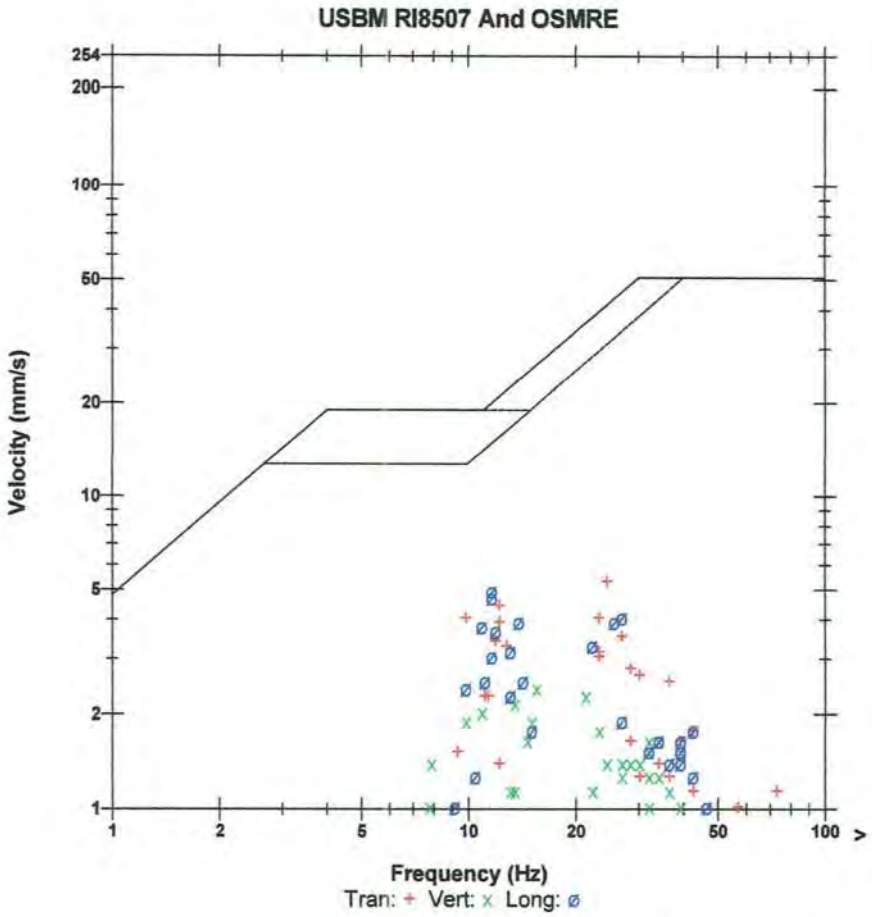
Notes
Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada
General: N.43.40245 W.79.87814

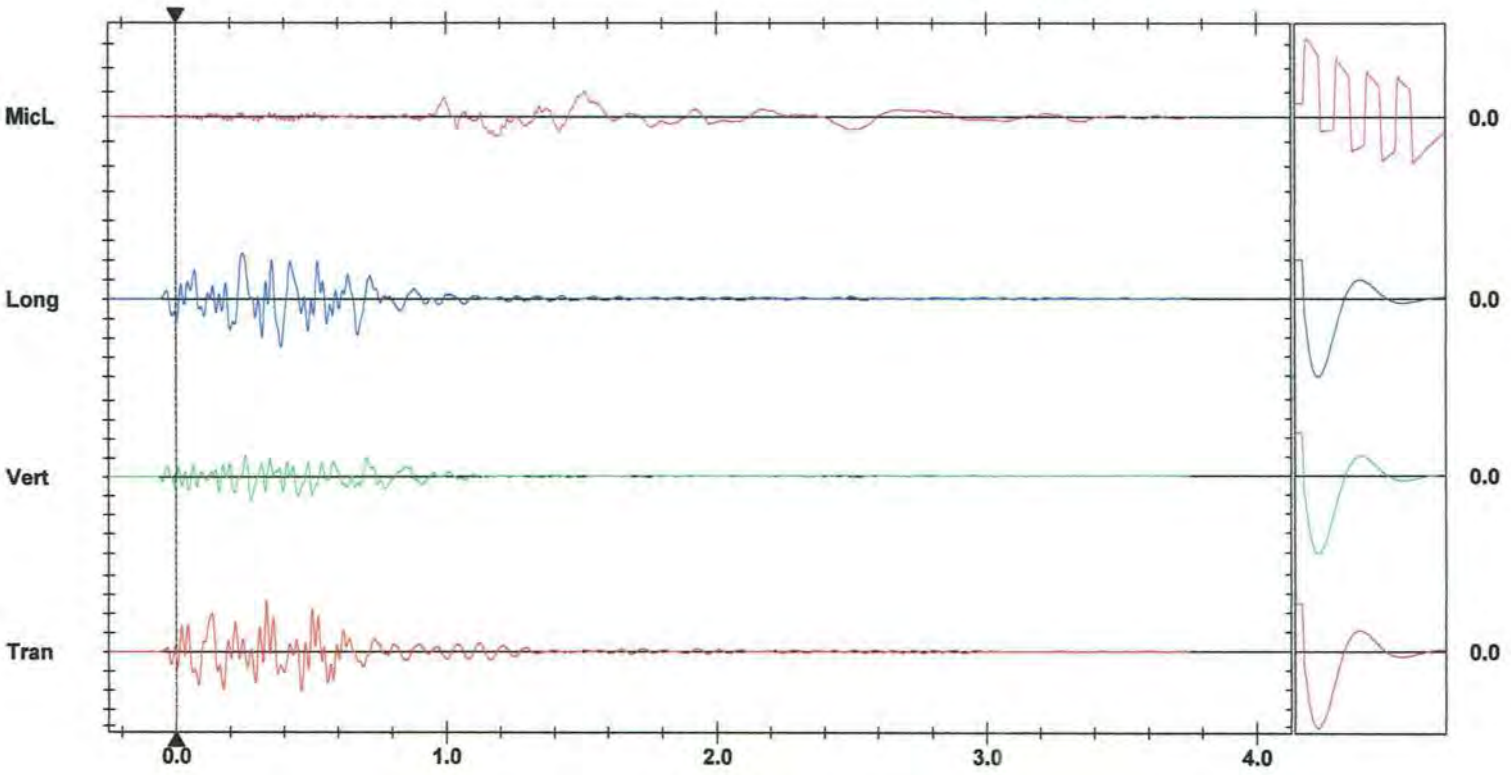
Extended Notes
Sand Bagged

Microphone	Linear Weighting
PSPL	114.2 dB(L) at 1.513 sec
ZC Freq	3.5 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 692 mv)

	Tran	Vert	Long	
PPV	5.334	2.413	4.953	mm/s
ZC Freq	24	16	12	Hz
Time (Rel. to Trig)	0.334	0.275	0.388	sec
Peak Acceleration	0.093	0.053	0.066	g
Peak Displacement	0.056	0.027	0.066	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.6	7.4	7.4	Hz
Overswing Ratio	3.7	3.9	4.2	

Peak Vector Sum 5.677 mm/s at 0.333 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Event Report

Date/Time	MicL at 12:02:29 October 2, 2018
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.25 sec (Auto=3Sec) at 1024 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.2 Volts
Unit Calibration	November 3, 2017 by Instantel
File Name	__TEMP.EVT
Scaled Distance	5850.2 (1850.0 m, 0.1 kg)

Notes

Location:	SouthWest Corner of property
Client:	Nelson Aggregates
User Name:	Orica Canada
General:	N. 44.39585; W-80.25085

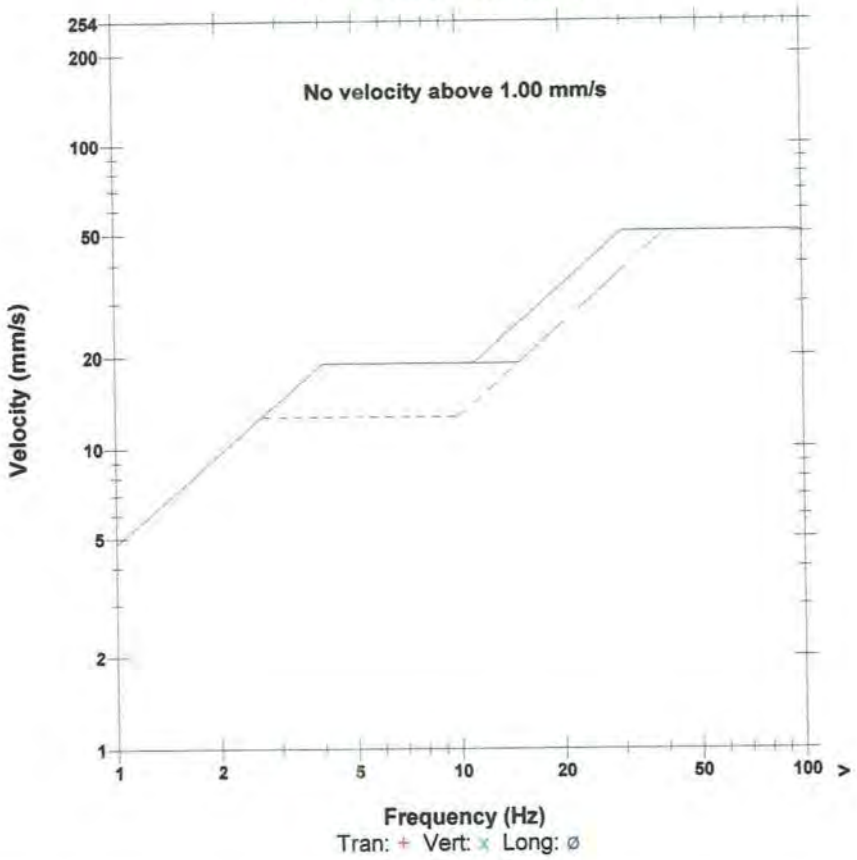
Extended Notes
Sand Bagged

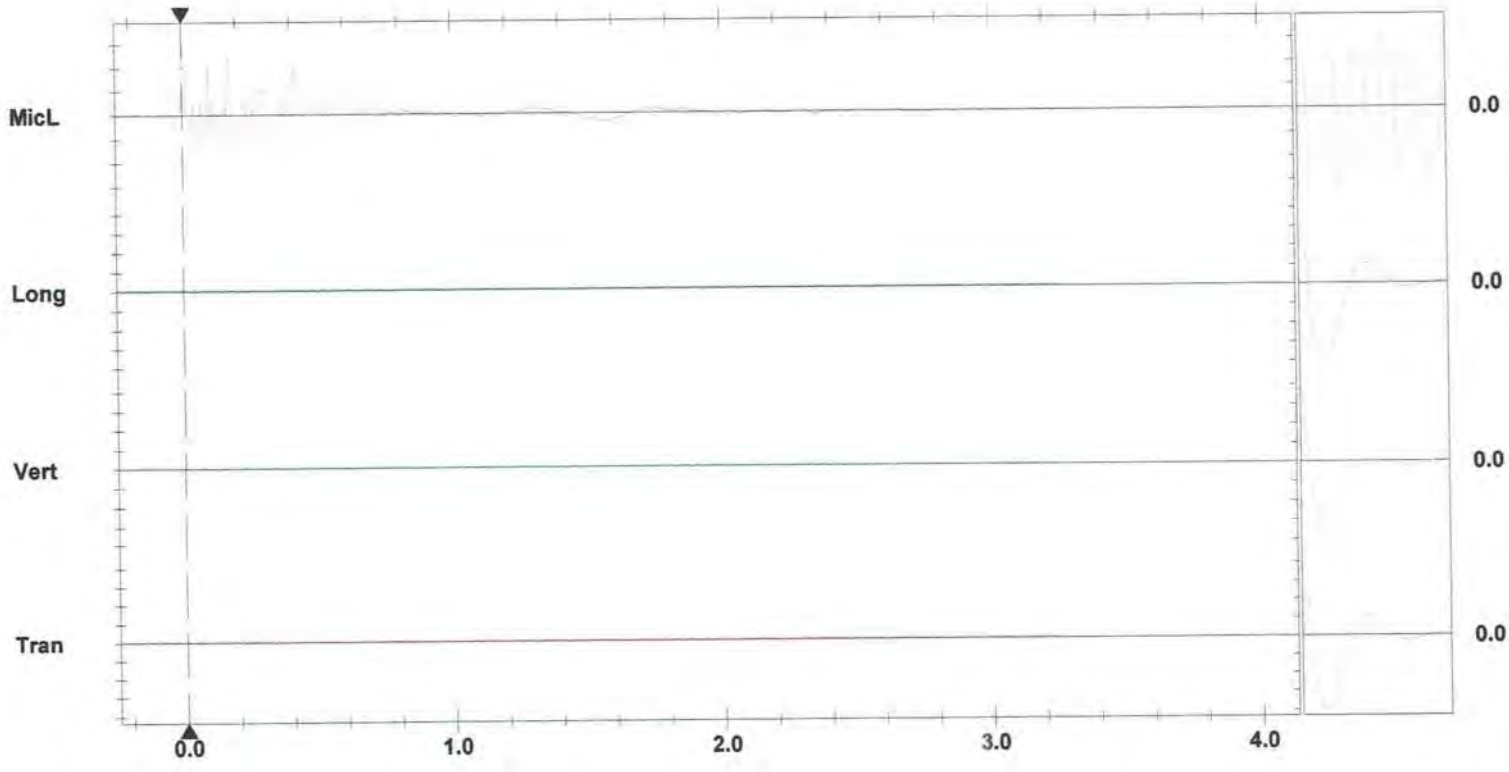
Microphone	Linear Weighting
PSPL	123.5 dB(L) at 0.004 sec
ZC Freq	20 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 584 mv)

	Tran	Vert	Long	
PPV	0.254	0.508	0.254	mm/s
ZC Freq	>100	47	73	Hz
Time (Rel. to Trig)	0.032	0.197	0.037	sec
Peak Acceleration	0.013	0.013	0.027	g
Peak Displacement	0.001	0.002	0.001	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.9	3.7	4.1	

Peak Vector Sum 0.568 mm/s at 0.197 sec

USBM RI8507 And OSMRE





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div

Trigger = ▶——◀

Sensor Check

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-10-02

Blast Number: 18-017
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)
GPS Coordinates: 43.40374 °N Latitude (Centre of Blast) 79.88268 °W Longitude (Centre of Blast)

Design te Blasted:	26,093 te
Total Holes Loaded:	48 holes
... including:	Dead Holes
... and:	2 Helper Holes
Helper Hole Collar:	60.0 ft avg
# Rows Blasted:	4 rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes: 48	=	3,657.6 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0°	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	12.0 ft avg
Spacing:	10.0 ft avg
# Holes:	19 front row

- Design Pattern (Main Body) -

Burden:	9.0 ft avg
Spacing:	10.0 ft avg
# Holes:	29 main body
Bench Height:	74.2 ft avg
Sub-drill:	2.0 ft avg
Hole Depth:	76.2 ft avg

- Design Stone Decking -

Front Row:	ft avg
Main Body:	ft avg

- Design Collar Stemming -

Front Row:	7.0 ft avg
Main Body:	7.0 ft avg
Material used:	.75" Stone

Bulk Expl. Required:

	kg
CENTRA GOLD 70	12,500

Pkgd Expl. Required:

	kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	98	33.3

total explosives weight in Blast (kg):	12,533
Pkgd Prod (0 kg) % of Total kg:	0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		80
UNITRONIC 600 15M		66
UNITRONIC 600 25M		54
UNITRONIC 600 30M		36

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row:	69.2 ft avg
Main Body:	69.2 ft avg

- Design Charge Weight -

Front Row:	201.8 kg/hole
Main Body:	201.8 kg/hole
Max Chge Wt / delay:	250.0 kg/delay

Required kg Loaded:	12,533 kg
Rock Density:	2.65 g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.480 kg/te (actual)
1.349 lb/yd³	Front row:	0.302 kg/te (theoretical)
1.799 lb/yd³	Main Body:	0.403 kg/te (theoretical)
1.686 lb/yd³	"KPI" PF:	0.377 kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	
HELPER HOURS	Enter total Helper man-hours	
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

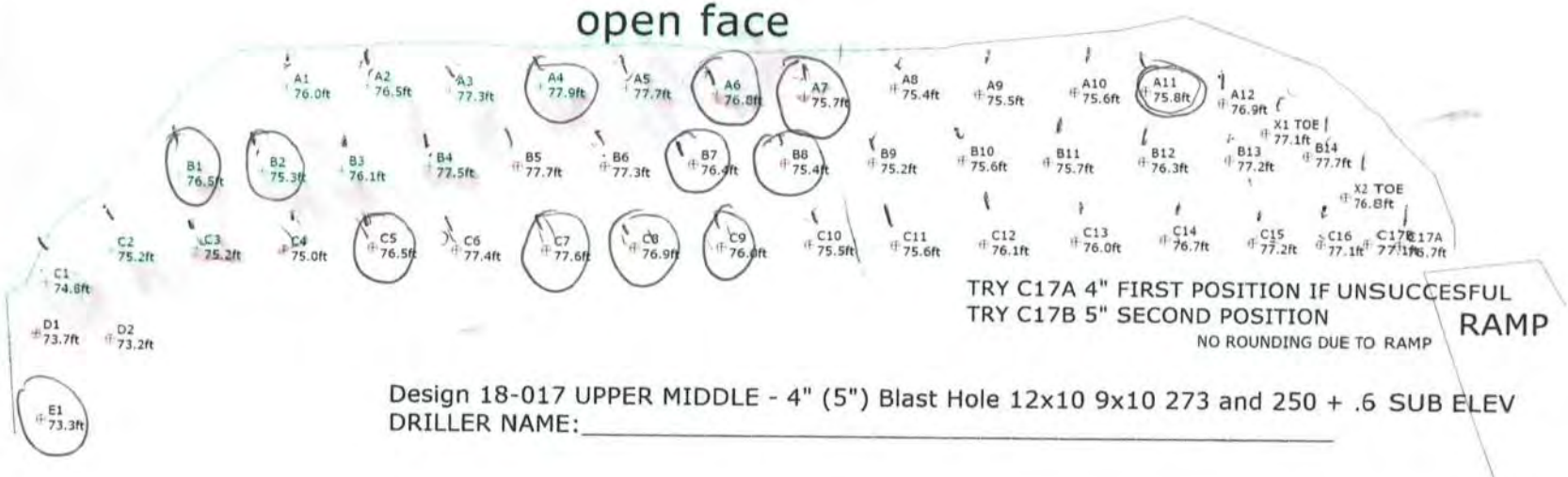
Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 49	Hole angle: 0.0°
Total drilled: 3733.8ft			

open face



Design 18-017 UPPER MIDDLE - 4" (5") Blast Hole 12x10 9x10 273 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

Scale 1:250

SHOTPlus 5.7.0.8	9/5/2018
Mine	Burlington
Location	UPPER MIDDLE NO ROUNDING ON NORTH
Title/author	Design 18-017 UPPER MIDDLE
Filename	

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-019
P.O. #:		Orica Order #:	2407202
Blast Date:	2018-11-01	Blast Time:	11:57 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40371 °N Latitude (Centre of Blast) 79.88251 °W Longitude (Centre of Blast)

Wind from the: at 0 kph Temperature: 6 to 10 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:		Snow:		Inversion:	

Ceiling 7,842 ft

Tonnes Blasted:	27,342 te	10,516 m3
Total tonnes per day:	27,342 te	NB80-01 Rate Code
Total Holes Loaded:	50 holes	
… including:		Dead Holes
… and:	1	Helper Holes
Helper Hole Collar:	60.0 ft avg	
# Rows Blasted:	5 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	44	=	3,319.4 ft (4 " diam)
Secondary Bit diam:	114.3	mm	0 °	# Holes:	6	=	452.6 ft (4 1/2 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	22	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	28	main body
Bench Height:	73.4	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	75.4	ft avg

- Stone Decking -

Front Row:	8.0	ft avg
Main Body:	8.0	ft avg
# Decks:	16	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75' Stone	

- Charge Length -

Front Row:	60.4	ft avg
Main Body:	60.4	ft avg

- Charge Weight -

Front Row:	176.2	kg/hole
Main Body:	176.2	kg/hole
Max. per delay:	288.0	kg/delay
SD () Equation:	160.6	kg/delay
Total kg Loaded:	11,295	kg
Rock Density:	2.60	g/cc = te/m^3

Theoretical PF (Based on a single hole)

- Powder Factor -

1.810 lb/yd^3	Yield PF:	0.413	kg/te (actual)
1.190 lb/yd^3	Front row:	0.272	kg/te (theoretical)
1.587 lb/yd^3	Main Body:	0.362	kg/te (theoretical)
1.508 lb/yd^3	"KPI" PF:	0.344	kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blasted)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,970	22,720	11,250

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	132	44.9

total explosives weight in Blast (kg): 11,295

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			49
UNITRONIC 600 15M			10
UNITRONIC 600 20M			7
UNITRONIC 600 25M			66

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		1.0
BULK TRUCK CHARGE		>/=10,000 kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		15.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		1.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

3 Helper due to the amount of voids found on the drill log.

16 Stone decks in total

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-019
P.O. #:		Orica Order #:	2407202
Blast Date:	2018-11-01	Blast Time:	11:57 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40371**	**79.88251**	0.757538	1.394213
Front Row Corner	43.40391	79.88264	0.757541	1.394215
Back Row Corner	43.40352	79.88237	0.757534	1.394210
Average (Centre of Blast)	43.40371	79.88251	0.757538	1.394213

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**380.2**	m				
Post Blast Data: ppV:	**5.7**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**11.3**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**116.3**	dB	Trigger set at:	**124**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**965.3**	m				
Post Blast Data: ppV:	**0.3**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**12.2**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**118.8**	dB	Trigger set at:	**120**	dB	

Coling rd & Blind Line (Bruce Trail)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1257.1**	m				
Post Blast Data: ppV:	**1.8**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**41.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**114.2**	dB	Trigger set at:	**120**	dB	

South West Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(380.2)^2}{30^2} \text{ kg}$$

$$= \frac{144{,}552}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 161 kg

jim bray

Orica
Blaster-in-charge: Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

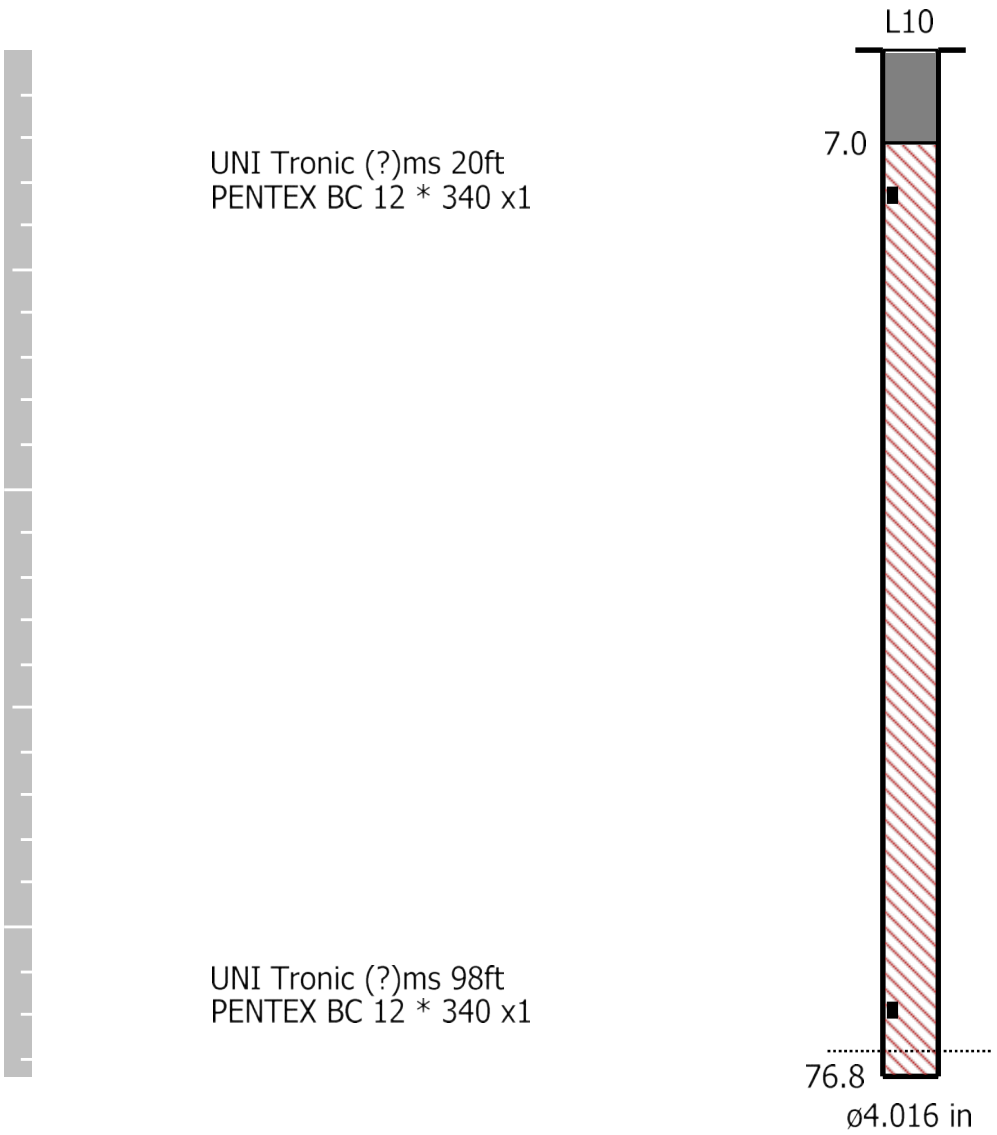
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-019
P.O. #:		Orica Order #:	2407202
Blast Date:	10/23/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Bill White

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	MicL at 11:57:30 November 1, 2018	**Serial Number**	UM6857 V 10-89 Micromate ISEE
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)	**Battery Level**	3.6 Volts
Range	Geo: 254.0 mm/s	**Unit Calibration**	February 14, 2018 by Instantel
Record Time	5.357 sec (Auto=5Sec) at 2048 sps	**File Name**	UM6857_20181101115730.IDFW
Operator/Setup:	MIKE DERKNDEREN/COLLING RD_BURLINGTO.MMB		

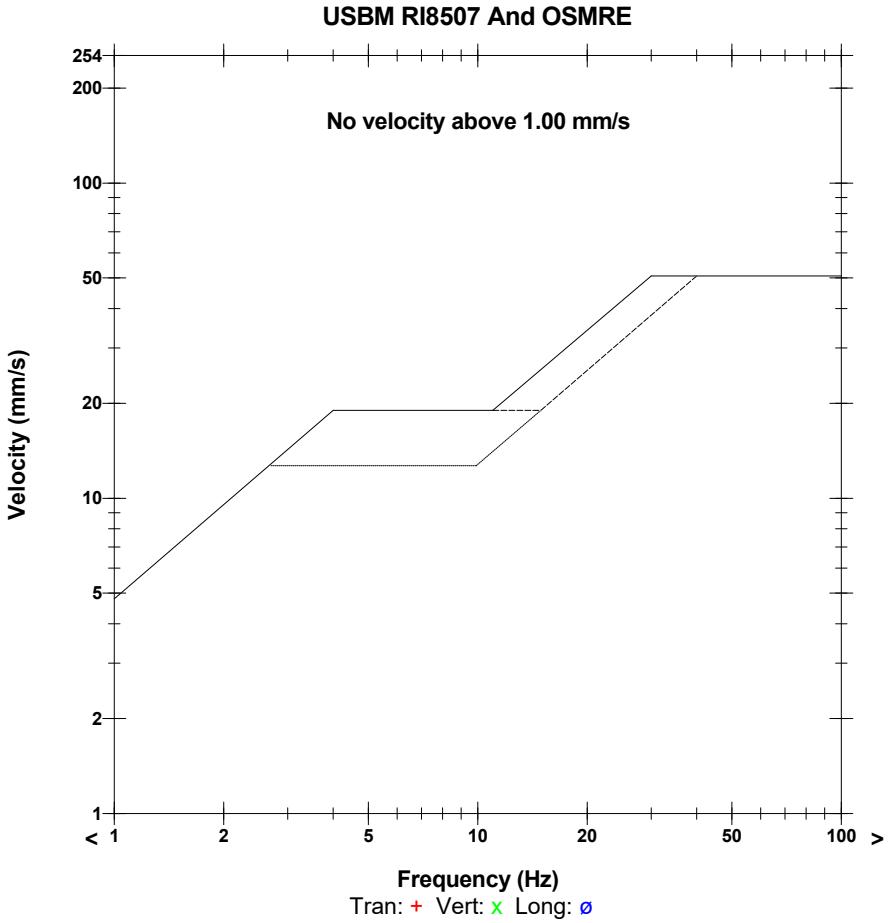
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

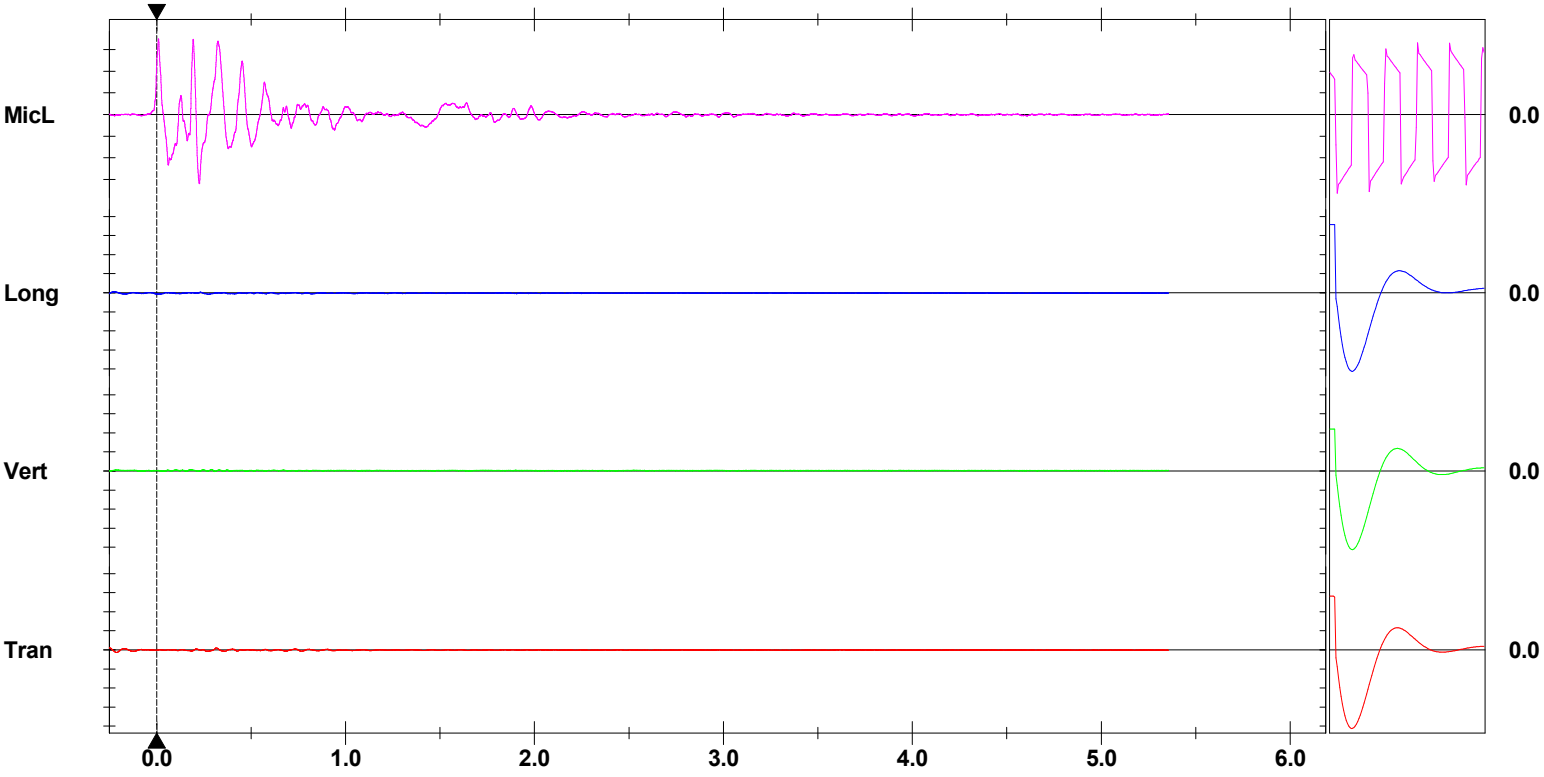
Extended Notes
N 43.31617
W 80.02664

Microphone	Linear Weighting
PSPL	118.8 dB(L) at 0.010 sec
ZC Freq	5.7 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1551 mv)

	Tran	Vert	Long	
PPV	0.284	0.166	0.181	mm/s
ZC Freq	12.2	17.7	7.5	Hz
Time (Rel. to Trig)	-0.209	0.292	0.275	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.004	0.023	0.018	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.5	3.5	3.5	

Peak Vector Sum 0.299 mm/s at -0.209 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time Long at 11:57:29 November 1, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 2048 sps
Operator/Setup: ORICA CANADA/Nelson 2450 2nd.MMB

Serial Number UM9119 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration December 7, 2017 by Instantel
File Name UM9119_20181101115729.IDFW

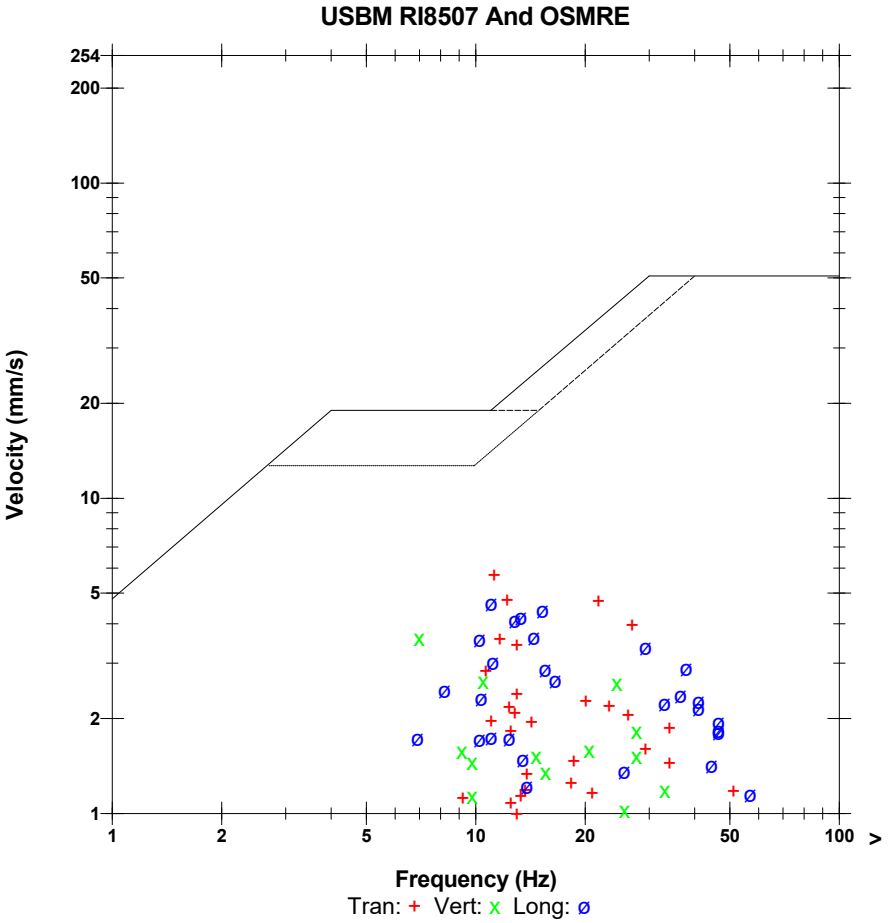
Notes
Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada Inc.
General: Burlington

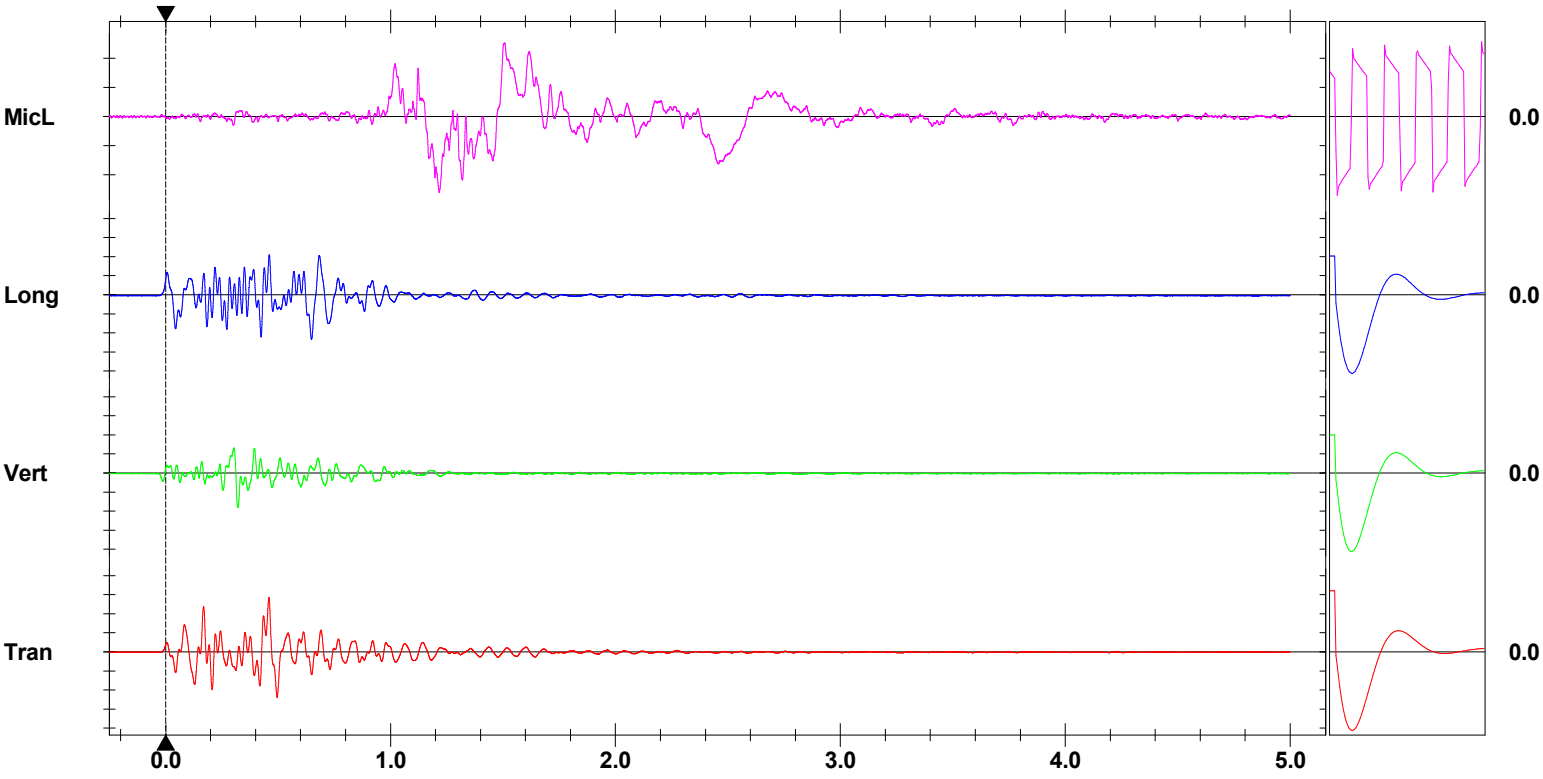
Extended Notes
43.40245,-79.87814
Sand Bagged

Microphone Linear Weighting
PSPL 116.3 dB(L) at 1.216 sec
ZC Freq 4.1 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 1547 mv)

	Tran	Vert	Long	
PPV	5.714	3.618	4.658	mm/s
ZC Freq	11.3	7.0	11.0	Hz
Time (Rel. to Trig)	0.459	0.321	0.648	sec
Peak Acceleration	0.092	0.066	0.123	g
Peak Displacement	0.068	0.049	0.055	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.5	7.3	Hz
Overswing Ratio	3.7	3.8	3.8	

Peak Vector Sum 7.029 mm/s at 0.460 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Event Report

Date/Time	Long at 11:57:29 November 1, 2018
Trigger Source	Geo: 1.500 mm/s, Mic: 121.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.024 sec (Auto=4Sec) at 2048 sps
Operator/Setup:	Operator/Nelsons SW.mmb

Serial Number	UM6859 V 10-89 Micromate ISEE
Battery Level	3.7 Volts
Unit Calibration	December 22, 2017 by Instantel
File Name	UM6859_20181101115729.IDFW

Notes

Location:	SouthWest Corner of Quarry
Client:	Nelsons Burlington
User Name:	Orica Canada Inc.
General:	Monitoring Vibration and Airblast

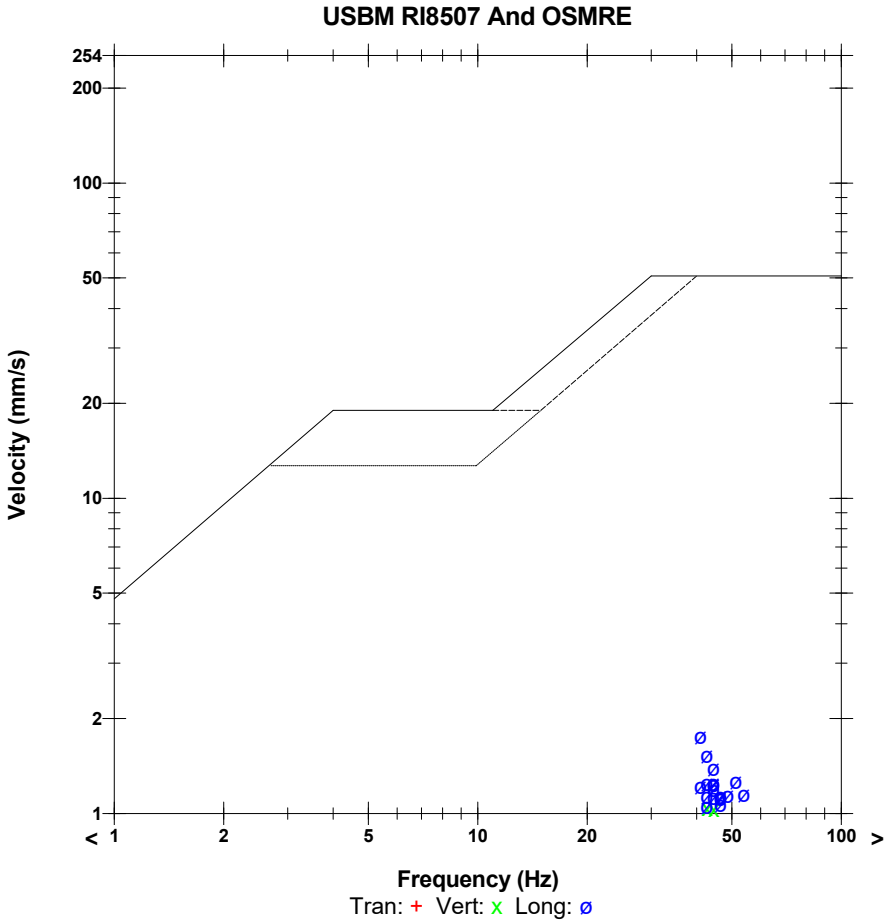
Extended Notes

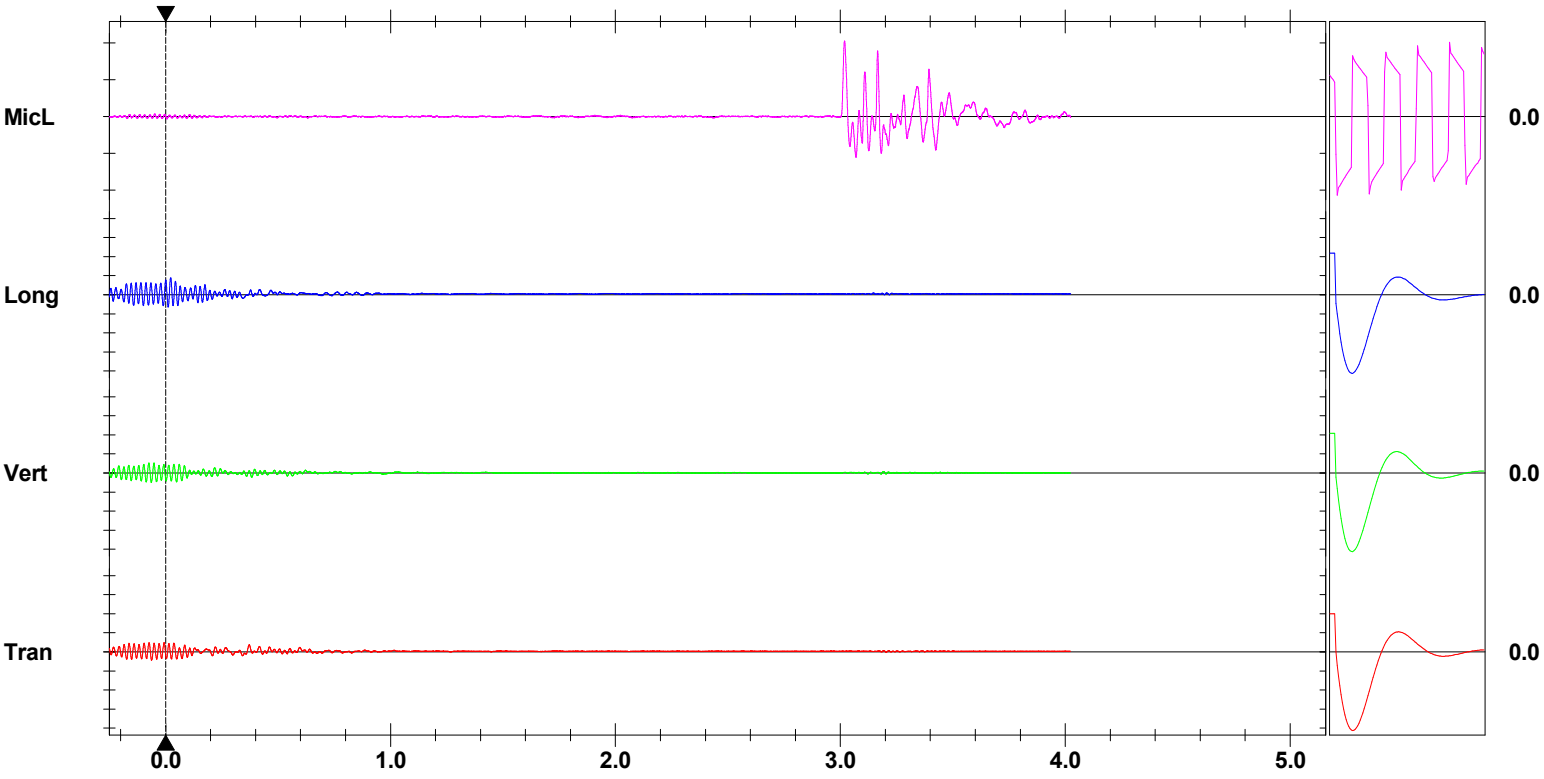
N 43.39339
W 79.88880

Microphone	Linear Weighting
PSPL	114.2 dB(L) at 3.019 sec
ZC Freq	17.1 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1525 mv)

	Tran	Vert	Long	
PPV	0.977	1.040	1.766	mm/s
ZC Freq	43	43	41	Hz
Time (Rel. to Trig)	-0.007	-0.052	0.022	sec
Peak Acceleration	0.031	0.038	0.048	g
Peak Displacement	0.060	0.004	0.105	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.1	Hz
Overswing Ratio	3.9	3.6	4.4	

Peak Vector Sum 1.938 mm/s at 0.023 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div Sensor Check

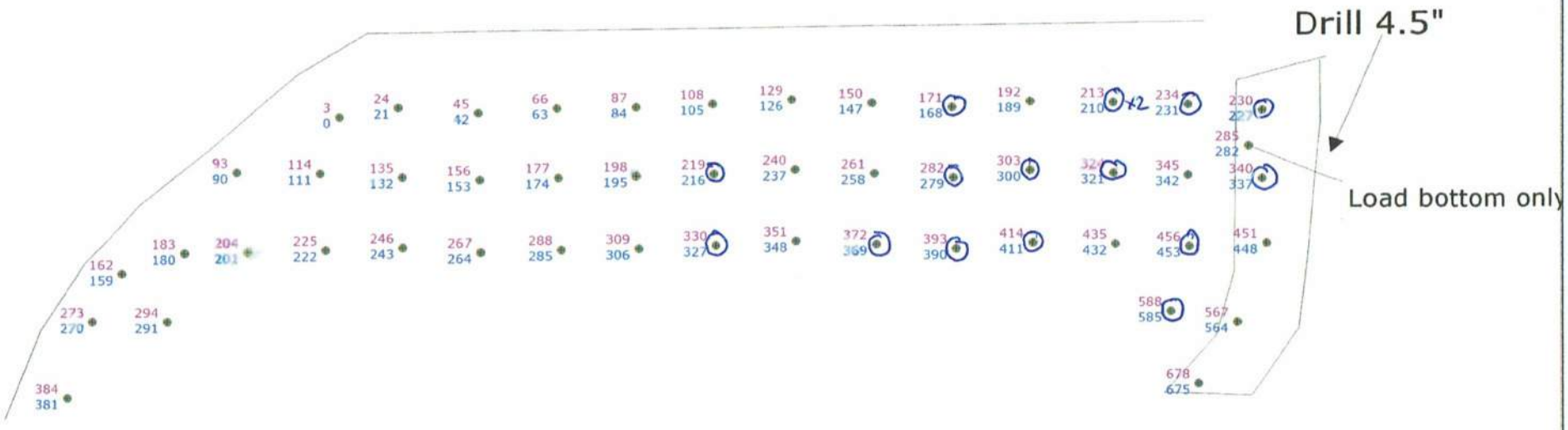
Trigger = ▶----------◀

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.3ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 50	Hole angle: 0.0°
Total drilled: 3772.9ft			

O = DECK



Not to scale

SHOTPlus™ Professional 5.7.3.0		10/31/2018
Mine	Burlington	
Location	UPPER MIDDLE SOUTH FACE SCAN Design	
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl	
Filename	2018-11-02 18-019 Revised Timing Upper Mid	

Load Sheet
250 Kg
4" Hole

320 Kg
4.5" Hole

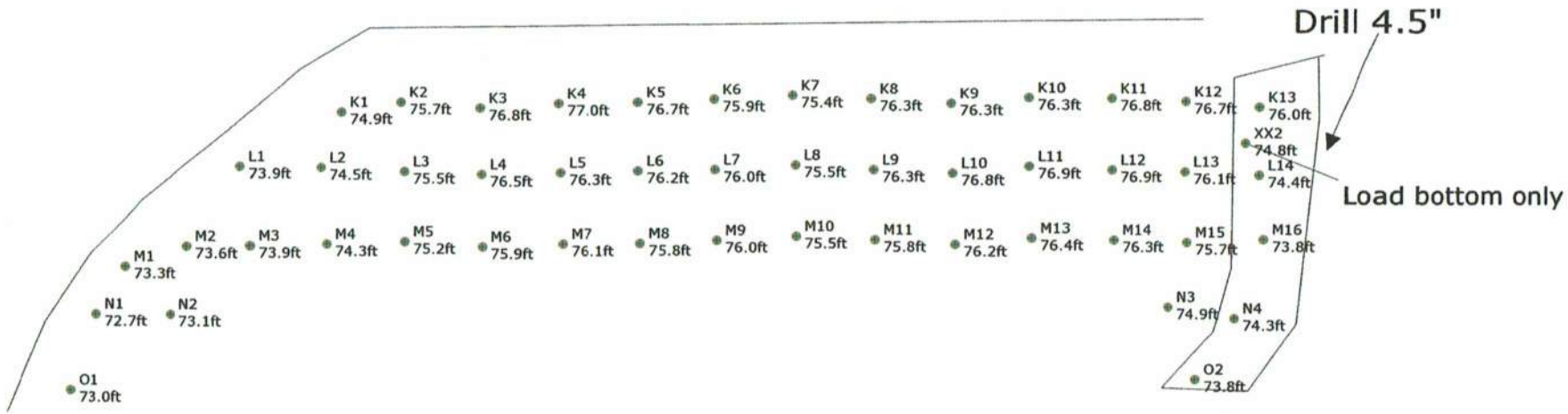
Not to scale

SHOTPlus™ Professional 5.7.3.0		10/29/2018
Mine	Burlington	
Location	UPPER MIDDLE SOUTH FACE SCAN Design	
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl	
Filename	Dessign_18-019_Upper_Middle_Partial_Fnl tim	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.3ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 50	Hole angle: 0.0°
Total drilled: 3772.9ft			



Not to scale

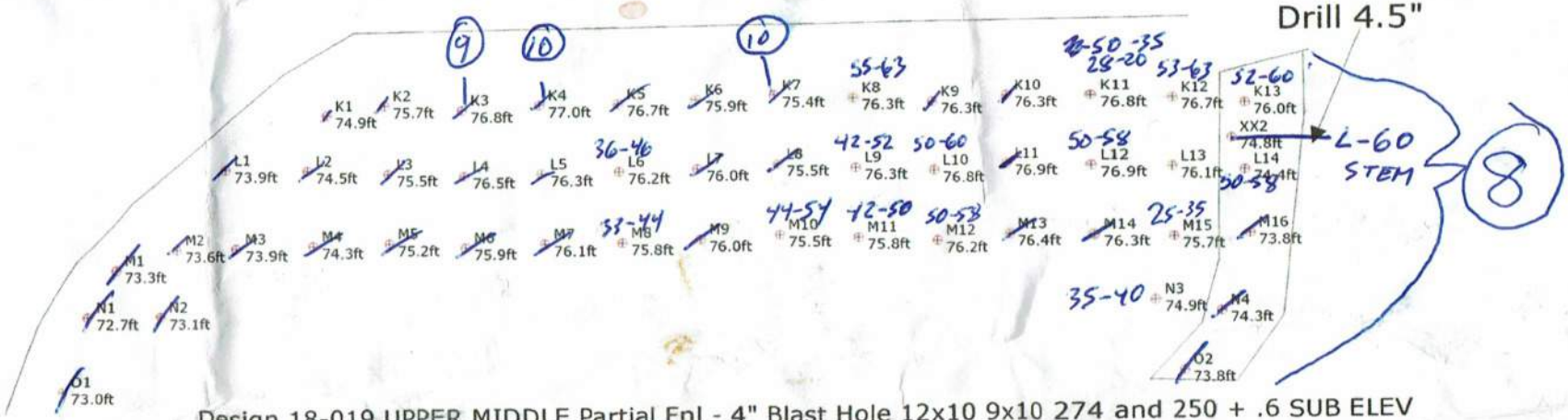
SHOTPlus™ Professional 5.7.3.0		11/1/2018
Mine	Burlington	
Location	UPPER MIDDLE SOUTH FACE SCAN Design	
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl	
Filename	2018-11-02 18-019 Revised Timing Upper Mid	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.3ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 50	Hole angle: 0.0°
Total drilled: 3772.9ft			

16 DECKS



Design 18-019 UPPER MIDDLE Partial Fnl - 4" Blast Hole 12x10 9x10 274 and 250 + .6 SUB ELEV

DRILLER NAME:_____

Not to scale

SHOTPlus™ Professional 5.7.3.0	10/23/2018
Mine	Burlington
Location	UPPER MIDDLE SOUTH FACE SCAN Design
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl
Filename	Dessign_18-019_Upper_Middle_Partial_Fnl.spf

1091137

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissement

Orica Canada Inc.

GROSS / BRUT	
TARE	
NET	
TIME IN / HEURE D'ENTRÉE	6:45am
TIME OUT / HEURE SORTIE	
ORDER NUMBER / N° DE COMMANDE	2407202
B/L NUMBER / N° DE CONNAISSEMENT	86185300

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

REPRINT

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
01 Nov 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
01 Nov 2018	FOB Dest'n, Own Truck	F-73289	PT 15013

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG / MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
245	PC	X	113	132	PENTEX BC 340 (49/CS)	5	89.425
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
160 ~~180~~	PC	X	111	49	*uni tronic 600-06.0M CU/ZC(20')80PC	2	[redacted] 11.680
132	PC	X	122	10	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
108	PC	X	~~98~~ 42	66	*uni tronic 600-25M CU/ZC SPL(80')54P	2	26.352
100	PC		95	5	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
66	PC	X	59	7	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
					TOTAL GROSS WEIGHT		[redacted] KG 170,033
					**** TOTAL PACKAGES ****	13	

GHS/WHMIS SDS documents available
Website: www.oricaminingservices.com
Email: sds.na@orica.com
Phone: 1-855-26-ORICA (1-855-266-7422)

24 HOUR NUMBER 1-613-996-6666

PALETS USED / PALETTES UTILISÉES | PALETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT (YES / OUI ✓ — NO / NON)	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636		Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE: $

NETTE No. CONV / PRESSAGE / WT AGREEMENT NO.:

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: Ryan Bentham	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: Ryan Bentham	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	SIGNATURE	SIGNATURE
DATE: 01 11 18 (D/J M/M Y/A)	DATE: 01 11 18 (D/J M/M Y/A)	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-10-23

Blast Number: 18-019
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40371 °N Latitude (Centre of Blast) 79.88251 °W Longitude (Centre of Blast)

Design te Blasted:	27,342	te
Total Holes Loaded:	50	holes
... including:		Dead Holes
... and:	1	Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	5	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes: 44	=	3,319.4 ft (4 " diam)
Secondary Bit diam:	114.3	mm	0°	# Holes: 6	=	452.6 ft (4 1/2 " diam)
Tertiary Bit diam:		mm	0°	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	22	front row

- Design Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	28	main body
Bench Height:	73.4	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	75.4	ft avg

- Design Stone Decking -

Front Row:		ft avg
Main Body:		ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Material	

Bulk Expl. Required:

		kg
		12,200

Pkgd Expl. Required:

		kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	100	34.0

total explosives weight in Blast (kg): 12,234

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		60
UNITRONIC 600 15M		66
UNITRONIC 600 25M		54

Cord & Access. Req'd:

	U of M	# req'd
	units	
	units	
	units	

- Design Charge Length -

Front Row:	68.4	ft avg
Main Body:	68.4	ft avg

- Design Charge Weight -

Front Row:	199.6	kg/hole
Main Body:	199.6	kg/hole
Max Chge Wt / delay:	220.0	kg/delay

Required kg Loaded:	12,234	kg
Rock Density:	2.60	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.447	kg/te (actual)
1.348 lb/yd³	Front row:	0.308	kg/te (theoretical)
1.797 lb/yd³	Main Body:	0.410	kg/te (theoretical)
1.707 lb/yd³	"KPI" PF:	0.390	kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

SHOTPlus 5 Plan (0)

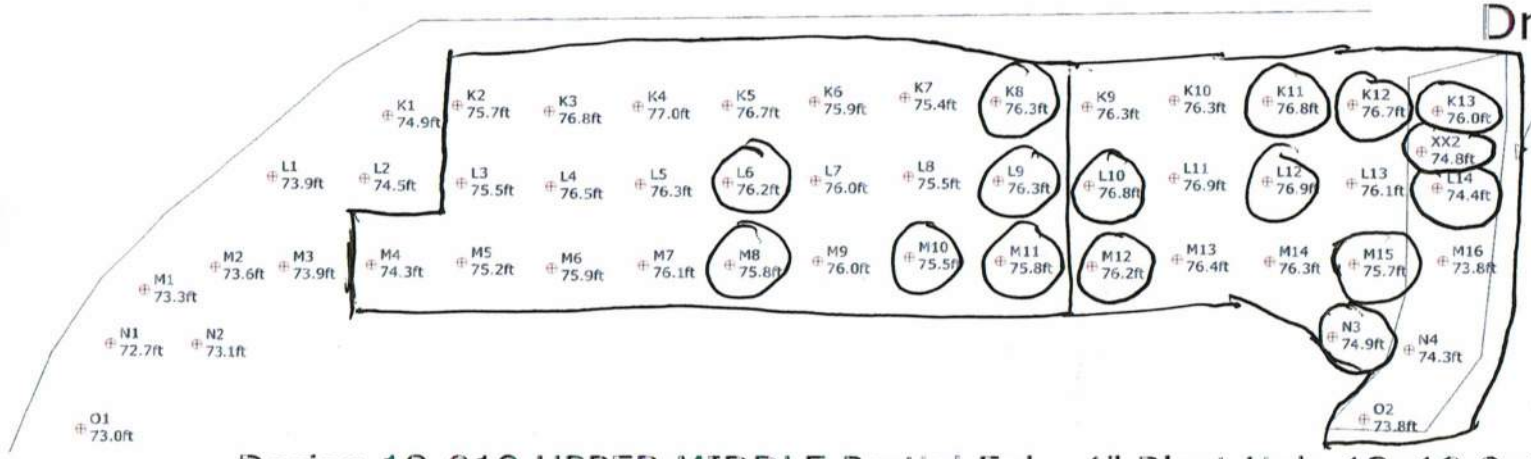
Blast Summary Data

Burden: 9.3ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 50	Hole angle: 0.0°
Total drilled: 3772.9ft			

4" dia = 3326'

4½" dia = 447.1'

Drill 4.5"



Design 18-019 UPPER MIDDLE Partial Fnl - 4" Blast Hole 12x10 9x10 274 and 250 +

DRILLER NAME: _____

ORICA

Not to scale

SHOTPlus™ Professional 5.7.4.19	11/10/2018
Mine	Burlington
Location	UPPER MIDDLE SOUTH FACE SCAN D
Title/author	Design 18-019 UPPER MIDDLE Partia
Filename	Dessign_18-019_Upper_Middle_Parti

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-020
P.O. #:		Orica Order #:	2410149
Blast Date:	2018-11-08	Blast Time:	11:57 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40437 °N Latitude (Centre of Blast) 79.88535 °W Longitude (Centre of Blast)

Wind from the: W at 5 kph Temperature: 1 to 5 °C

Clear:		Rain:		Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 3,758 ft

Tonnes Blasted:	24,552 te	9,443 m3
Total tonnes per day:	24,552 te	NF-14 Rate Code
Total Holes Loaded:	251 holes	
… including:		Dead Holes
… and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	12 rows	

- Drilling Information -

				Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	# Holes:	251	=	2,756.0 ft	(4 " diam)
Secondary Bit diam:		mm	# Holes:		=	0.0 ft	(" diam)
Tertiary Bit diam:		mm	# Holes:		=	0.0 ft	(" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	25,140	22,650	2,490

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	251	85.3

total explosives weight in Blast (kg): 2,575

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
EXEL HANDIDET 9m		25/500	251
CONNECTADET 9M		25 ms	18
CONNECTADET 9M		42 ms	23
UNITRONIC 600 6M			2

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	0
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours		2.5
BULK TRUCK CHARGE	>/=2,000kg	<5,000kg	1
BLASTER HOURS	Enter Blaster hours		7.0
HELPER HOURS	Enter total Helper man-hours		18.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs		0
3D LASER PROFILE	Enter hours		0.0
BORETRACK	Enter hours		0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days		0.0

Theoretical PF (Based on a single hole)

- Pattern (Front Row)-		
Burden:	11.0	ft avg
Spacing:	11.0	ft avg
# Holes:	21	front row
- Pattern (Main Body) -		
Burden:	11.0	ft avg
Spacing:	11.0	ft avg
# Holes:	230	main body
Bench Height:	11.0	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	11.0	ft avg
- Stone Decking -		
Front Row:		ft avg
Main Body:		ft avg
# Decks:		per blast
- Collar Stemming -		
Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	
- Charge Length -		
Front Row:	4.0	ft avg
Main Body:	4.0	ft avg
- Charge Weight -		
Front Row:	11.6	kg/hole
Main Body:	11.6	kg/hole
Max. per delay:	21.0	kg/delay
SD () Equation:	429.0	kg/delay
Total kg Loaded:	2,575	kg
Rock Density:	2.60	g/cc = te/m^3

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

0.460 lb/yd^3	Yield PF:	0.105	kg/te (actual)
0.520 lb/yd^3	Front row:	0.119	kg/te (theoretical)
0.520 lb/yd^3	Main Body:	0.119	kg/te (theoretical)
0.520 lb/yd^3	"KPI" PF:	0.119	kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

1 Extra helper due to the number of holes

1 Advanced Blast design

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-020
P.O. #:		Orica Order #:	2410149
Blast Date:	2018-11-08	Blast Time:	11:57 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40442**	**79.88533**	0.757550	1.394262
Front Row Corner	43.40454	79.88495	0.757552	1.394255
Back Row Corner	43.40417	79.88577	0.757546	1.394270
Average (Centre of Blast)	43.40437	79.88535	0.757549	1.394262

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**621.4**	m				
Post Blast Data: ppV:	**2.0**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**43.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**110.4**	dB	Trigger set at:	**115**	dB	

2450 2nd Line (Beside cut tree stump in front yard)

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	**1254.2**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

South West Corner of Property

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	**0.0**	m				
Post Blast Data: ppV:	**0.0**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**0.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**0.0**	dB	Trigger set at:	**115**	dB	

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(621.4)^2}{30^2} \text{ kg}$$

$$= \frac{386{,}138}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 429 kg

jim bray

Orica
Blaster-in-charge: *Mike derkinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

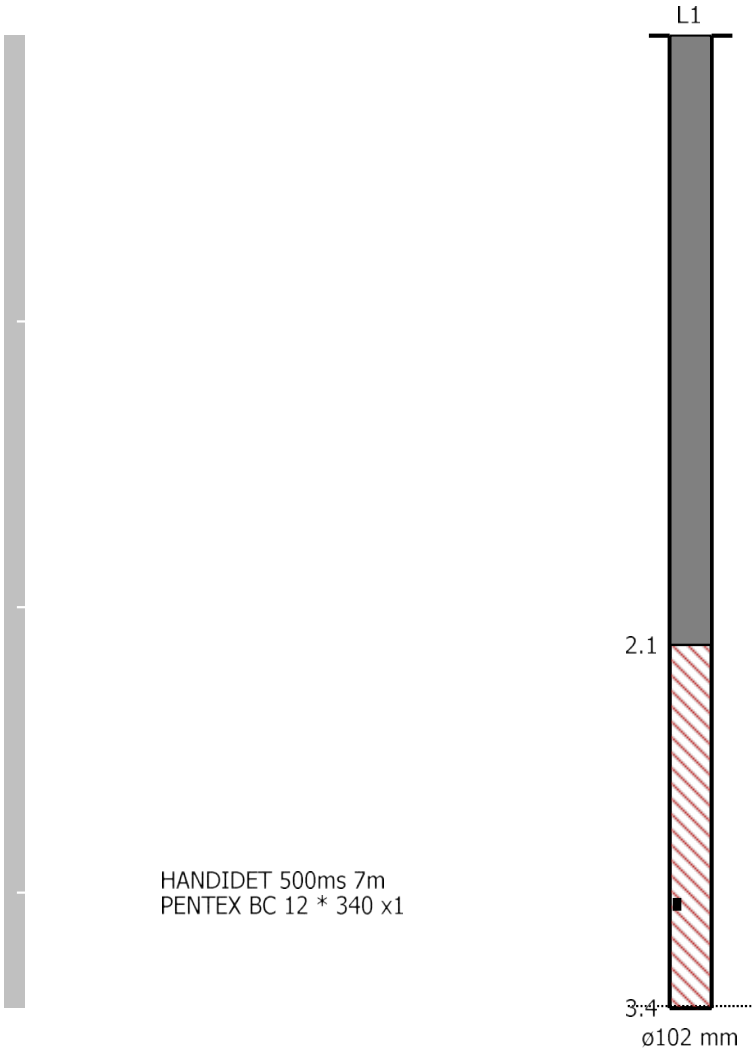
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	18-020
P.O. #:		Orica Order #:	2410149
Blast Date:	11/8/2018		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

Quarry Manager:

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Vert at 12:57:15 November 8, 2018
Trigger Source	Geo: 1.500 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.0 sec at 2048 sps
Operator/Setup:	ORICA CANADA/Nelson 2450 2nd.mmb

Serial Number	UM9119 V 10-89 Micromate ISEE
Battery Level	3.7 Volts
Unit Calibration	December 7, 2017 by Instantel
File Name	UM9119_20181108125715.IDFW

Notes
Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada Inc.
General: Burlington

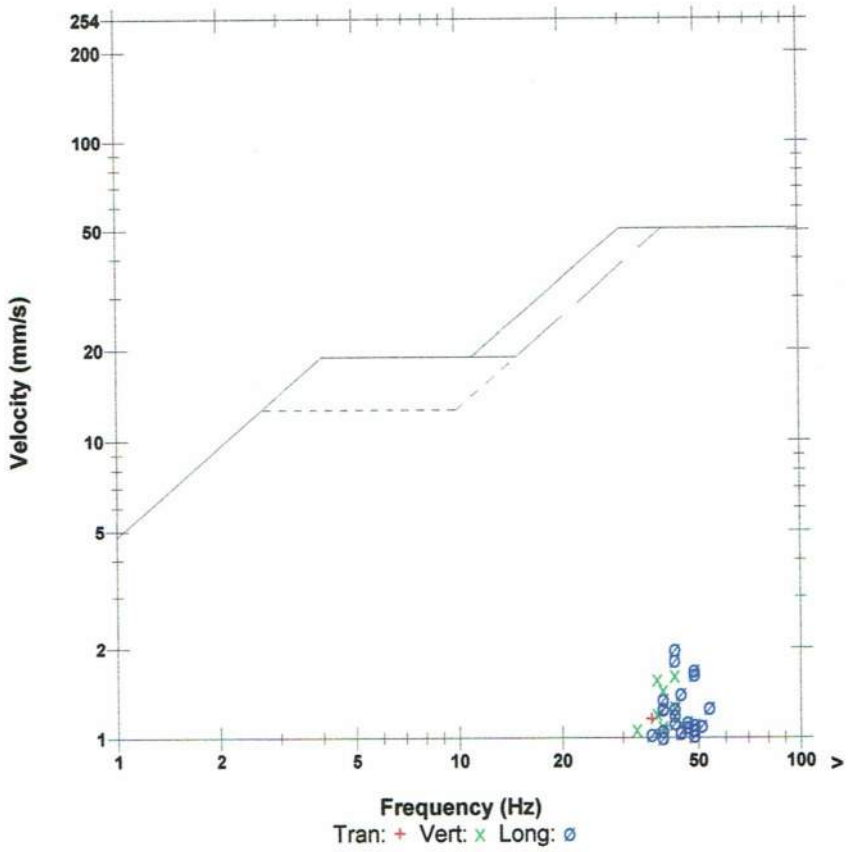
Extended Notes
43.40245,-79.87814
Sand Bagged

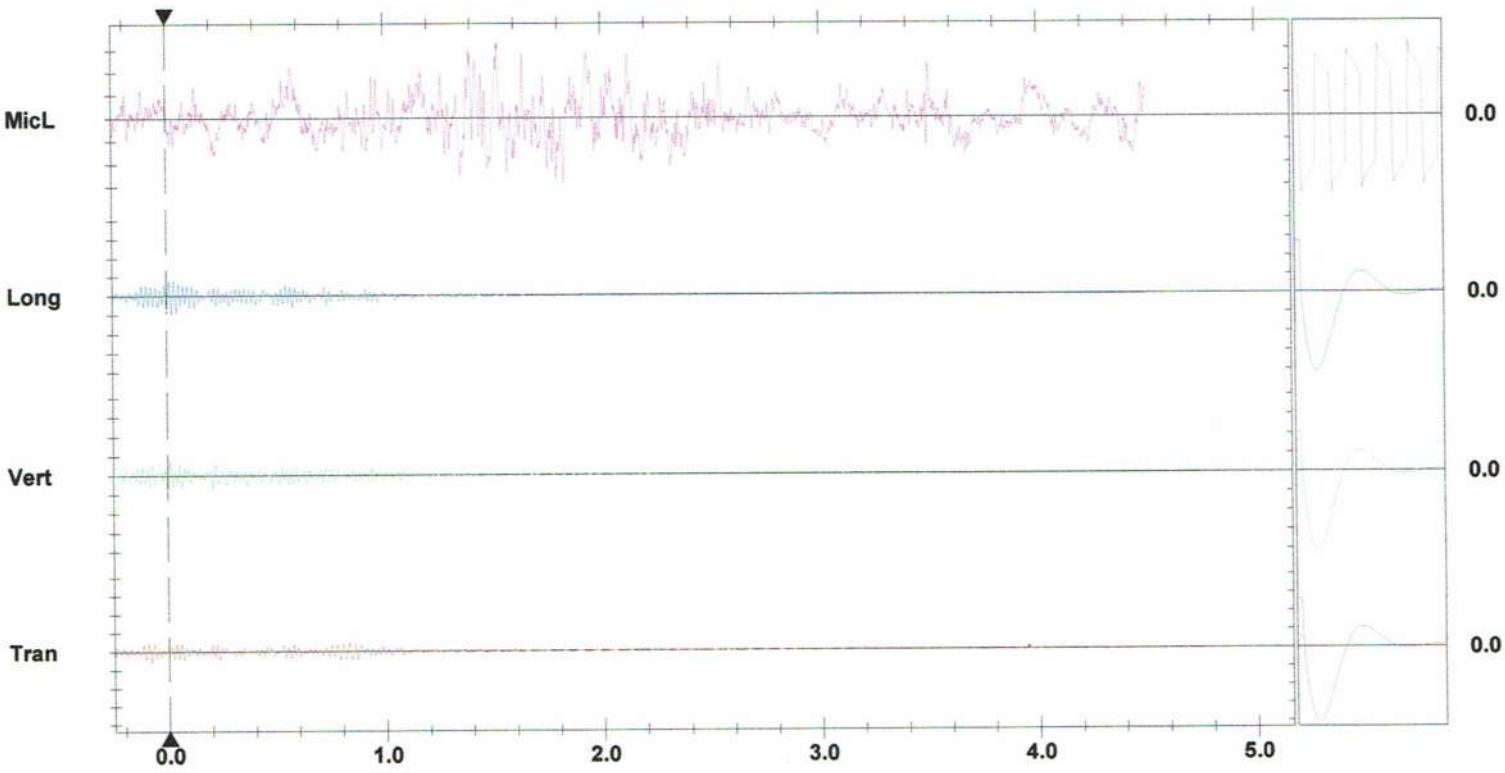
Microphone	Linear Weighting
PSPL	110.4 dB(L) at 1.525 sec
ZC Freq	14.2 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1585 mv)

	Tran	Vert	Long	
PPV	1.151	1.616	1.978	mm/s
ZC Freq	37	43	43	Hz
Time (Rel. to Trig)	-0.081	0.013	0.022	sec
Peak Acceleration	0.031	0.046	0.089	g
Peak Displacement	0.005	0.008	0.018	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.3	Hz
Overswing Ratio	3.9	3.9	3.9	

Peak Vector Sum 2.305 mm/s at 0.023 sec

USBM RI8507 And OSMRE

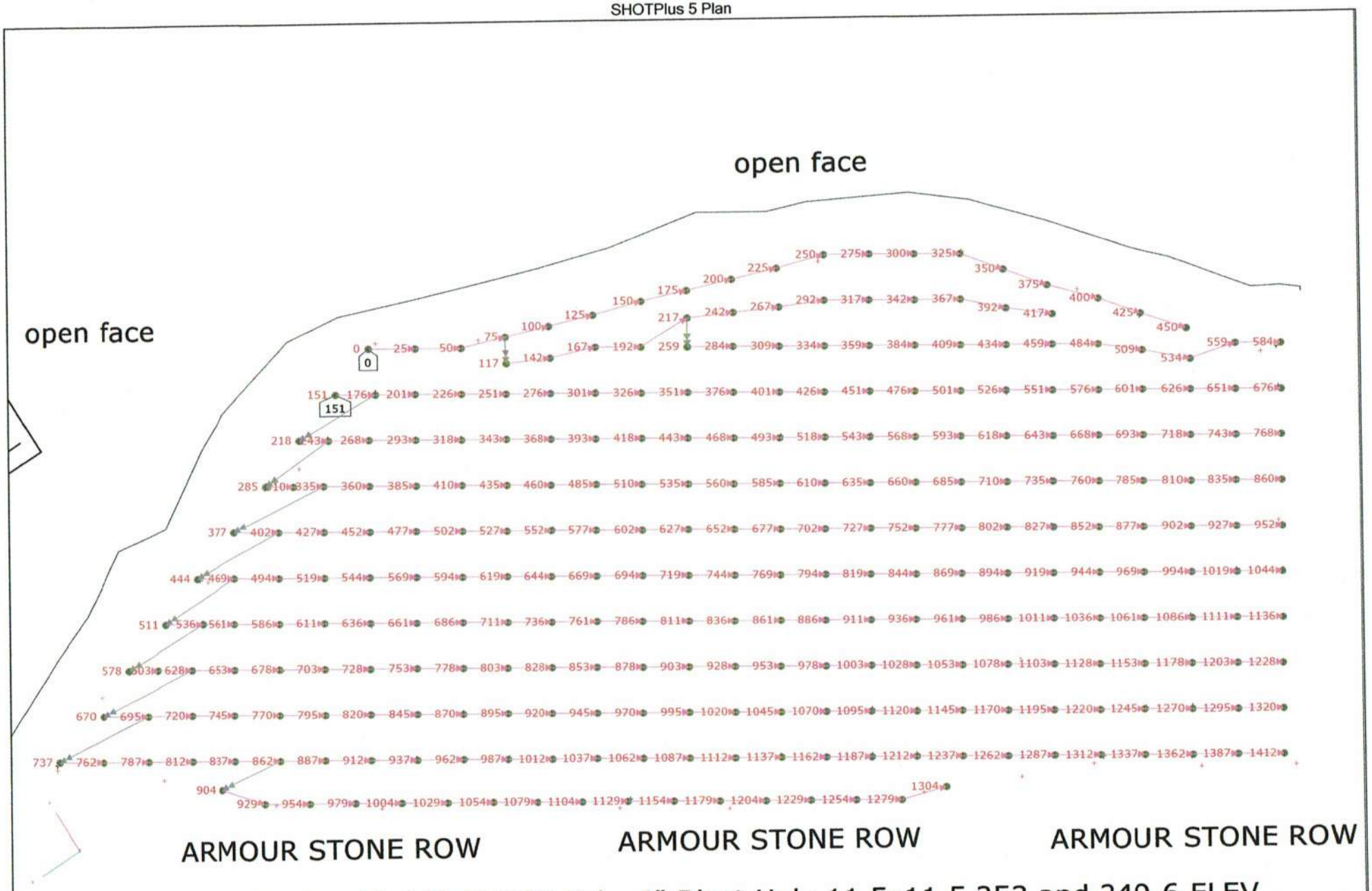




Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 2.000 pa.(L)/div

Sensor Check

Trigger =



Design 18-020 FLOOR Fnl - 4" Blast Hole 11.5x11.5 253 and 249.6 ELEV

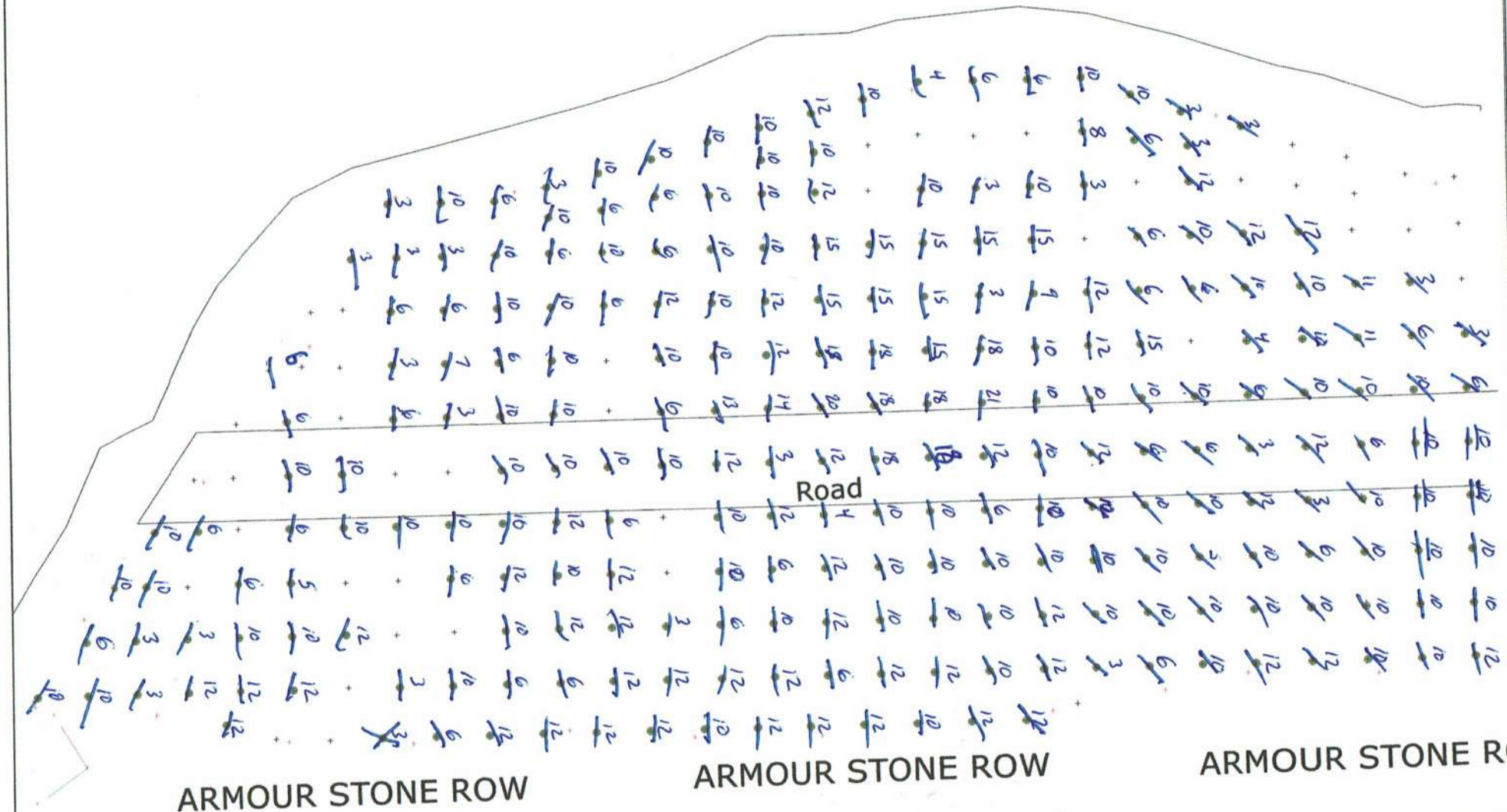
SHOTPlus™ Professional 5.7.4.4		11/8/2018
Mine	Burlington	
Location	FLOOR	
Title/author	Design 18-020 FLOOR	
Filename	Design_18-020_FLOOR_Final R1.spf	

ORICA

DRILL TO SHALE

Not to scale

Load sheet
Max Load 21Kg



ORICA

Not to scale

SHOTPlus™ Professional 5.7.4.4	11/7/2018
Mine	Burlington
Location	FLOOR
Title/author	Design 18-020 FLOOR
Filename	Design_18-020_FLOOR_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.8ft	Spacing: 11.8ft	Subdrill: 0.0ft	Stemming: 5.6ft
1st row burden: 11.8ft	Hole Diameter: 4.0in	Number of holes: 289	Hole angle: 0.0°
Total drilled: 3228.3ft			

Design 18-020 FLOOR Fnl - 4" Blast Hole 11.5x11.5 253 and 249.6 ELEV

DRILL TO SHALE

Not to scale

SHOTPlus™ Professional 5.7.3.0		11/1/2018
Mine	Burlington	
Location	FLOOR	
Title/author	Design 18-020 FLOOR	
Filename	Design_18-020_FLOOR_Final.spf	

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

1091195

Bill of Lading / Connaissement

Orica Canada Inc.

CONSIGNOR / EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE / CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT	
TARE	
NET	

TIME IN / HEURE D'ENTRÉE	TIME OUT / HEURE SORTIE

ORDER NUMBER / N° DE COMMANDE	B/L NUMBER / N° DE CONNAISSEMENT
2410149	86192440

PAGE 2

DATE REQUIRED / DATE REQUISE	TIME REQUIRED / HEURE REQUISE	INVOICE TO / BUYER / FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. / N° DE COMMANDE DU CLIENT
08 Nov 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a

DATE SHIPPED / EXPÉDIÉ LE	FREIGHT TERMS / CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. / PERMIS EXPÉDITEUR	VEHICLE NO. / N° DE VÉHICULE
08 Nov 2018	FOB Dest'n, Own Truck	F-73289	PT18230

SHIP VIA / TRANSPORTEUR	ROUTING / ITINÉRAIRE	MAG. LIC. NO. / N° DE PERMIS
Orica Truck	STANDARD	

QTY. / QTÉ.	UM	DG MD	QTY. RET'D / QTÉ. RET.	QTY. SOLD / QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT / MONTANT
					NET EXPLOSIVES QUANTITY: 117.137 KG		
343	PC	X	92	251	PENTEX BC 340 (49/CS)	7	125.195
1	PC		1	0	Harness Wire Duplex (6 pack) 400m	1	2.920
5	PC	X	3	2	*uni tronic 600-06.0M CU/ZC(20')80PC	1	0.365
100	PC		100	0	MINI STEM PLUGS - PART #74853		0.700
390	PC	X	139	251	EXEL HANDIDET 9M 25/500(30') 65/CS	6	39.390
65	PC	X	47	18	EXEL Connectadet 9M 25MS (30 FT) 65/CS	1	6.305
65	PC	X	42	23	EXEL Connectadet 9M 42MS (30 FT) 65/CS	1	6.370
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
					TOTAL GROSS WEIGHT		181.245 KG
					**** TOTAL PACKAGES ****	17	

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES | PALLETS RETURNED / PALETTES RETOURNÉES | BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER / TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :
ERAP 2-1510	1-877-561-3636	✓ YES / OUI ___ NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5

THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.

DECLARED VALUE OF SHIPMENT / VALEUR DÉCLARÉE $

NETTE No. CONV / PRESSAGE / WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR: K. Klatt	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR: K Klatt	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE: K Klatt	DATE: 8 11 18 (D/J M/M Y/A)	SIGNATURE: K Klatt	DATE: 8 11 18 (D/J M/M Y/A)	SIGNATURE	DATE (D/J M/M Y/A)

2 SHIPPING ORDER / BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRES AU VERSO

D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.8ft	Spacing: 11.8ft	Subdrill: 0.0ft	Stemming: 5.6ft
1st row burden: 11.8ft	Hole Diameter: 4.0in	Number of holes: 289	Hole angle: 0.0°
Total drilled: 3228.3ft			

4'-5' Broken material over all holes

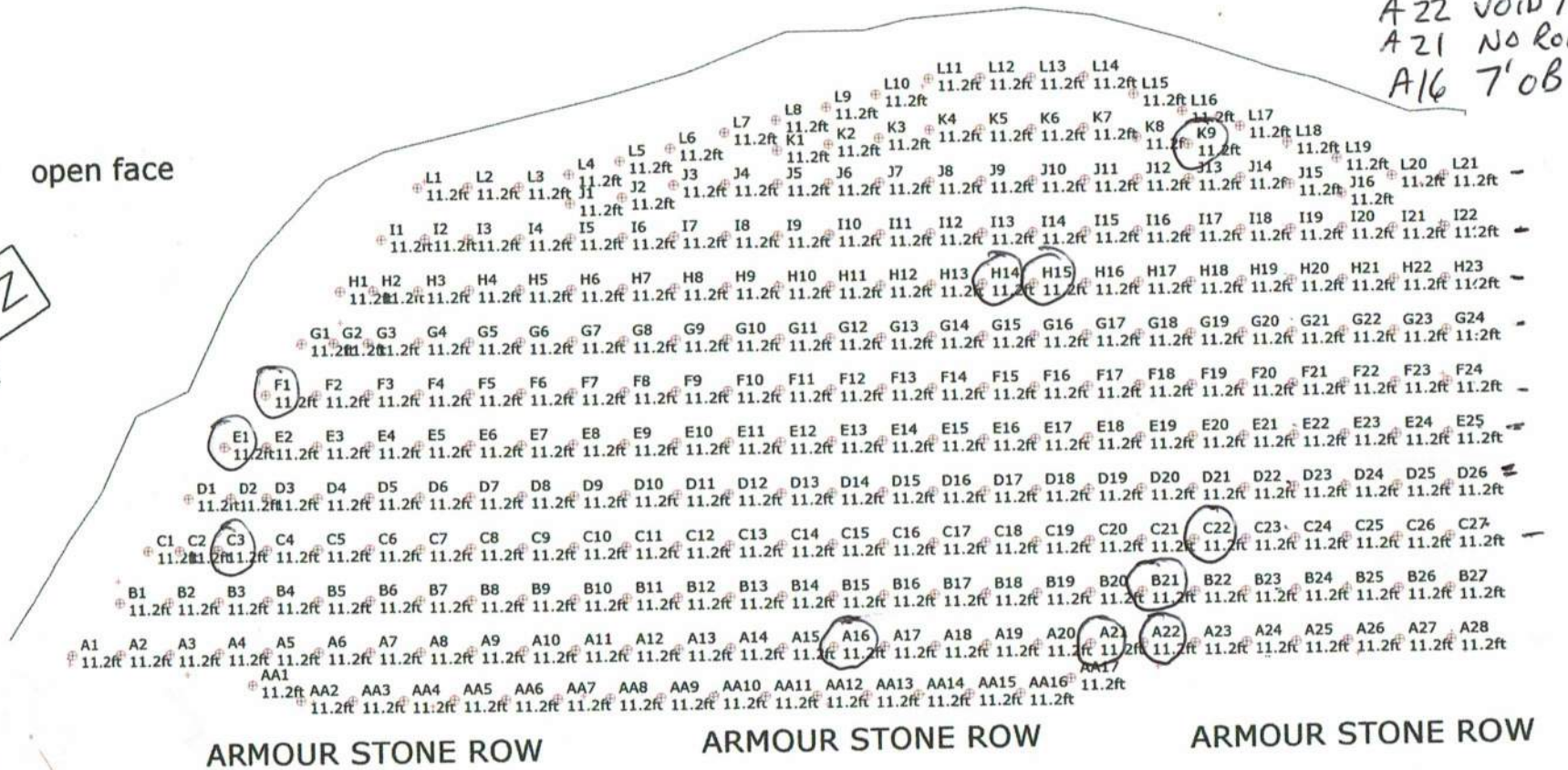
H15 6'oB
H14 6'oB
K9 VoiD 7-7.5'
C22 VoiD 7.5-8'
C3 No ROCK
B21 VoiD 7-7.5
A22 VoiD 7-7.5
A21 No ROCK
A16 7'oB

open face

open face

= BILL'S MARKI STONE

F1 NoROCK
E1 NoROCK



Design 18-020 FLOOR Fnl - 4" Blast Hole 11.5x11.5 253 and 249.6 ELEV

DRILL TO SHALE

ORICA

Not to scale

SHOTPlus™ Professional 5.7.3.0	11/1/2018
Mine	Burlington
Location	FLOOR
Title/author	Design 18-020 FLOOR
Filename	Design_18-020_FLOOR_Final.spf

GODRILLING®

SHOT DIAGRAM

ORICA

Burlington

NOV | 2018 |

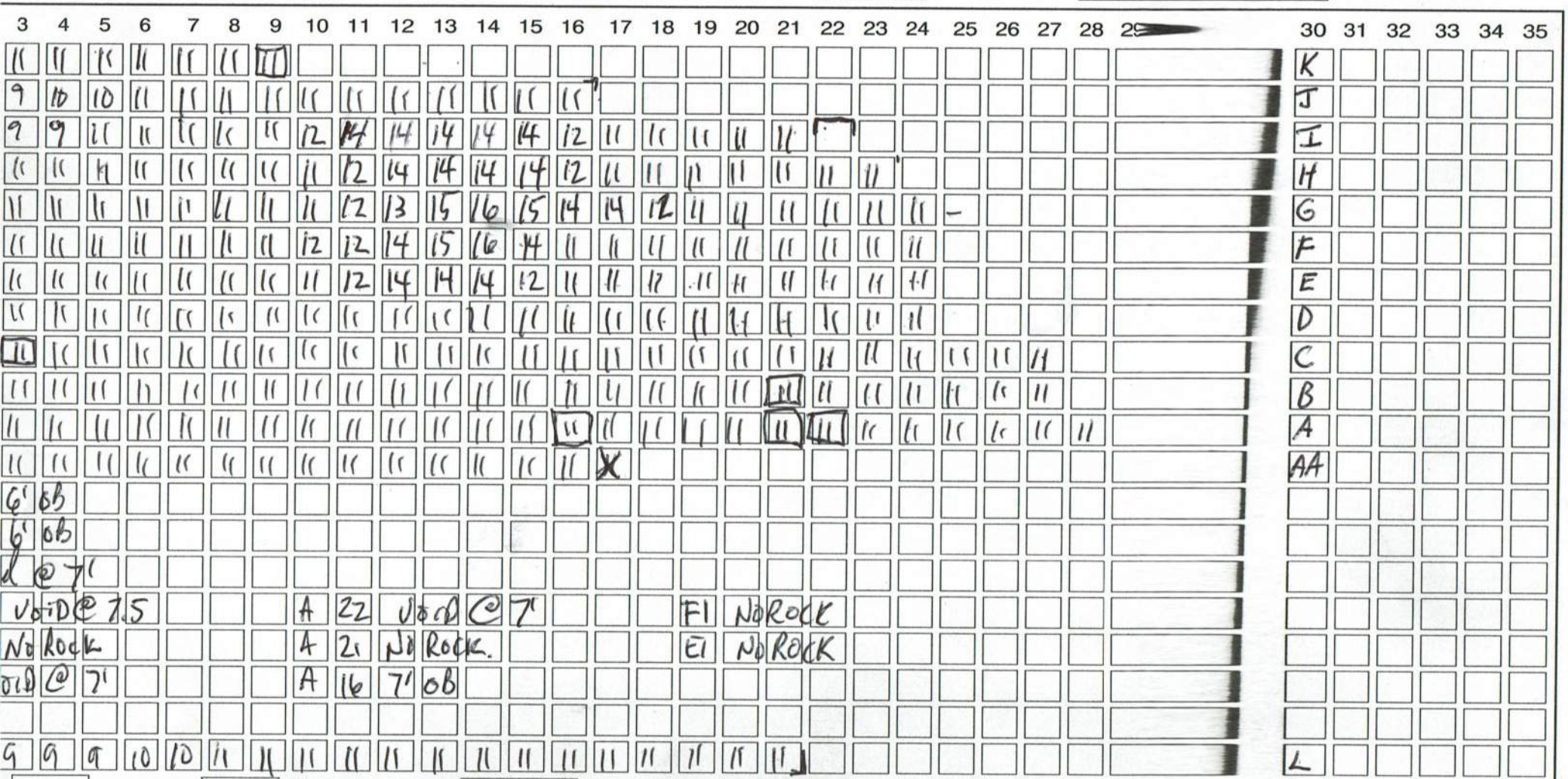
Depth to shale.

Driller: ONEIL

Blast Num:

Employee:

GPS Coordinates GPS LF: GPS RF: GPS LR: GPS RR:



Spacing: Hole Diameter: Total Cubic Meters: Total Tonnes: Total Footage:

Average Hole Depth: Total Holes: 254

Shot Notes

125

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date:

Blast Number: 18-020
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: enter data on p2 °N Latitude (Centre of Blast) enter data on p2 °W Longitude (Centre of Blast)

Design te Blasted:	28,320	te
Total Holes Loaded:	289	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	12	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 289	=	3,179.0 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	11.0	ft avg
Spacing:	11.0	ft avg
# Holes:	21	front row

- Design Pattern (Main Body) -

Burden:	11.0	ft avg
Spacing:	11.0	ft avg
# Holes:	268	main body
Bench Height:	11.0	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	11.0	ft avg

- Design Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Stone	

Bulk Expl. Required:

	kg
	6,000

Pkgd Expl. Required:

	kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	289	98.3

total explosives weight in Blast (kg): 6,098

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
EXEL HANDIDET 9m	25/500	289

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row:	4.0 ft avg
Main Body:	4.0 ft avg

- Design Charge Weight -

Front Row:	11.7 kg/hole
Main Body:	11.7 kg/hole
Max Chge Wt / delay:	16.0 kg/delay

Required kg Loaded:	6,098	kg
Rock Density:	2.60	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.215	kg/te (actual)
0.522 lb/yd³	Front row:	0.119	kg/te (theoretical)
0.522 lb/yd³	Main Body:	0.119	kg/te (theoretical)
0.522 lb/yd³	"KPI" PF:	0.119	kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

NELSON AGGREGATES
BURLINGTON QUARRY

SIESMIC REPORT SUMMARY

Shot #	Date	Time	Max Kg/Delay	Hole Dia. (in.)	Pattern Spacing (ft.)	Pattern Burden (ft.)	# Of Decks	# Of Rows	# Of Holes	Time Between (ms.) Decks	Time Between (ms.) Holes	Time Between (ms.) Rows	Sub Drill	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1 (mm/s)	Monitor 1 (dbl.)	Monitor 2 (mm/s)	Monitor 2 (dbl.)	Monitor 3 (mm/s)	Monitor 3 (dbl.)	Monitor 4 (mm/s)	Monitor 4 (dbl.)
01-14	Mar. 5/14	11:21AM	130.80	4	11.5	11.5	1	8	117	0	25	67	0	N/A	17.00	21800.0	1.02	103.5	2.05	104.2	1.78	115.2		
02-14	Mar. 31/14	11:58AM	75.80	4	11.5	11.5	1	6	102	0	25	67	0	N/A	18.75	20609.0	N/R	N/R	2.52	103.5	1.78	115.2		
03-14	Apr. 9/14	12:42PM	54.0	4	12	12	1	6	186	0	25	134	0	N/A	13.00	28371.2	2.03	104.9	1.02	108.0	1.02	100.0		
04-14	Apr. 21/14	12:00PM	240.79	4	11	11	1	2	37	0	13	110	2	73.38	81.00	29548.2	2.79	126.7	N/R	N/R	N/R	N/R		
05-14	Apr. 30/14	11:57AM	107.02	4	11.5	11.5	1	9	138	0	25	67	0	N/A	18.00	26726.4	1.78	106.0	N/R	N/R	1.27	101.0		
06-14	May 7/14	11:59AM	44.59	4	11.5	11.5	1	7	162	0	25	67	0	N/A	11.00	19202.7	2.16	105.5	N/R	N/R	1.02	104.9		
07-14	May 16/14	12:01PM	80.06	4	11.5	11.5	1	9	125	0	25	67	0	N/A	15.50	23884.8	2.67	101.9	1.48	97.5	3.17	110.6		
08-14	May 27/14	01:08PM	234.84	4	11	11	1	2	40	0	13	58	2	71.56	82.25	32437.0	3.56	120.4	N/R	N/R	1.90	125.5		
09-14	Jun. 2/14	11:10AM	89.19	4	11.5	11.5	1	10	116	0	25	67	0	N/A	16.00	21379.4	N/R	N/R	N/R	N/R	N/R	N/R		
10-14	Jun. 11/14	12:00PM	89.18	4	11.5	11.5	1	8	155	0	25	67	0	N/A	13.50	26185.5	N/R	N/R	1.78	88.0	3.43	111.5		
11-14	Jun. 17/14	12:07PM	237.42	4	11	11	1	2	43	0	13	110	2	76.29	82.50	34975.7	3.05	114.9	2.16	118.6	N/R	N/R		
12-14	Jun. 24/14	11:11AM	65.25	4	11.5	11.5	1	14	164	0	25	67	0	N/A	13.50	24294.3	N/R	N/R	N/R	N/R	3.05	111.2		
13-14	Jul. 7/14	12.18PM	240.79	4	11	11	1	1	34	0	13	0	2	70.83	80.50	26984.8	2.92	116.9	N/R	N/R	1.78	124.1		
14-14	Jul. 15/14	11:57AM	55.74	4	11.5	11.5	1	8	210	0	25	67	0	N/A	11.25	25458.1	N/R	N/R	N/R	N/R	N/R	N/R		
15-14	Jul. 21/14	12:07PM	240.79	4	11	11	1	1	35	0	13	0	2	77.04	83.50	28813.7	4.57	123.4	1.02	124.2	N/R	N/R		
16-14	Aug. 1/14	12:02PM	240.79	4	11	11	1	1	29	0	13	0	2	78.28	82.75	23659.8	3.68	126.6	N/R	N/R	1.90	127.0		
17-14	Aug. 14/14	11:34AM	77.29	4	11.5	11.5	1	7	155	0	25	84	0	N/A	12.50	20878.4	1.78	106.0	1.27	104.2	1.02	100.0		
18-14	Aug. 20/14	11:55AM	49.05	4	11.5	11.5	1	9	166	0	25	67	0	N/A	11.50	23669.3	N/R	N/R	1.02	88.0	N/R	N/R		
19-14	Aug. 25/14	1:52PM	204.67	4	11	11	1	1	35	0	13	0	2	76.73	85.00	29331.3	3.30	129.4	2.16	132.2	N/R	N/R		
20-14	Aug. 28/14	12:15PM	77.29	4	11.5	11.5	1	9	190	0	25	84	0	N/A	12.50	25592.8	N/R	N/R	1.40	103.5	1.02	101.0		
21-14	Sept. 4/14	12:11PM	62.43	4	11.5	11.5	1	17	187	0	25	67	0	N/A	13.00	26336.4	N/R	N/R	N/R	N/R	5.08	111.8		
22-14	Sept. 10/14	12:47PM	176.58	4	11.5	11.5	1	14	186	0	25	67	0	N/A	12.75	25555.1	N/R	N/R	1.02	94.0	8.64	127.9		
23-14	Sept. 16/14	12:12PM	204.14	4	11.5	11.5	1	2	37	0	13	97	2	71.70	83.50	33292.2	5.21	128.4	1.40	133.4	1.40	134.6		
24-14	Sept. 24/14	11:59AM	40.13	4	11.5	11.5	1	9	141	0	25	84	0	N/A	12.75	19509.8	N/R	N/R	N/R	N/R	2.92	107.0		
25-14	Sept. 24/14	12:10PM	62.43	4	11.5	11.5	1	7	73	0	25	67	0	N/A	13.00	10226.3	N/R	N/R	N/R	N/R	10.70	113.3		
26-14	Oct. 2/14	1:40PM	240.79	4	11.5	11.5	1	2	60	0	13	97	2	74.93	85.25	55107.0	4.32	131.8	1.65	124.2	1.27	128.6		
27-14	Oct. 7/14	12:23PM	60.20	4	11.5	11.5	1	10	172	0	25	67	0	N/A	12.75	23631.6					6.86	116.4		
28-14	Oct. 22/14	11:54AM	255.65	4	11.5	11.5	1	2	31	0	13	97	2	73.73	87.75	29313.2	6.22	128.0	2.03	128.4	1.40	119.2		
29-14	Oct. 31/14	12:02PM	62.43	4	11.5	11.5	1	9	231	0	25	67	0	N/A	13.00	33340.7	N/R	N/R	3.17	104.9	3.68	112.3		
30-14	Nov. 5/14	12:02PM	246.74	4	11.5	11.5	1	2	35	0	13	97	2	74.69	87.00	32812.7	4.57	118.6	1.02	127.1	1.65	126.7		
31-14	Nov. 11/14	12:00PM	237.82	4	11.5	11.5	1	2	28	0	13	110	2	72.85	81.75	24666.1	3.56	130.6	N/R	N/R	N/R	N/R		
32-14	Nov. 24/14	12:08PM	246.74	4	11.5	11.5	1	2	26	0	13	97	2	74.88	88.75	24865.5	3.81	128.7	1.02	98.8	1.90	101.0		
33-14	Nov 27/14	11:55AM	71.34	4	11.5	11.5	1	7	232	0	24	84	0	N/A	14.00	35000.2	N/R	N/R	3.56	94.0	4.83	115.9		

NELSON AGGREGATES
BURLINGTON QUARRY

SIESMIC REPORT SUMMARY

Shot #	Date	Time	Max Kg/Delay	Hole Dia. (in.)	Pattern Spacing (ft.)	Pattern Burden (ft.)	# Of Decks	# Of Rows	# Of Holes	Time Between (ms.) Decks	Time Between (ms.) Holes	Time Between (ms.) Rows	Sub Drill	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1 (mm/s)	Monitor 1 (dbl.)	Monitor 2 (mm/s)	Monitor 2 (dbl.)	Monitor 3 (mm/s)	Monitor 3 (dbl.)	Monitor 4 (mm/s)	Monitor 4 (dbl.)
34-14	Dec. 2/14	11:57AM	246.74	4	11.5	11.5	1	2	59	0	13	97	2	71.46	83.75	52344.1	4.83	129.6	2.03	127.5	1.40	132.8		
35-14	Dec. 9/14	11:50AM	89.60	4	11.5	11.5	1	9	179	0	25	67,84	0	N/A	13.00	25215.7	1.14	104.9	2.16	88.0	4.83	116.7		

NELSON AGGREGATES
BURLINGTON QUARRY

SIESMIC REPORT SUMMARY

Shot #	Date	Time	Max Kg/Delay	Hole Dia. (in.)	Pattern Spacing (ft.)	Pattern Burden (ft.)	# Of Decks	# Of Rows	# Of Holes	Time Between (ms.) Decks	Time Between (ms.) Holes	Time Between (ms.) Rows	Sub Drill	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1 (mm/s)	Monitor 1 (dbl.)	Monitor 2 (mm/s)	Monitor 2 (dbl.)	Monitor 3 (mm/s)	Monitor 3 (dbl.)	Monitor 4 (mm/s)	Monitor 4 (dbl.)
01-15	Apr. 2/15	12:00PM	225.93	4	11.5	11.5	1	2	24	0	13	84	2	73.37	82.00	21207.0	2.41	115.6	1.52	94.0	2.29	125.6		
02-15	Apr. 9/15	11:57AM	35.67	4	11.5	11.5	1	19	121	0	25	84	0	N/A	12.00	17198.4	1.27	117.1	2.16	88.0	2.16	126.7		
03-15	Apr. 21/15	12:05PM	11.9	4	11.5	11.5	1	20	114	0	25	84	0	N/A	10.00	14763.0	11.78	104.2	1.02	98.8	N/R	N/R		
04-15	Apr. 23/15	12:03PM	225.93	4	11.5	11.5	1	2	23	0	13	123	2	75.04	81.00	20075.5	4.06	123.2	1.78	122.4	2.79	124.8		
07-15	May. 15/15	11:54AM	49.05	4	11.5	11.5	1	19	159	0	25	67	0	N/A	14.25	25644.0	1.78	103.5	1.4	103.5	N/R	N/R		
08-15	May. 22/15	11:51AM	120.39	4	11.5	11.5	1	12	153	0	25	67	0	N/A	19.50	32150.0	1.02	104.9	1.27	105.5	1.52	101.9		
09-15	May 28 2015	12:02PM	222.95	4	11.5	11.5	1	2	28	0	13	110	2	70.42	28.00	23534.6	3.81	116.6	N/R	N/R	1.02	122.3		
10-15	June 2 2015	12:01PM	246.74	4	11.5	11.5	1	1	15	0	13	0	2	80.27	92.75	14992.0	3.3	122.9	1.02	95.9	1.78	125		
11-'15	June 10/15	11:50AM	225.92	4	11.5	11.5	1	2	30	0	13	110	2	70.86	77.25	24793.2	4.32	119.8	1.02	114.2	2.79	123.4		
12-'15	June 12/15	12:18PM	98.1	4	11.5	11.5	1	13	254	0	25	67	0	N/A	17.00	47629.6	1.78	125.5	3.81	133.0	1.40	128.2		
13-'15	June 17/15	12:03PM	255.65	4	11.5	11.5	1	2	35	0	13	130	2	83.00	92.00	34698.5	4.83	125.3	1.27	122	11.52	130.7		
14-'15	July 8/15	12:02PM	214.04	4	11.5	11.5	1	2	29	0	13	123	2	71.64	77.00	24062.6	3.17	117.2	N/R	N/R	2.67	124.1		
15'-15'	July 13/15	12:02PM	275.20	4	11.5	11.5	1	2	38	0	13	38	2	77.87	88.50	36239.4	4.32	124.3	N/R	N/R	1.40	129.2		
16-'15	July 30/15	12:00PM	214.04	4	11.5	11.5	1	6	29	0	13	29	2	75.38	77.75	24297.0	2.29	130.7	N/R	N/R	2.92	112.6		
17-'15	Aug 19/15	12:02PM	246.74	4	11.5	11.5	1	2	44	0	13	182	2	75.75	86.25	39827.8	3.68	126.3	1.4	126.9	N/R	N/R		
18'-15'	Aug 26/15	12:01PM	120.49	4	11.5	11.5	1	9	242	0	25	84	0	N/A	19.50	51061.7	1.27	107	2.03	108.4	N/R	N/R		
19'-15'	Sept 1/15	12:01PM	217.01	4	11.5	11.5	1	3	34	0	13	68	2	70.87	78.50	28761.0	4.19	130.5	1.02	91.5	N/R	N/R		
20'-15'	Sept10/15	11:19AM	115.94	4	11.5	11.5	1	9	153	0	25	67	0	N/A	19.00	31325.6	N/R	N/R	1.40	106.0	N/R	N/R		
21'-15	Oct 6/15	12:03PM	237.82	4	11.5	11.5	1	3	25	0	13	45	2	72.72	82.50	22225.4	5.08	121.1	1.78	88	1.02	123.0		
22-15	Oct 21/15	12:03PM	225.93	4	11.5	11.5	1	5	32	0	13	45	2	73.28	80.50	27758.7	6.6	134.3	1.78	91.5	3.94	130.9		

NELSON AGGREGATES

BURLINGTON QUARRY

BLAST REPORT SUMMARY

Blast #	Date	Time	Blast Location	Weather	Wind From	Wind Velocity	Terrain	Hole Dia (in.)	# Of Rows	# Of Holes	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1 Location	Monitor 1 (mm/s)	Monitor 1 (dbl.)	Monitor 2 Location	Monitor 2 (mm/s)	Monitor 2 (dbl.)	Monitor 3 Location	Monitor 3 (mm/s)	Monitor 3 (dbl.)
01-16	Apr. 8/16	1:01PM	Buldge #2 Side Rd					4	2	40	55.25	70.00	27605.9	2479 #2 Side R	N/R	N/R	SW Corner	N/R	N/R	2450 #2 Side R	2.29	113.5
02-16	Apr. 19/16	12:28PM	NE Face					4	2	27	69.37	81.00	23567.0	2470 #2 Side R	N/R	N/R	SW Corner	1.65	97.5	Colling Rd	1.14	123.1
03-16	May 4/16	12:00PM	Buldge #2 Side Rd					4	2	42	51.86	67.75	28054.0	2470 #2 Side R	1.40	112.0	SW Corner	12.80	118.1	Colling Rd	2.41	116.6
04-16	May 9/16	12:00PM	NE Face	Partly Cloudy 14(	East	5 KPH	Rough	4,4.5	2	26,1	75.35	84.25	23604.7	2450 #2 Side R	3.43	118.8	SW Corner	1.65	91.5	Colling Rd	3.17	129.5
05-16	May 18/16	12:06PM	Pit Floor	Clear 15c	East	10 KPH	Flat	4	16	272	N/A	15.00	43965.8	2450 #2 Side R	N/R	N/R	SW Corner	2.92	105.5	Colling Rd	1.65	111.5
06-16	May 24/16	12:01PM	Pit Floor	Clear 27c	West	15 KPH	Flat	4	14	152	N/A	16.50	27026.0	2450 #2 Side R	1.02	109.5	SW Corner	2.41	95.9	Colling Rd	3.81	106.0
07-16	May 30/16	2:41PM	NE Face	Partly Cloudy 25(	West	10 KPH	Uneven	4,4.5	3	46,3	70.40	79.50	41977.6	2450 #2 Side R	3.94	124.9	SW Corner	1.14	125.0	Colling Rd	2.67	124.6
08-16	Jun 3/16	12:00PM	Buldge #2 Side Rc	Partly Coludy 23(	East	10 KPH	Slope	4	2	43	50.39	63.75	27026.7	2450 #2 Side R	1.52	113.3	SW Corner	5.71	114.8	Colling Rd	1.90	115.9
16-09	Jul 5/16	12:00PM	N Face	Partly Cloudy 31	West	15KPH	Flat	4	3	20	74.74	83.00	17888.0	2450 #2 Side R	2.79	123.6	SW corner	N/R	N/R	Colling Rd	N/R	N/R
16-10	Jul 5/16	12:01PM	NE Face	Partly Cloudy 31	West	15kKPH	Flat	4	1	10	62.20	74.25	8001.1	2450 #2 Side R	4.06	122.1	SW Corner	N/R	N/R	Colling Rd	1.90	128.3
16-11	Jul 12/16	12:38PM	Pit Floor	Clear 32	Southwest	15KPH	Flat	4	14	248	N/A	19.00	50776.2	NOT USED			SW Corner	1.02	106	Colling Rd	4.06	105.5
16-12	Jul 15/16	12:00PM	Bulge#2 Side Rd	Partly Cloudy 27	West	25KPH	Flat	4	3	31	45.40	57.75	17650.5	2450 #2 Side R	1.14	88	SW Corner	4.44	117.4	Colling Rd	1.52	110.9
16-13	Jul 20/16	11:55PM	Pit Floor	Clear 29	West	10KPH	Flat	4.5	14	202	N/A	17.50	39035.8	2450 #2 Side R	N/R	N/R	SW Corner	2.54	103.5	Colling Rd	2.41	106
16-14	Jul 22/16	12:00PM	N Face	Partly Cloudy 33	Northwest	25KPH	Flat	4	3	21	61.50	73.50	16632.6	2450 #2 Side R	2.92	118.1	SW Corner	N/R	N/R	Colling Rd	1.40	124.5
16-15	Aug 4/16	12:00PM	Bulge#2 Side Rd	Clear 31	Southwest	10KPH	Flat	4	3	35	43.85	58.00	20014.3	2450 #2 Side R	1.40	108.8	SW Corner	3.05	117.9	Colling Rd	1.02	113.8
16-16	Aug 9/16	12:00PM	N Face	Partly Cloudy 31	South	15KPH	Uneven	4,4.5	3	45	66.05	77.50	37581.0	2450 #2 Side R	2.29	115.7	SW Corner	1.4	118.8	Colling Rd	2.16	127.5
16-17	Aug 30/16	12:00PM	N Face	Clear	West	15KPH	Uneven	4	3	41	64.95	80.00	35345.0	2450 #2 Side R	3.05	120.0	SW Corner	N/R	N/R	Colling Rd	1.78	128.8
16-18	Sep 20/16	12:01PM	NE Face	Clear	Northwest	10KPH	Flat	4,4.5	3	47	41.90	47.50	24057.3	2450 #2 Side R	2.52	127.2	SW Corner	N/R	N/R	Colling Rd	1.78	117.4
16-19	Oct 6/16	11:55AM	N Face	Clear	South	10KPH	Flat	4,4.5	2	41	38.78	45.75	20212.9	2450 #2 Side R	2.67	124.3	SW Corner	2.29	91.5	Colling Rd	1.65	114.4
16-20	Oct 12/16	11:47AM	NE Face	Clear	South	20KPH	Downslope	4,4.5	6	27	60.00	71.75	20872.3	2450 #2 Side R	4.57	122.1	SW Corner	1.52	88	Colling Rd	2.03	122.9
16-21	Oct 24/16	11:59AM	Bulge#2 Side Rd	Partly Cloudy 11	Northwest	25KPH	Uneven	4	4	29	45.68	59.25	16940.7	2450 #2 Side R	3.05	111.2	SW Corner	4.06	123.4	Colling Rd	2.41	109.9
17-01	Apr 11/17	11:56AM	Bulge#2 Side Rd	Partly Cloudy 20	Southwest	20KPH	Uneven	4	5	26	50.33	58.25	26417.9	2450 #2 Side R	2.55	111.5	SW Corner	N/R	N/R	Colling Rd	N/R	N/R
17-02	Apr 18/17	11:53AM	N Face	Clear	East	15KPH	Flat	4	3	13	72.82	80.50	21384.4	2450 #2 Side R	3.56	125.0	SW Corner	0.18	124.1	Colling Rd	N/R	N/R
17-03	April 21/17	11:53AM	Low Bench	Rain	West	22KPH	Flat	4,4.5	3	50	39.38	44.75	21133.9	2450 #2 Side R	3.56	122.9	SW Corner	1.02	116.7	Colling Rd	N/R	N/R
17-04	May 1/17	11:52AM	Bulge#2 Side Rd	Rain	East	15KPH	Downslope	4	3	32	N/A	69.70	17585.0	2450 #2 Side R	3.05	108.0	SW Corner	2.03	88	Colling Rd	N/R	N/R
17-05	May 15/17	12:35PM	Bulge#2 Side Rd	Clear	Northwest	10KPH	Downslope	4	3	34	N/A	74.00	21062.0	2450 #2 Side R	3.82	111.5	SW Corner	3.30	95.9	Colling Rd	0.13	88.0
17-06	May 17/17	11:53AM	Low Bench	Cloudy26	Southwest	40KPH	Flat	4,4.5	2	42	N/A	41.20	15010.0	2450 #2 Side R	N/R	N/R	SW Corner	N/R	N/R	Colling Rd	1.14	111.8
17-07	May 29/17	12:00PM	Bulge#2 Side Rd	Cloudy23	West	10KPH	Flat	4	3	32	N/A	72.00	21440.0	2450 #2 Side R	1.42	98.8	SW Corner	1.52	88	Colling Rd	6.10	91.5
17-08	Jun 1/17	2:30PM	Low Bench	Clear	Southwest	25KPH	Flat	4	4	86	N/A	37.30	29085	2450 #2 Side R	5.84	101.0	SW Corner	N/R	N/R	Colling Rd	3.81	91.5
17-09	June 8/17	11:55PM	Bulge#2 Side Rd	Clear	Southeast	5KPH	Flat	4	3	30	N/A	79.40	20898	2450 #2 Side R	3.30	94.0	SW Corner	2.41	88	Colling Rd	N/R	N/R

NELSON AGGREGATES

BURLINGTON QUARRY

BLAST REPORT SUMMARY

Blast #	Date	Time	Blast Location	Weather	Wind From	Wind Velocity	Terrain	Hole Dia (in.)	# Of Rows	# Of Holes	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1 Location	Monitor 1 (mm/s)	Monitor 1 (dbl.)	Monitor 2 Location	Monitor 2 (mm/s)	Monitor 2 (dbl.)	Monitor 3 Location	Monitor 3 (mm/s)	Monitor 3 (dbl.)
17-01	April 11/17	11:56AM	Bulge#2 Side Rd	Part Cloudy20	Southwest	20KPH	Uneven	4	5	26	50.33	58.25	26417.9	2450#2 Side R	2.55	111.5	SW Corner	N/R	N/R	Colling Rd	N/R	N/R
17-02	April 18/17	11:53AM	North Face	Clear	East	15KPH	Flat	4	3	13	72.82	80.50	21384.4	2450#2 Side R	3.56	125	SW Corner	0.18	124.1	Colling Rd	N/R	N/R
17-03	April 21/17	11:53AM	Low bench	Rain	West	22KPH	Flat	4,4.5	3	50	39.38	44.75	21133.9	2450#2 Side R	3.56	122.9	SW Corner	1.02	116.7	Colling Rd	N/R	N/R
17-04	May 1/17	11:52AM	Bulge#2 Side Rd	Rain	East	15KPH	Downslope	4	3	32	N/A	69.70	17585.0	2450 #2 Side F	3.05	108	SW Corner	2.03	88	Colling Rd	N/R	N/R
17-05	May 15/17	12:35PM	Bulge#2 Side Rd	Clear	Northwest	10KPH	Downslope	4	3	34	N/A	74.00	21062.0	2450#2 Side R	3.82	111.5	SW Corner	3.3	95.9	Colling Rd	0.13	88.0
17-06	May 17/17	11:53AM	Low bench	Cloudy 26	Southwest	40KPH	Flat	4,4.5	2	42	N/A	41.20	15010.0	2450#2 Side R	N/R	N/R	SW Corner	N/R	N/R	Colling Rd	1.14	111.8
17-07	May 29/17	12:00PM	Bulge#2 Side Rd	Cloudy 23	West	10KPH	Flat	4	3	32	N/A	72.00	21440.0	2450#2 Side R	1.42	98.8	SW Corner	1.52	88.0	Colling Rd	6.10	91.5
17-08	June 1/17	2:30PM	Low bench	Clear	Southwest	25KPH	Flat	4	4	86	N/A	37.30	29085.0	2450#2 Side R	5.84	101	SW Corner	N/R	N/R	Colling Rd	3.81	91.5
17-09	June 8/17	11:55AM	Bulge#2 Side Rd	Clear	Southeast	5KPH	Flat	4	3	30	N/A	79.40	20898.0	2450#2 Side R	3.3	94	SW Corner	2.41	88	Colling Rd	N/R	N/R
17-11	June 20/17	12:02PM	Bulge#2 Side Rd	Part Cloudy22	Southwest	10KPH	Flat	4	3	36	N/A	84.10	23583.0	2450#2 Side R	2.03	108.4	SW Corner	2.41	101.9	Colling Rd	N/R	N/R
17-10	June 21/17	12:35PM	Low bench	Part Cloudy21	West	10KPH	Flat	4,4.5	3	84	N/A	40.80	25680.0	2450#2 Side R	N/R	N/R	SW Corner	N/R	N/R	Colling Rd	did not	use
17-12	June 26/17	1:00PM	Floor	Part Cloudy	Southwest	15KPH	Flat	4	12	252	N/A	16.00	40014.0	2450#2 Side R	6.22	91.5	SW Corner	1.78	88	Colling Rd	N/R	N/R
17-14	July 4/17	12:46PM	North Face	Part Cloudy	Southeast	10KPH	Flat	4,4.5	3	36	N/A	57.95	33601.0	2450#2 Side R	12.20	95.9	SW Corner	4.19	88.0	Colling Rd	1.27	88
17-13	July 10/17	1:40PM	Floor	Part Cloudy	Southwest	10KPH	Flat	4	11	295	N/A	16.70	48920.0	2450#2 Side R	2.16	91.5	SW Corner	4.22	88.0	Colling Rd	1.02	104.2
17-15	July 25/17	11:57AM	Low Bench	Part Cloudy	NorthEast	5KPH	Flat	4	4	52	N/A	42.00	15057.0	2450#2 Side R	3.56	91.5	SW Corner	2.16	88	Colling Rd	1.14	112.8
17-17	August 3/17	12:41PM	North Face	Part Cloudy	North	0.00	Flat	4,5	4	23	N/A	77.10	11832.0	2450#2 Side R	2.92	88	SW Corner	1.27	88	Colling Rd	N/R	N/R
17-18	August 28/17	12:32PM	Floor	Partly Cloudy	West	5KPH	Flat	4	8	188	N/A	17.70	26351.0	2450 #2 Side F	4.70	104.9	SW Corner	3.3	88	Colling Rd	1.14	107.5
17-16	August 30/17	12:01PM	Bulge#2 Side Rd	Partly Cloudy	Southwest	5KPH	Flat	4	3	28	N/A	84.30	16211.0	2450 #2 Side F	1.52	91.5	SW Corner	1.52	92.0	Colling Rd	N/R	N/R
17-19	ptember 12 2(	11:49AM	Low bench	Partly Cloudy	Southeast	10KPH	Flat	4	3	37	N/A	38.90	21101.0	2450 #2 Side F	2.92	88.0	SW Corner	1.90	94	Colling Rd	1.02	114.6
17-22	eptember26/1	11:56AM	Low bench	Partly Cloudy	South	5KPH	Flat	4	5	62	N/A	38.80	19349.0	2450 #2 Side F	1.65	88.0	SW Corner	1.65	88	Colling Rd	1.14	115.6
17-20	eptember 27/1	12:01PM	Bulge#2 Side Rd	Partly Cloudy	West	10KPH	Flat	4,4.5	3	40	N/A	81.90	27877.0	2450 #2 Side F	2.54	103.5	SW Corner	3.17	88	Colling Rd	N/R	N/R
17-23	October 6/17	11:53AM	Upper Middle	Partly Cloudy	North	10KPH	Flat	4,4.5	3	34	N/A	77.20	21365.0	2450 #2 Side F	3.43	95.9	SW Corner	3.05	94	Colling Rd	1.27	88.0
17-24	October 11/17	12:41PM	Bulge#2 Side Rd	Rain	East	20KPH	Flat	4,4.5	3	45	N/A	81.70	30695.0	2450 #2 Side F	0.38	91.5	SW Corner	4.95	122.4	Colling Rd	N/R	N/R
17-25	October 30/17	11:55AM	Low bench	Partly Cloudy	West	35KPH	Flat	4	9	41	N/A	39.10	11407.0	2450#2 Side R	1.14	122.8	SW Corner	N/R	N/R	Colling Rd	N/R	N/R

NELSON AGGREGATES

BURLINGTON QUARRY

BLAST REPORT SUMMARY

Blast#	Date	Time	Blast Location	Weather	Wind From	Wind Velocity	Terrain	Hole Dia (in.)	# Of Rows	# Of Holes	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1 Location	Monitor 1 (mm/s)	Monitor 1 (dbl.)	Monitor 2 Location	Monitor 2 (mm/s)	Monitor 2 (dbl.)	Monitor 3 Location	Monitor 3 (mm/s)	Monitor 3 (dbl.)
18-001	Apr 9/18	11:56 AM	Upper Middle	Part Cloudy	Southeast	5KPH	Flat	4	3	49	N/A	75.50	27194.0	2450#2 Side R	3.60	115.3	SW Corner	1.2	119.7	Colling Rd	0.4	121.9
18-002	Apr 11/18	11:16AM	Floor	Overcast	Southwest	10KPH	Flat	4	9	180	N/A	10.00	19279.0	2450#2 Side R	DNT	DNT	SW Corner	2	88.4	Colling Rd	N/A	N/A
18-003	Apr 18/18	10:54	Lower middle	Overcast	West	10KPH	Flat	4	4	39	N/A	40.10	11087.0	2450#2 Side R	2.70	119.7	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-004	May 22/18	12:02PM	Upper Middle	Overcast	SouthEast	5KPH	Flat	4,4.5	3	49	N/A	75.50	26332.0	2450#2 Side R	3.3	124.3	SW Corner	0.3	39.1	Colling Rd	0.30	123.1
18-005	June 4/18	11:50AM	Lower middle	Overcast	West	15KPH	Flat	4	8	67	N/A	44.20	20811.0	2450#2 Side R	N/R	N/R	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-006	June 6/18	12:10PM	Lower middle	Overcast	West	5KPH	Flat	4	11	61	N/A	41.70	17948.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-007	June 11/18	11:56AM	Upper Middle	Part Cloudy	East	15KPH	Flat	4,4.5	4	55	N/A	73.10	28467.0	2450#2 Side R	2.70	116.9	SW Corner	0.10	119.6	Colling Rd	0.20	120.2
18-008	June 13/18	11:52AM	Lower middle	Part Cloudy	West	10KPH	Sloped	4	7	89	N/A	50.00	28929.0	2450#2 Side R	1	120.6	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-009	June 25/18	12:01PM	Lower middle	Clear	Southeast	10KPH	Flat	4	13	99	N/A	35.30	25983.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-010	July 5/18	11:51AM	Upper Middle	Clear	Southwest	5KPH	Flat	4	3	53	N/A	76.00	30963.0	2450#2 Side R	2.30	115.9	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-011	20-Jul	11:59AM	Lower middle	Part Cloudy	East	5KPH	Flat	4	15	125	N/A	26.00	24173.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-012	Aug 3/18	11:52AM	Upper Middle	Part Cloudy	none	0	Flat	4,5	3	46	N/A	76.40	27176.0	2450#2 Side R	2.4	115	SW Corner	0.01	117.1	Colling Rd	0.01	116.4
18-013	Aug 14/18	10:54AM	Floor	Part Cloudy	South	5.00	Flat	4	11	182	N/A	10.00	17069.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-014	Aug 30/18	11:55AM	Upper Middle	Part Cloudy	NorthEast	5KPH	Flat	4,5	3	58	N/A	75.20	31778.0	2450#2 Side R	3.7	113.3	SW Corner	2.00	93.2	Colling Rd	DNT	DNT
18-015	Sept 10/18	11:49AM	Floor	Rain	East	15KPH	Flat	4	9	204	N/A	11.50	22269.0	2450#2 Side R	DNT	DNT	SW Corner	NSU	NSU	Colling Rd	0.1	118
18-018	Sept 21/18	12:34PM	Floor	Part Cloudy	Southwest	15KPH	Flat	4	21	345	N/A	11.20	38483.0	2450#2 Side R	DNT	DNT	SW Corner	NSU	NSU	Colling Rd	DNT	DNT
18-017	Oct 2/18	12:02PM	Upper Middle	Rain	Sourhwest	5KPH	Flat	4	3	48	N/A	76.40	26868.0	2450#2 Side R	5.30	114.2	SW Corner	0.5	123.5	Colling Rd	0.20	121.6
18-016	Oct 10/18	12:24PM	Lower middle	Part Cloudy	East	5KPH	Flat	4	5	100	N/A	61.80	44223.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-019	Nov 1/18	11:57AM	Upper Middle	Rain	None	0.00	Flat	4,4.5	5	50	N/A	73.40	27342.0	2450#2 Side R	5.70	116.3	SW Corner	1.80	114.2	Colling Rd	0.30	118.8
18-020	Nov11/18	11:57AM	Floor	Cloudy	West	5KPH	Flat	4	12	251	N/A	11.00	24552.0	2450#2 Side R	2.00	110.4	SW Corner	DNT	DNT	Colling Rd	0.00	0.0

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-006
P.O. #:		Orica Order #:	2487394
Blast Date:	2019-05-28	Blast Time:	11:09 AM

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Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle North East (Bench / Face)

GPS Coordinates: 43.40506 °N Latitude (Centre of Blast) 79.88187 °W Longitude (Centre of Blast)

Wind from the: NE at 10 kph Temperature: 6 to 10 °C

		x		x	
Clear:		Rain:		Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 591 ft

Tonnes Blasted:	18,760 te	7,215 m3
Total tonnes per day:	18,760 te	NB60-08 Rate Code
Total Holes Loaded:	47 holes	
… including:	5 Dead Holes	
… and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	4 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	13 front row	
- Pattern (Main Body) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	34 main body	
Bench Height:	61.7 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	63.7 ft avg	
- Stone Decking -		
Front Row:	0.0 ft avg	
Main Body:	0.0 ft avg	
# Decks:	0 per blast	
- Collar Stemming -		
Front Row:	8.0 ft avg	
Main Body:	8.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	55.7 ft avg	
Main Body:	55.7 ft avg	
- Charge Weight -		
Front Row:	162.5 kg/hole	
Main Body:	162.5 kg/hole	
Max. per delay:	197.0 kg/delay	
SD () Equation:	195.0 kg/delay	
Total kg Loaded:	8,712 kg	
Rock Density:	2.60 g/cc = te/m^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

2.035 lb/yd^3	Yield PF:	0.464 kg/te (actual)
1.306 lb/yd^3	Front row:	0.298 kg/te (theoretical)
1.741 lb/yd^3	Main Body:	0.397 kg/te (theoretical)
1.632 lb/yd^3	"KPI" PF:	0.372 kg/te (theoretical)

- Drilling Information -

				Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	43	=	2,739.9 ft (4 " diam)
Secondary Bit diam:	92.1	mm	0 °	# Holes:	4	=	254.9 ft (3 5/8 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,740	25,080	8,660

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	1	25

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	47	10.7
PENTEX 12 (OR EQUIVALENT)	0.34	47	16.0

total explosives weight in Blast (kg):	8,712
Pkgd Prod (25 kg) % of Total kg:	0.3%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			47
UNITRONIC 600 25M			47

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	2
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	5.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

Hole D7 Recived packaged product to load though small seam from 15'-9'

We were unable to locate the drill log.

After speaking with the driller we felt confident to continue and load the blast

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-006
P.O. #:		Orica Order #:	2487394
Blast Date:	2019-05-28	Blast Time:	11:09 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40510**	**79.88190**	0.757562	1.394202
Front Row Corner	43.40488	79.88179	0.757558	1.394200
Back Row Corner	43.40519	79.88193	0.757563	1.394203
Average (Centre of Blast)	43.40506	79.88187	0.757561	1.394202

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**418.9**	m				
Post Blast Data: ppV:	**4.2**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**10.7**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**119.6**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**987.1**	m				
Post Blast Data: ppV:	**0.2**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**8.8**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**118.9**	dB	Trigger set at:	**115**	dB	

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1414.7**	m				
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(418.9)^2}{30^2} \text{ kg}$$

$$= \frac{175{,}477}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 195 kg

jim bray

Orica
Blaster-in-charge: *Mike der Kinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-006
P.O. #:		Orica Order #:	2487394
Blast Date:	5/28/2019		

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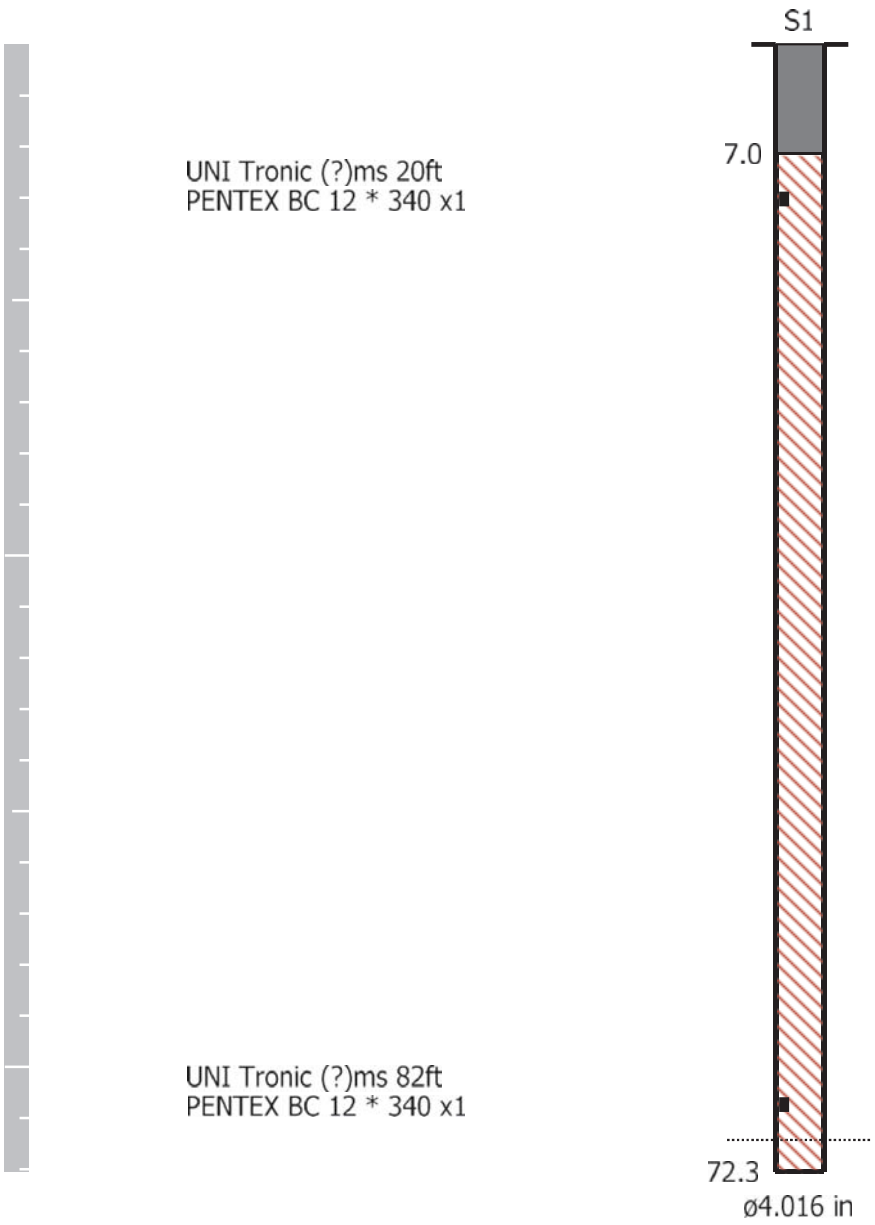
Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nick Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 11:09:14 May 28, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.2 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

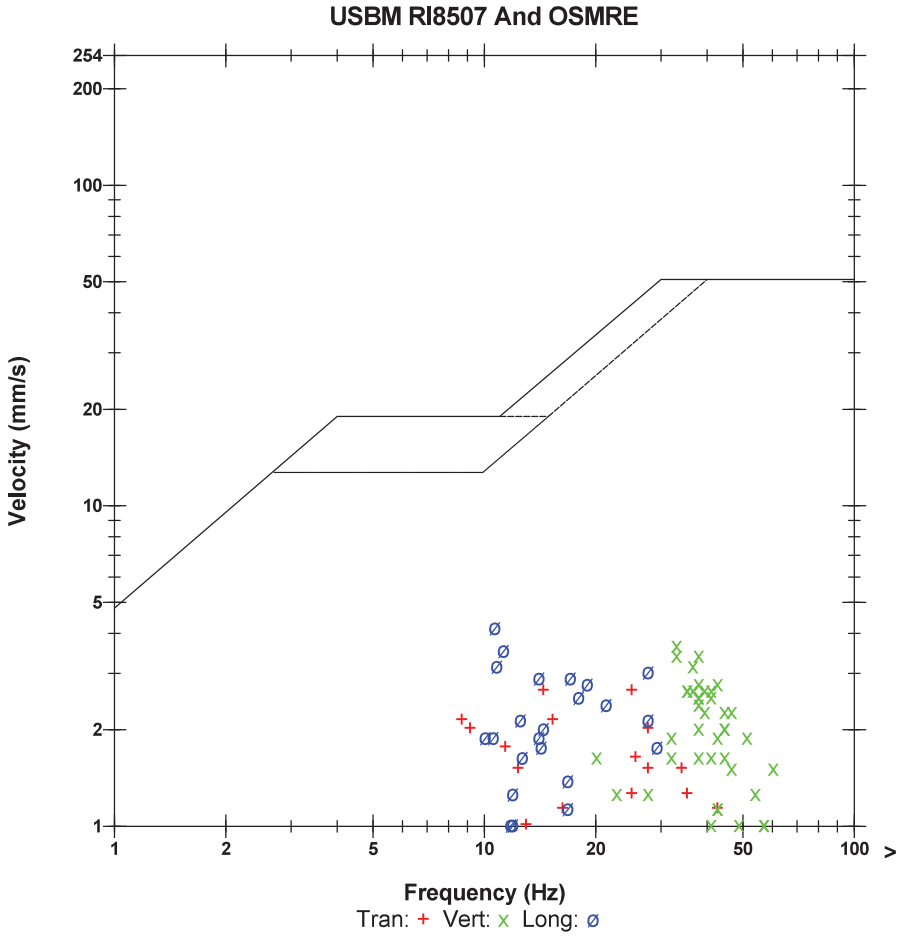
Notes
Location: 2450 Line 2
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

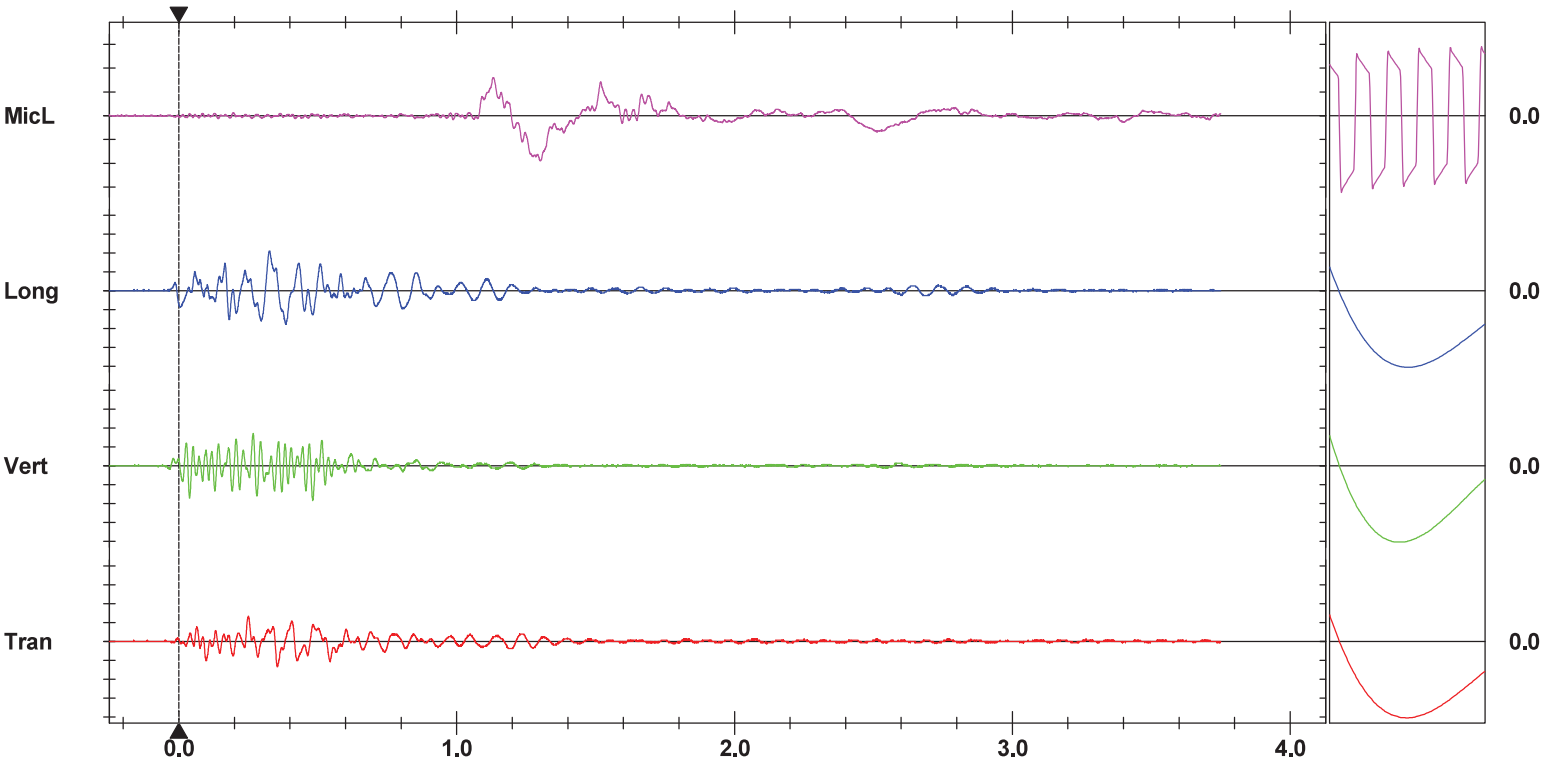
Extended Notes
In front Yard by tree stump
N-43.40245, W-79.87814

Microphone	Linear Weighting
PSPL	119.6 dB(L) at 1.301 sec
ZC Freq	2.0 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 562 mv)

	Tran	Vert	Long	
PPV	2.667	3.683	4.191	mm/s
ZC Freq	25	33	10.7	Hz
Time (Rel. to Trig)	0.250	0.482	0.325	sec
Peak Acceleration	0.053	0.106	0.106	g
Peak Displacement	0.030	0.018	0.057	mm
Sensor Check	Check	Check	Check	
Frequency	2.2	2.2	2.2	Hz
Overswing Ratio	226.0	174.0	247.0	

Peak Vector Sum 4.814 mm/s at 0.482 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	MicL at 11:09:17 May 28, 2019
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.117 sec (Auto=5Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.8 Volts
Unit Calibration	January 15, 2019 by Instantel
File Name	UM6857_20190528110917.IDFW

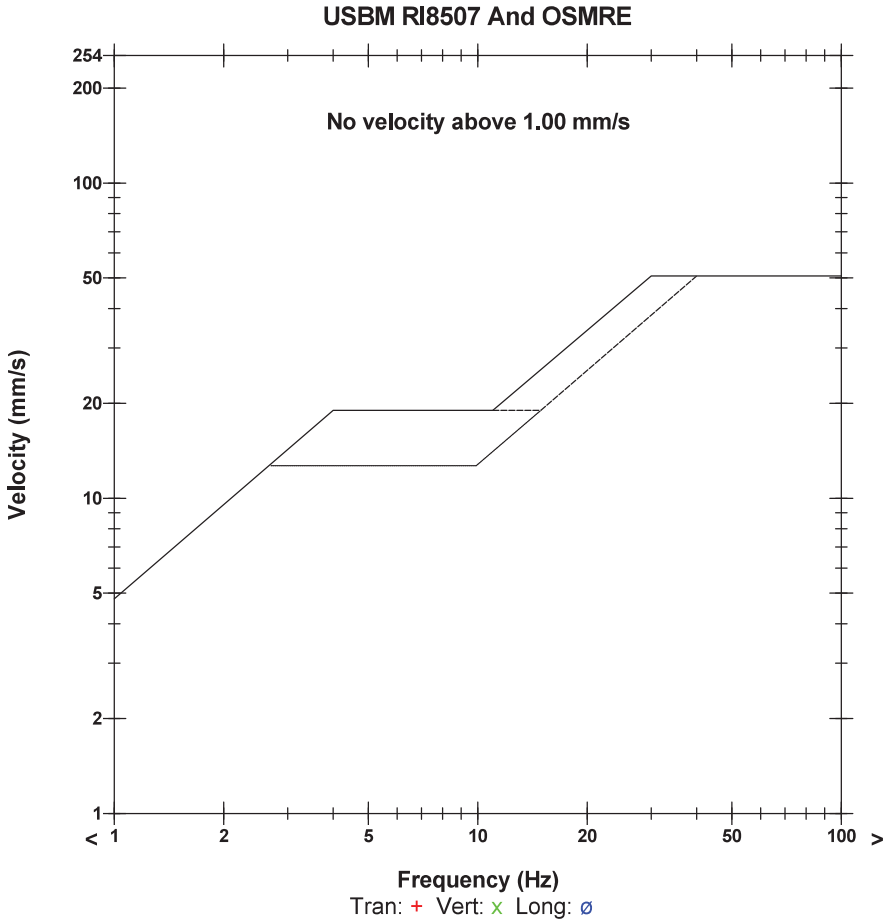
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

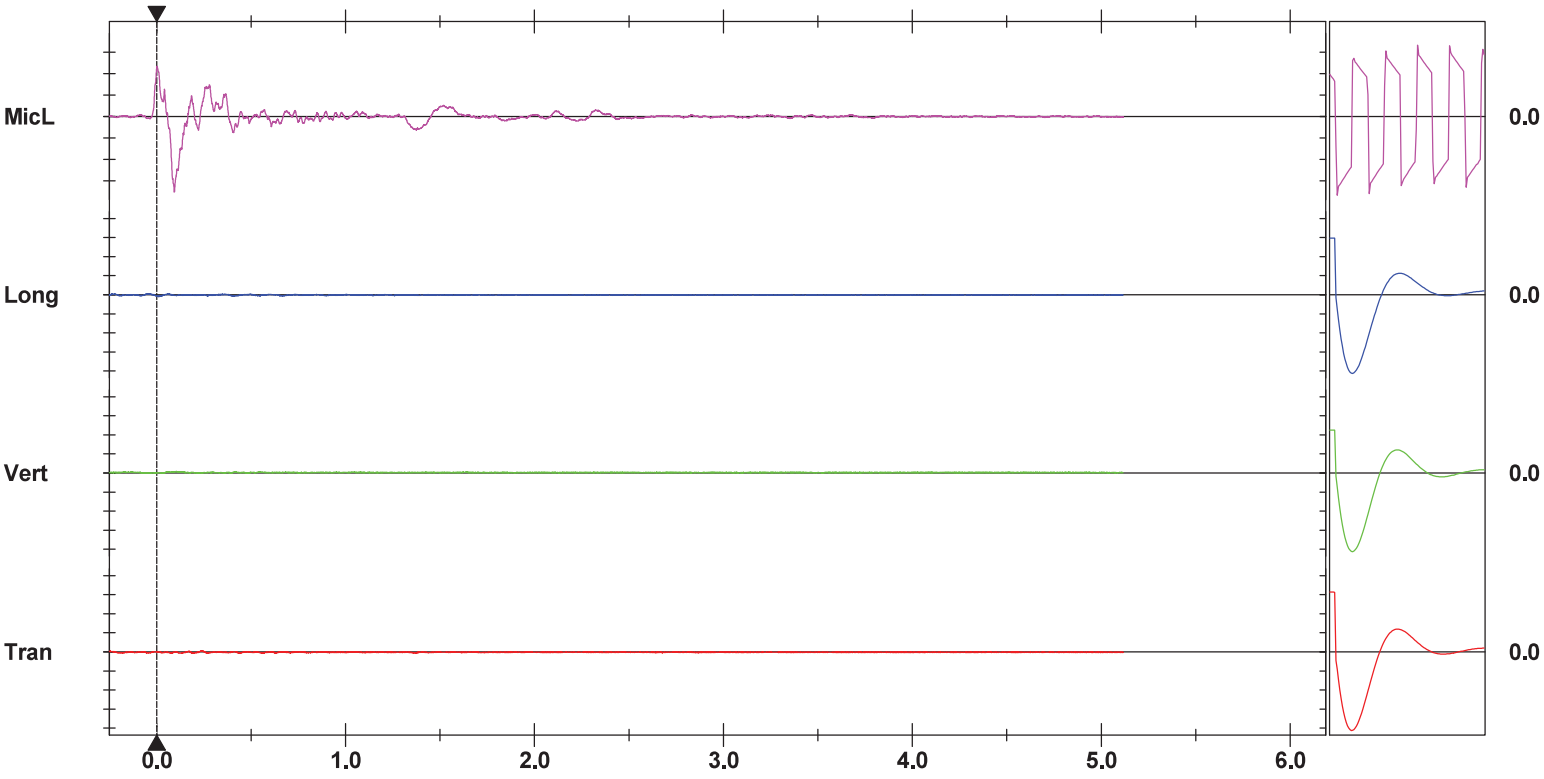
Extended Notes
N 43.31617
W 80.02664

Microphone	Linear Weighting
PSPL	118.9 dB(L) at 0.093 sec
ZC Freq	4.7 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1541 mv)

	Tran	Vert	Long	
PPV	0.142	0.166	0.197	mm/s
ZC Freq	9.6	3.0	8.8	Hz
Time (Rel. to Trig)	0.124	0.103	0.008	sec
Peak Acceleration	0.012	0.010	0.015	g
Peak Displacement	0.026	0.034	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.4	3.6	

Peak Vector Sum 0.202 mm/s at 0.008 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

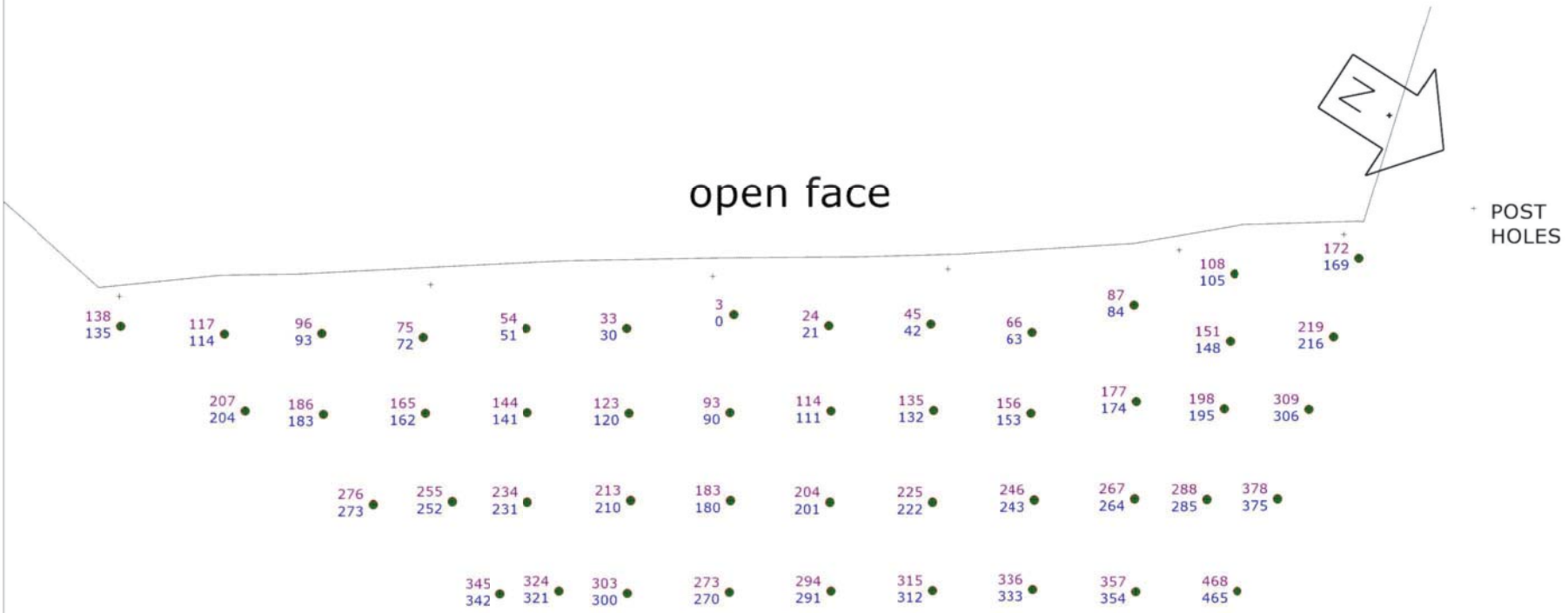
Nelson Aggregate
Across rod from 2102 Road 2
Burlington 2019-05-28 Blast 19-005

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
---	---	SERIAL NUMBER: UM6859
May 28 /19 05:53:15		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
May 28 /19 05:53:15	May 28 /19 11:40:31	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic:

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 47	Hole angle: 0.0°
Total drilled: 2994.8ft			



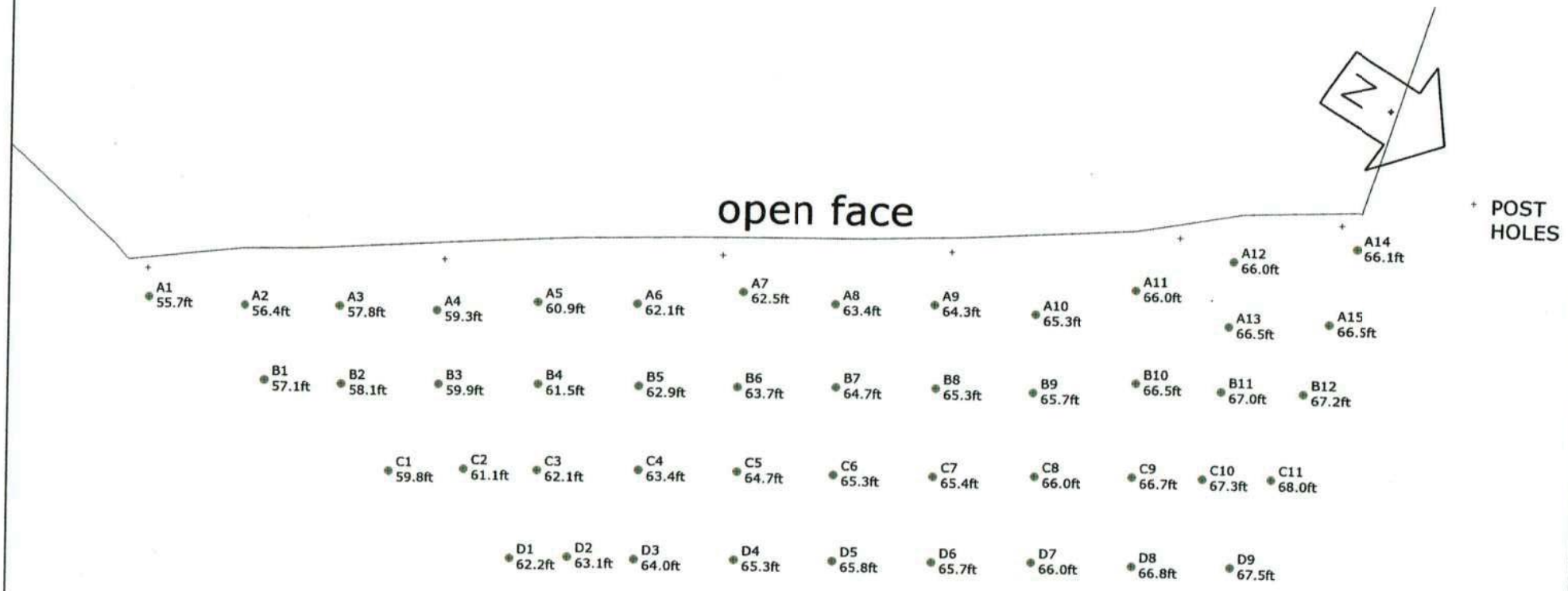
Not to scale

SHOTPlus™ Professional 5.7.4.4	5/28/2019
Mine	Burlington
Location	N E CRNR NEXT TO UPPER MIDDLE
Title/author	9NECRNR005 Design Partial
Filename	Burlington 2019-05-28 Blast 19-005 Upper Mid

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 47	Hole angle: 0.0°
Total drilled: 2994.8ft			



9NECRNR005 Design Fnl -3.625 and 4" Blast Holes 12x10 9x10 270.25 a

DRILLER NAME: _____

GREEN MARKER STONES 3.625" Blast Holes

ORICA

Not to scale

SHOTPlus™ Professional 5.7.4.4	5/27/2019
Mine	Burlington
Location	N E CRNR NEXT TO UPPER MIDDLE
Title/author	9NECRNR005 Design Partial
Filename	Burlington 2019-05-28 Blast 19-005 Upper Mid

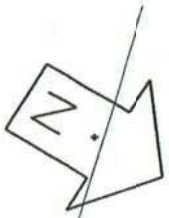
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 47	Hole angle: 0.0°
Total drilled: 2994.8ft			

Load Sheet
215Kg Max
open face

Ø = 3 5/8"



POST HOLES

159	173	181	156	161	180	184	185	190	197	195	190	182	
											152	144	
	176	160	163	179	184	191	196	194	192	191	192	189	
		168	187	186	190	190	197	187	190	192	146	193	
			181	142	184	194	194	179	193	193	185		

Not to scale

SHOTPlus™ Professional 5.7.4.4	5/27/2019
Mine	Burlington
Location	N E CRNR NEXT TO UPPER MIDDLE
Title/author	9NECRNR005 Design Partial
Filename	Burlington 2019-05-28 Blast 19-005 Upper Mid

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-007
P.O. #:		Orica Order #:	2480529
Blast Date:	2019-05-10	Blast Time:	12:55 PM

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40368 °N Latitude (Centre of Blast) 79.88238 °W Longitude (Centre of Blast)

Wind from the: W at 30 kph Temperature: 11 to 15 °C

		x		x			
Clear:		Rain:		Overcast:	x		
Partly Cloudy:		Snow:		Inversion:		Ceiling	2,434 ft

Tonnes Blasted:	40,349 te	15,519 m3
Total tonnes per day:	40,349 te	NF-02 Rate Code
Total Holes Loaded:	280 holes	
… including:		Dead Holes
… and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	13 rows	

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 283	=	4,188.4 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,110	27,740	6,370

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	5	5	0

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	280	95.2

total explosives weight in Blast (kg): 6,465

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 9m		25/500	280
CONNECTADET 9M		25 ms	1
CONNECTADET 9M		42 ms	26

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	7.5
HELPER HOURS	Enter total Helper man-hours	13.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0

Theoretical PF (Based on a single hole)

# Holes:	280	holes
- Pattern (Front Row)-		
Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	4	front row
- Pattern (Main Body) -		
Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	276	main body
Bench Height:	14.8	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	14.8	ft avg
- Stone Decking -		
Front Row:		ft avg
Main Body:		ft avg
# Decks:	0	per blast
- Collar Stemming -		
Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	3/4" Stone	
- Charge Length -		
Front Row:	7.8	ft avg
Main Body:	7.8	ft avg
- Charge Weight -		
Front Row:	22.7	kg/hole
Main Body:	22.7	kg/hole
Max. per delay:	42.0	kg/delay
SD () Equation:	151.3	kg/delay
Total kg Loaded:	6,465	kg
Rock Density:	2.60	g/cc = te/m3

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

0.702 lb/yd3	Yield PF:	0.160	kg/te (actual)
0.692 lb/yd3	Front row:	0.158	kg/te (theoretical)
0.692 lb/yd3	Main Body:	0.158	kg/te (theoretical)
0.692 lb/yd3	"KPI" PF:	0.158	kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Holes B7, B8, B9, where taken out of the shot due to being caved in before loading.

helper hours: 6.5 hours x 2

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-007
P.O. #:		Orica Order #:	2480529
Blast Date:	2019-05-10	Blast Time:	12:55 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40368	79.88241	0.757537	1.394211
Front Row Corner	43.40387	79.88250	0.757540	1.394213
Back Row Corner	43.40348	79.88223	0.757534	1.394208
Average (Centre of Blast)	43.40368	79.88238	0.757537	1.394211

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	369.0	m				
Post Blast Data: ppV:	did	mm/s	Trigger set at:	2.0	mm/s	
frequency:	not	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	trigger	dB	Trigger set at:	115	dB	

2450 2nd Line

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	976.5	m				
Post Blast Data: ppV:	did	mm/s	Trigger set at:	2.0	mm/s	
frequency:	not	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	trigger	dB	Trigger set at:	115	dB	

Colling Rd & Blind Line Bruce Trail

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	0.0	m				
Post Blast Data: ppV:	0.0	mm/s	Trigger set at:	2.0	mm/s	
frequency:	0.0	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	0.0	dB	Trigger set at:	115	dB	

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(369)^2}{30^2} \text{ kg}$$

$$= \frac{136{,}161}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 151 kg

jim bray

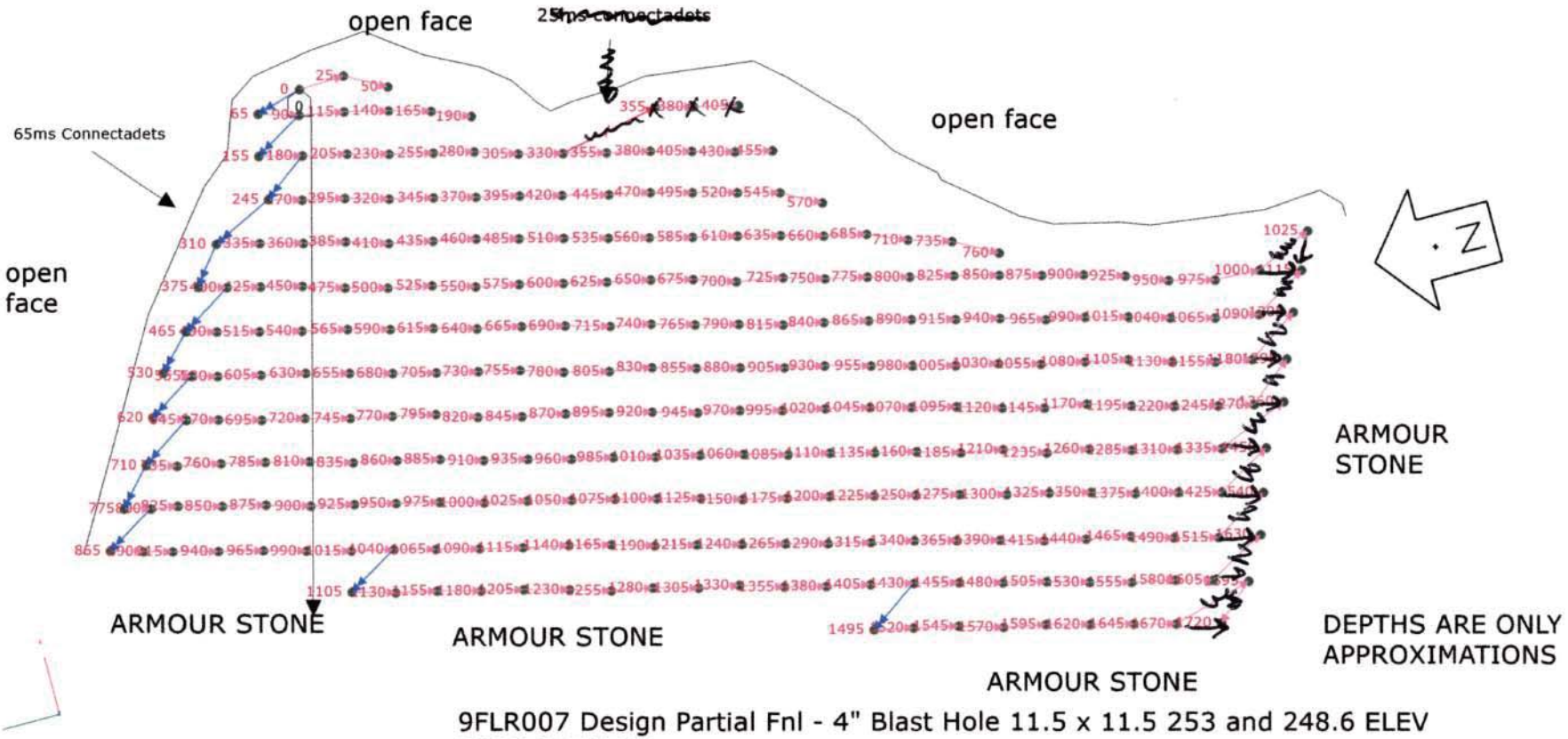
Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 283	Hole angle: 0.0°
Total drilled: 4211.9ft			



9FLR007 Design Partial Fnl - 4" Blast Hole 11.5 x 11.5 253 and 248.6 ELEV

DRILLER NAME: _____

DRILL TO SHALE

ORICA

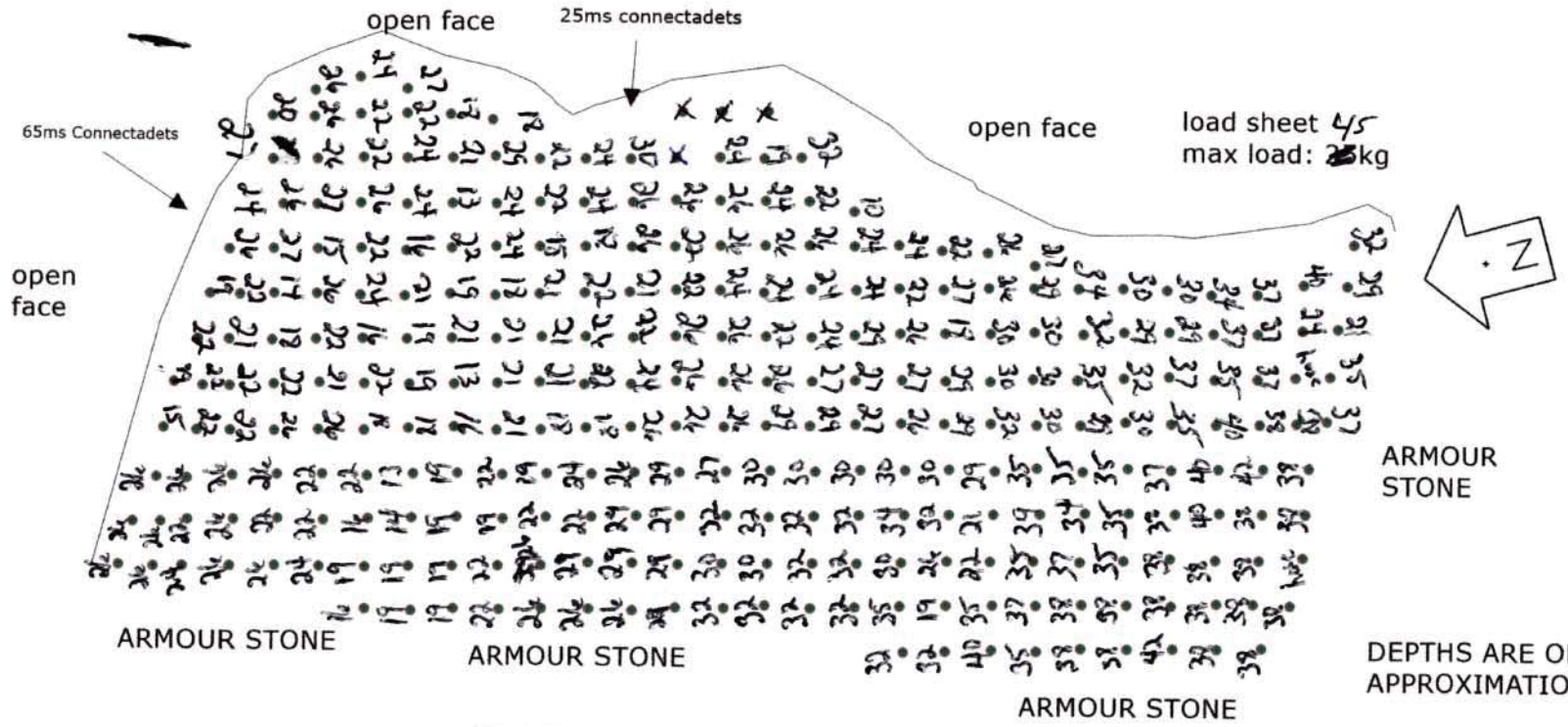
Not to scale

SHOTPlus™ Professional 5.7.6.1		5/9/2019
Mine	Burlington	
Location	FLOOR SHOT NEXT TO 9FLR004	
Title/author	9FLR007 Partial Design Fnl	
Filename	Burlington 2019-05-10 Blast 19-007 Floor.spf	

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 283	Hole angle: 0.0°
Total drilled: 4211.9ft			



9FLR007 Design Partial Fnl - 4" Blast Hole 11.5 x 11.5 253 and 248.6 ELEV

DRILLER NAME:_____

DRILL TO SHALE

ORICA

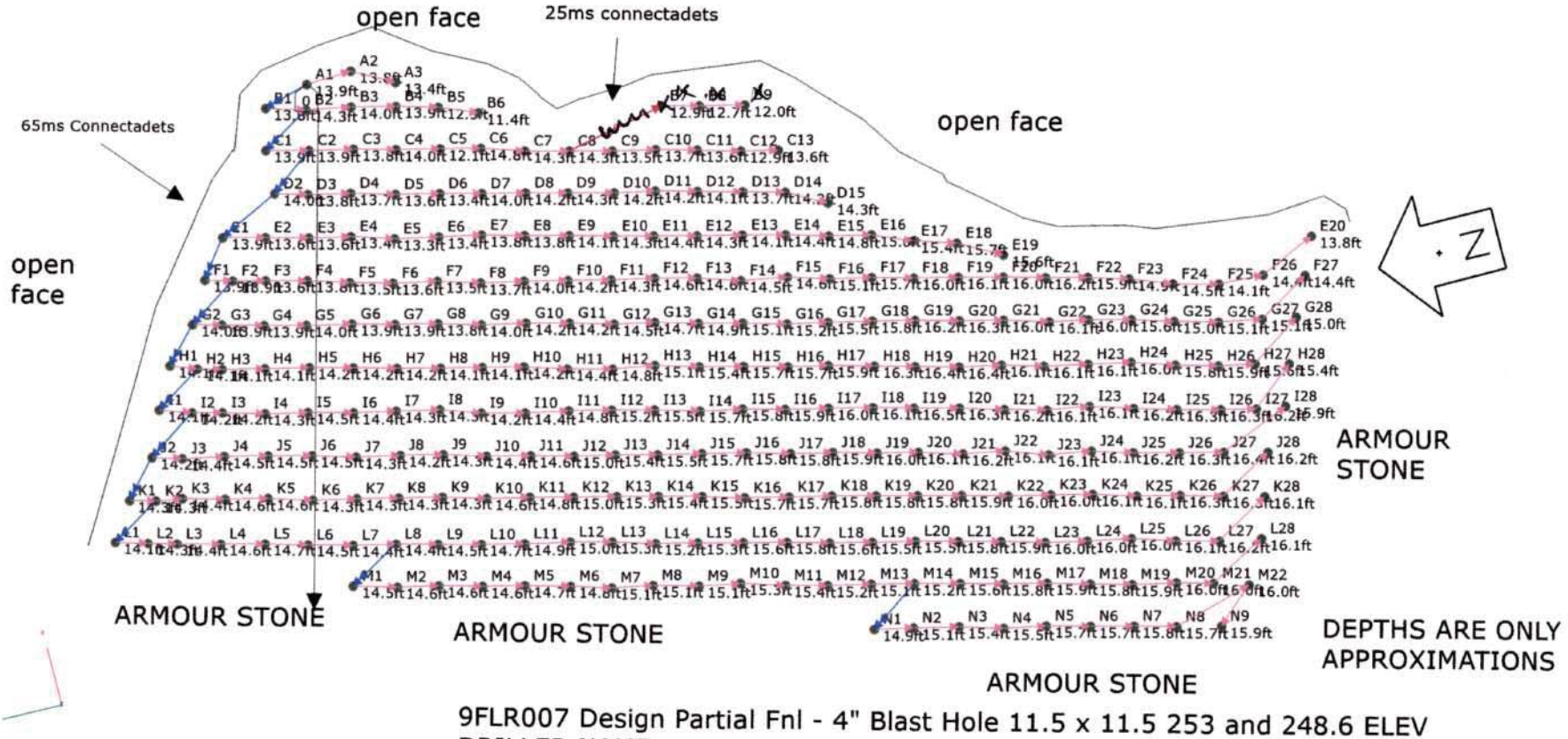
Not to scale

SHOTPlus™ Professional 5.7.6.1		5/9/2019
Mine	Burlington	
Location	FLOOR SHOT NEXT TO 9FLR004	
Title/author	9FLR007 Partial Design Fnl	
Filename	Burlington 2019-05-10 Blast 19-007 Floor.spf	

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 283	Hole angle: 0.0°
Total drilled: 4211.9ft			



9FLR007 Design Partial Fnl - 4" Blast Hole 11.5 x 11.5 253 and 248.6 ELEV

DRILLER NAME: _____

DRILL TO SHALE

Not to scale

SHOTPlus™ Professional 5.7.6.1		5/9/2019
Mine	Burlington	
Location	FLOOR SHOT NEXT TO 9FLR004	
Title/author	9FLR007 Partial Design Fnl	
Filename	Burlington 2019-05-10 Blast 19-007 Floor.spf	

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2019-05-10

Blast Number: 19-007
Orica Order #:

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40368 °N Latitude (Centre of Blast) 79.88238 °W Longitude (Centre of Blast)

Design te Blasted:	35,821	te
Total Holes Loaded:	283	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	13	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 283	=	4,245.0 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	7	front row

- Design Pattern (Main Body) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	276	main body
Bench Height:	13.0	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	15.0	ft avg

- Design Stone Decking -

Front Row:		ft avg
Main Body:		ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	3/4" Clear	

Bulk Expl. Required:

		kg
CENTRA GOLD 70		8,000

Pkgd Expl. Required:

		kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	283	96.2

total explosives weight in Blast (kg): 8,096
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
EXEL HANDIDET 9m		283
UNITRONIC 600 6M		1
CONNECTADET 9M	65 ms	27

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row:	8.0 ft avg
Main Body:	8.0 ft avg

- Design Charge Weight -

Front Row:	23.3 kg/hole
Main Body:	23.3 kg/hole
Max Chge Wt / delay:	25.0 kg/delay

Required kg Loaded:	8,096	kg
Rock Density:	2.60	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.226	kg/te (actual)
0.808 lb/yd³	Front row:	0.184	kg/te (theoretical)
0.808 lb/yd³	Main Body:	0.184	kg/te (theoretical)
0.808 lb/yd³	"KPI" PF:	0.184	kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

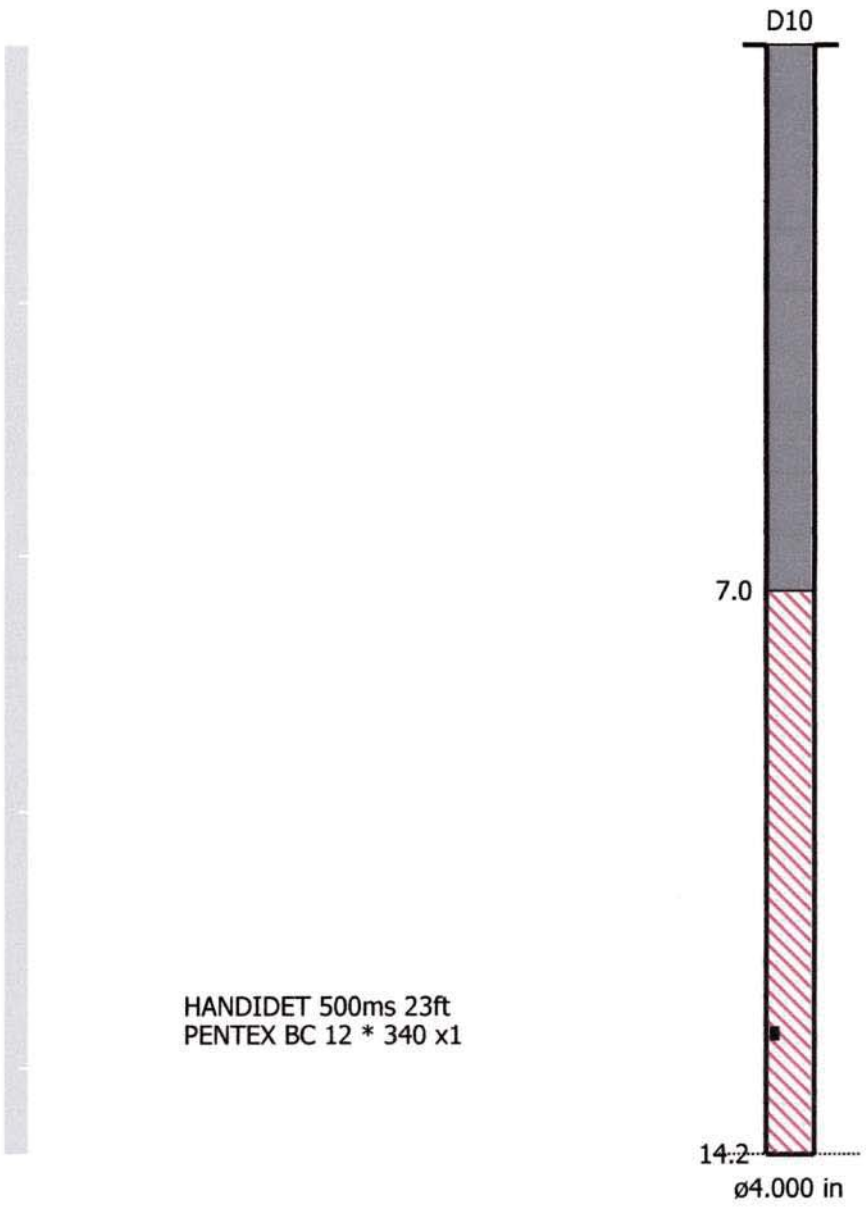
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-007
P.O. #:		Orica Order #:	
Blast Date:	5/10/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Kevin Toplis

Quarry Manager: Nick Heap

Signature required, indicating sign off on Blast Design

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-008
P.O. #:		Orica Order #:	2488743
Blast Date:	2019-05-30	Blast Time:	11:55 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40286 °N Latitude (Centre of Blast) 79.88663 °W Longitude (Centre of Blast)

Wind from the: W at 10 kph Temperature: 16 to 20 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 23,061 ft

Tonnes Blasted:	40,960 te	15,754 m3
Total tonnes per day:	40,960 te	NF-02 (Rate Code)
Total Holes Loaded:	227 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	18 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	229	=	4,243.8 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	26,810	19,270	7,540

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	227	77.2

total explosives weight in Blast (kg): 7,617

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 9m		25/500	227
CONNECTADET 9M		65 ms	18

Cord & Accessories:

	U of M	# used
	units	
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0

Theoretical PF (Based on a single hole)

# Holes:	20	front row
- Pattern (Main Body) -		
Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	207	main body
Bench Height:	18.5	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	18.5	ft avg
- Stone Decking -		
Front Row:		ft avg
Main Body:		ft avg
# Decks:		per blast
- Collar Stemming -		
Front Row:	8.0	ft avg
Main Body:	8.0	ft avg
Material used:	1/2" Clear	
- Charge Length -		
Front Row:	10.5	ft avg
Main Body:	10.5	ft avg
- Charge Weight -		
Front Row:	30.7	kg/hole
Main Body:	30.7	kg/hole
Max. per delay:	45.0	kg/delay
SD () Equation:	526.2	kg/delay
Total kg Loaded:	7,617	kg
Rock Density:	2.60	g/cc = te/m^3

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

0.815 lb/yd^3	Yield PF:	0.186	kg/te (actual)
0.746 lb/yd^3	Front row:	0.170	kg/te (theoretical)
0.746 lb/yd^3	Main Body:	0.170	kg/te (theoretical)
0.746 lb/yd^3	"KPI" PF:	0.170	kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-008
P.O. #:		Orica Order #:	2488743
Blast Date:	2019-05-30	Blast Time:	11:55 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40292	79.88668	0.757524	1.394286
Front Row Corner	43.40298	79.88617	0.757525	1.394277
Back Row Corner	43.40269	79.88704	0.757520	1.394292
Average (Centre of Blast)	43.40286	79.88663	0.757523	1.394285

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	688.2	m				
Post Blast Data: ppV:	1.3	mm/s	Trigger set at:	2.0	mm/s	
frequency:	35.0	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	104.2	dB	Trigger set at:	115	dB	

2450 2nd Line

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	1068.8	m				
Post Blast Data: ppV:	Did	mm/s	Trigger set at:	2.0	mm/s	
frequency:	Not	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	Trigger	dB	Trigger set at:	115	dB	

SouthWest Corner of Property

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	0.0	m				
Post Blast Data: ppV:	0.0	mm/s	Trigger set at:	2.0	mm/s	
frequency:	0.0	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)	
air overpressure:	0.0	dB	Trigger set at:	115	dB	

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(688.2)^2}{30^2} \text{ kg}$$

$$= \frac{473{,}619}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 526 kg

jim bray

Orica
Blaster-in-charge:

Signature required, indicating that
Blast Report is Complete & Accurate.

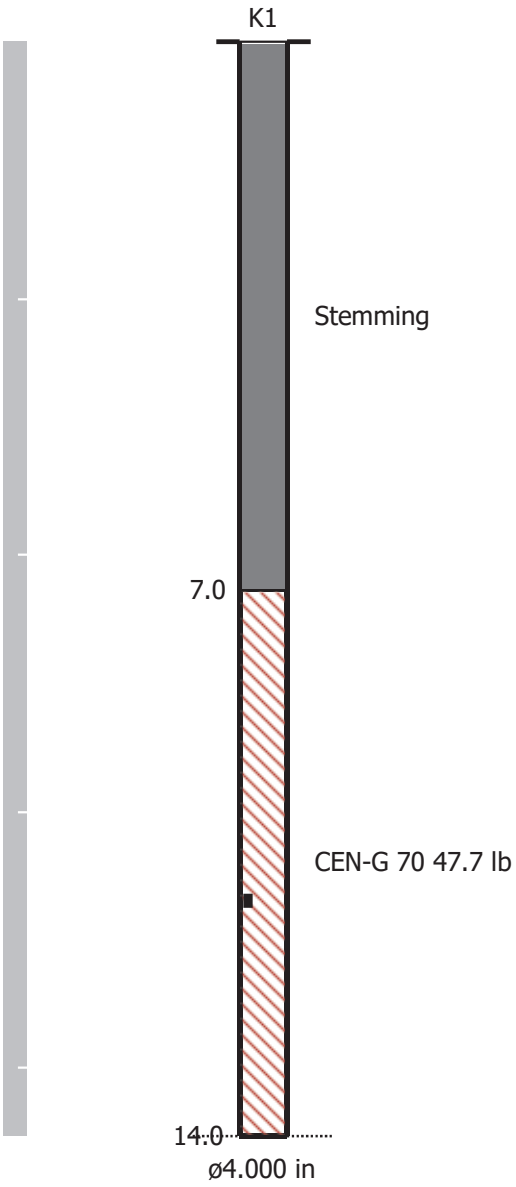
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-008
P.O. #:		Orica Order #:	2488743
Blast Date:	5/30/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nick Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 11:55:15 May 30, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.0 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 Line 2
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

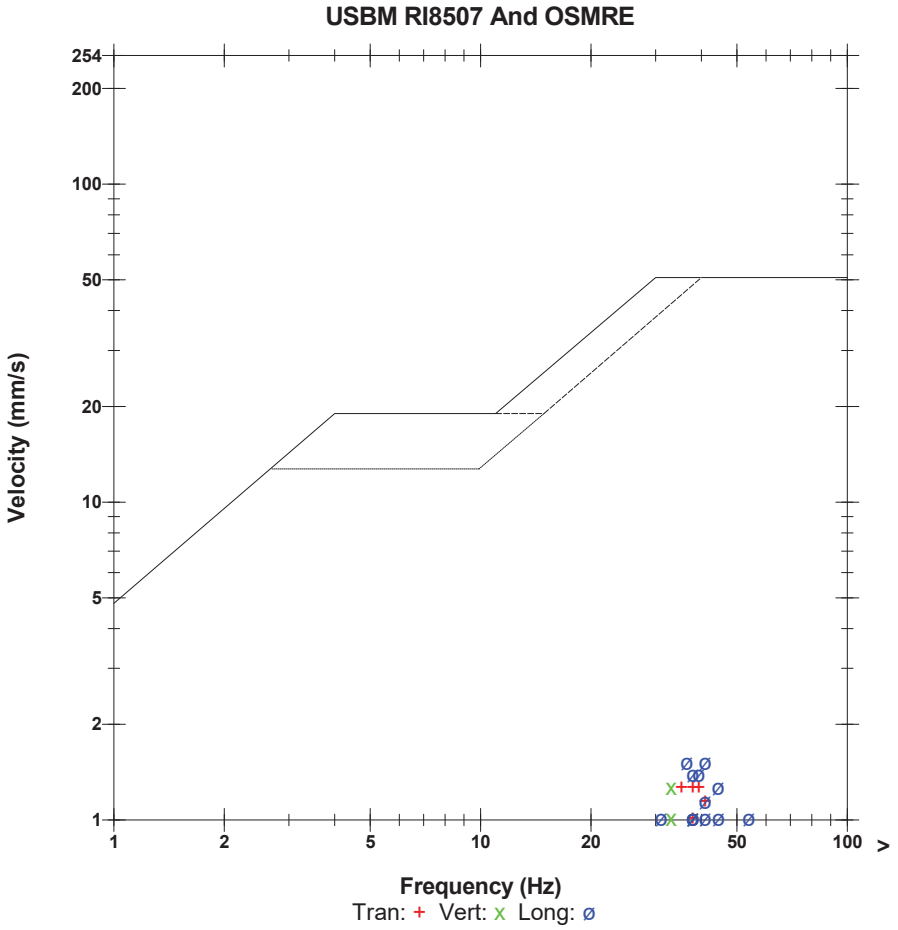
Extended Notes

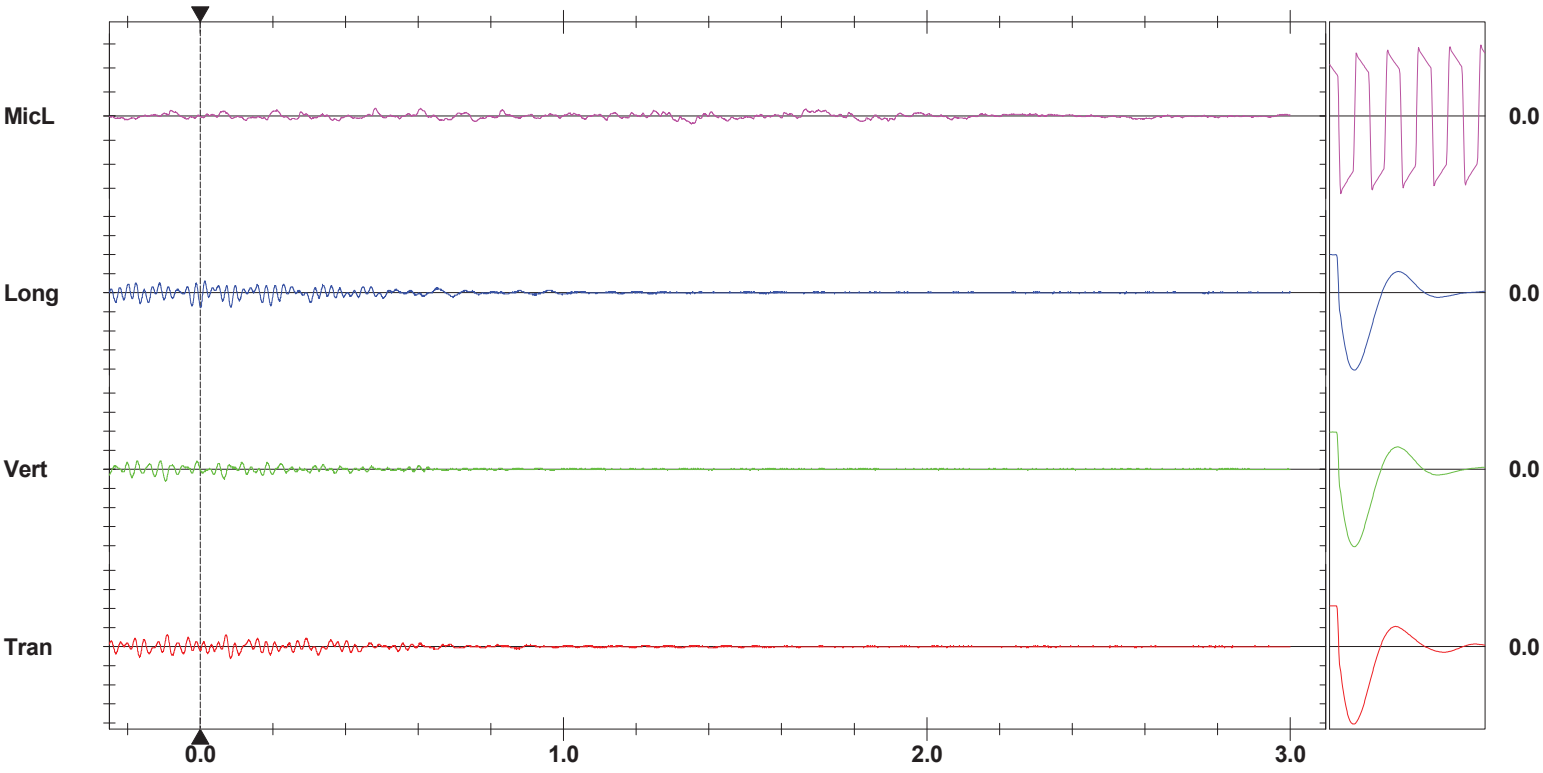
In front Yard by tree stump
N-43.40245, W-79.87814

Microphone	Linear Weighting
PSPL	104.2 dB(L) at 0.481 sec
ZC Freq	20 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 566 mv)

	Tran	Vert	Long	
PPV	1.270	1.270	1.524	mm/s
ZC Freq	35	33	41	Hz
Time (Rel. to Trig)	-0.092	-0.096	0.000	sec
Peak Acceleration	0.053	0.053	0.053	g
Peak Displacement	0.006	0.006	0.007	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.3	Hz
Overswing Ratio	3.9	3.5	3.7	

Peak Vector Sum 2.020 mm/s at 0.083 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Nelson Aggregate
Across rod from 2102 Road 2
Burlington 2019-05-30 Blast 19-008 Floor

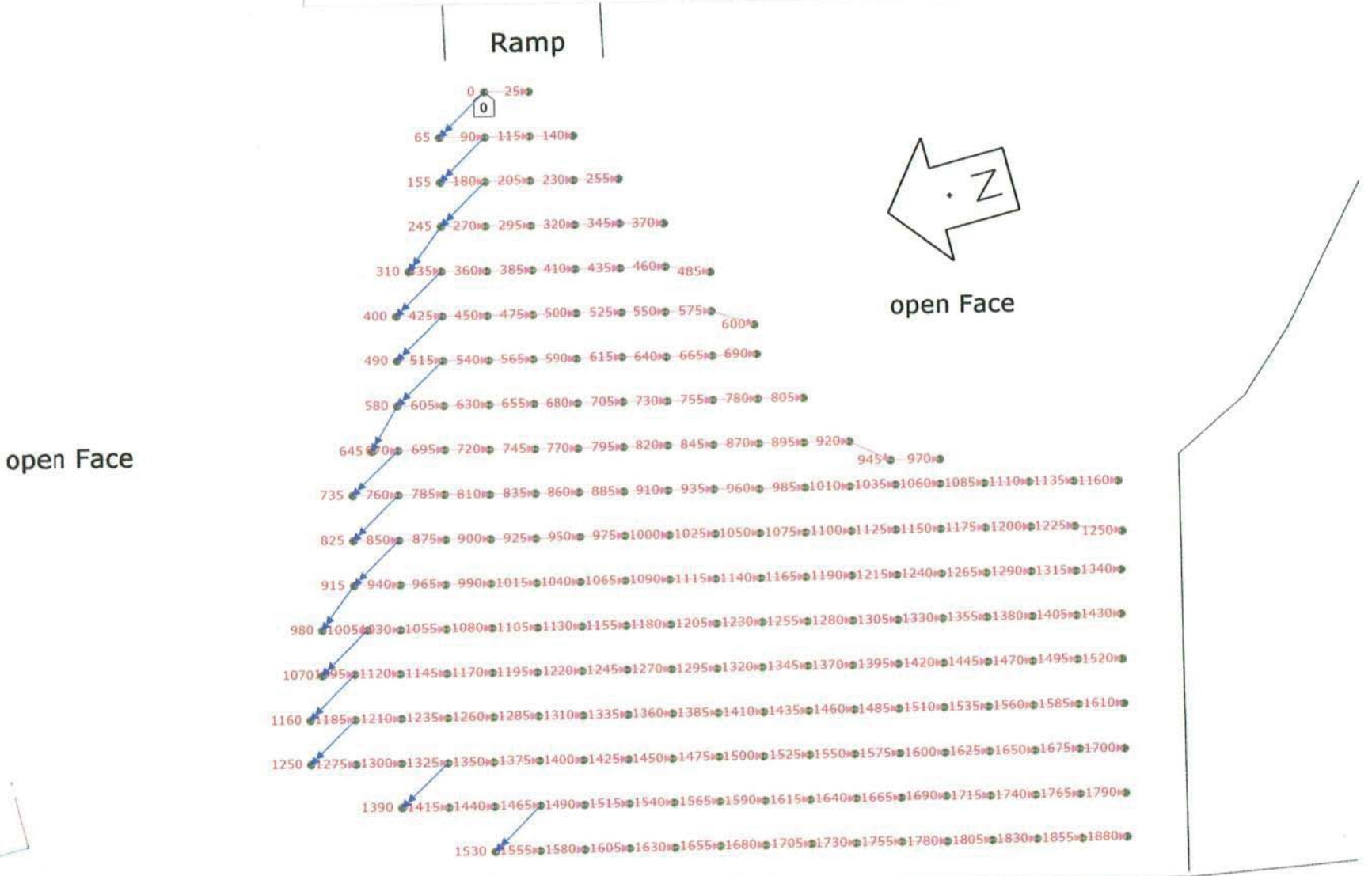
Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6859
May 30 /19 05:22:36		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
May 30 /19 05:22:36	May 30 /19 12:21:22	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic:

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 229	Hole angle: 0.0°
Total drilled: 3206.0ft			



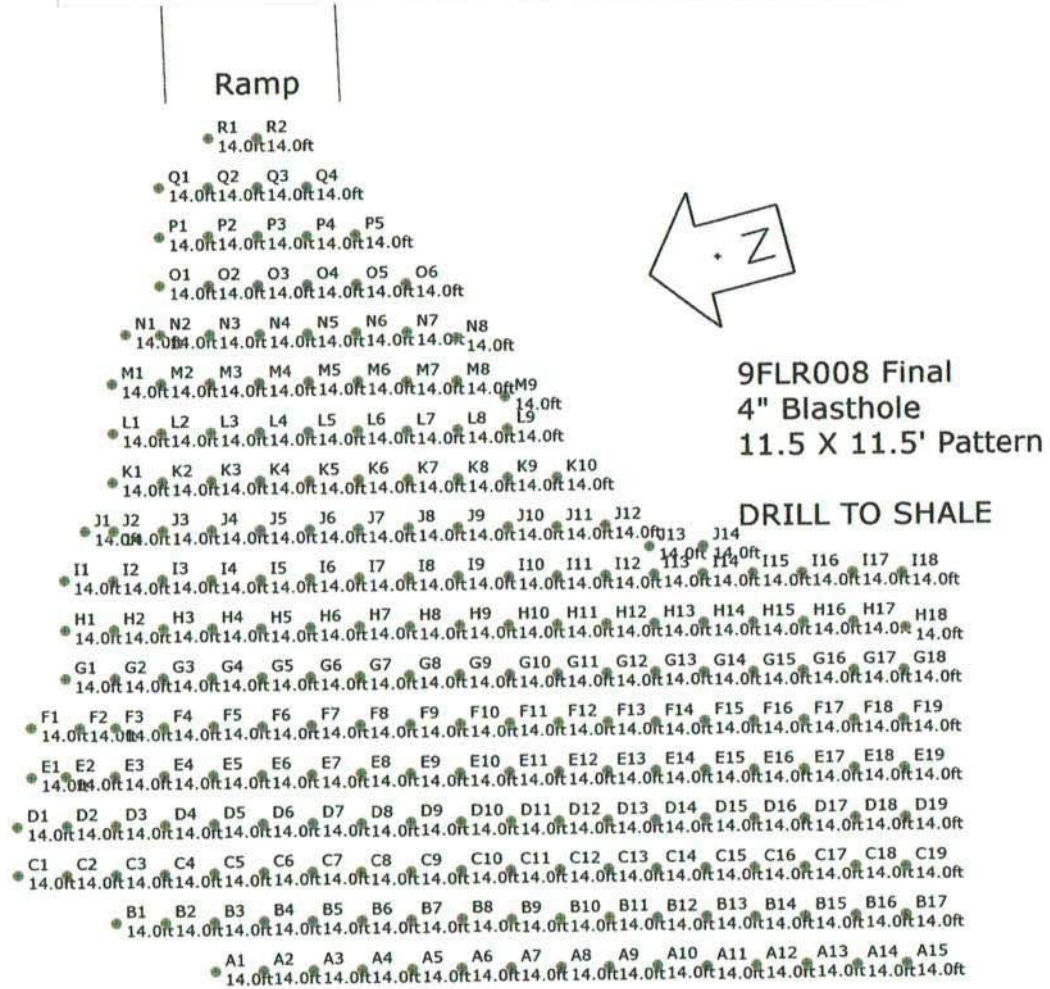
Not to scale

SHOTPlus™ Professional 5.7.4.4		5/29/2019
Mine	Burlington	
Location		
Title/author	9FLR008 Final	
Filename	Burlington 2019-05-30 Blast 19-008 Floor.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 229	Hole angle: 0.0°
Total drilled: 3206.0ft			



ORICA

Not to scale

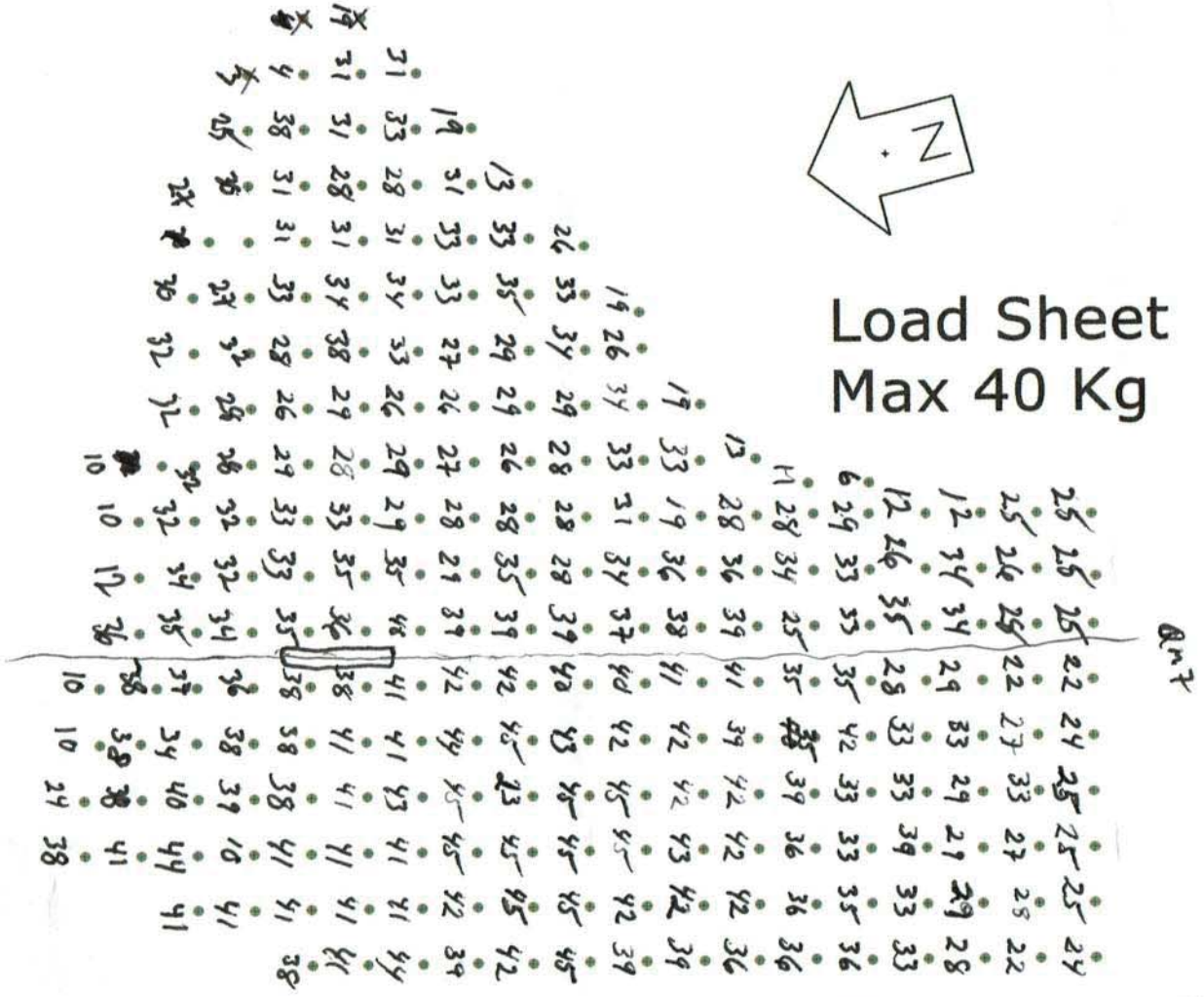
SHOTPlus™ Professional 5.7.4.4		5/29/2019
Mine	Burlington	
Location		
Title/author	9FLR008 Final	
Filename	Burlington 2019-05-30 Blast 19-008 Floor.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 229	Hole angle: 0.0°
Total drilled: 3206.0ft			

Ramp



Road

Not to scale

SHOTPlus™ Professional 5.7.4.4		5/29/2019
Mine	Burlington	
Location		
Title/author	9FLR008 Final	
Filename	Burlington 2019-05-30 Blast 19-008 Floor.spf	

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-009
P.O. #:		Orica Order #:	2491485
Blast Date:	2019-06-06	Blast Time:	12:07 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40361 °N Latitude (Centre of Blast) 79.88191 °W Longitude (Centre of Blast)

Wind from the: S at kph Temperature: 16 to 20 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling 3,169 ft

Tonnes Blasted:	27,603 te	10,616 m3
Total tonnes per day:	27,603 te	NB80-01 Rate Code
Total Holes Loaded:	53 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	19 front row	
- Pattern (Main Body) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	34 main body	
Bench Height:	70.2 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	72.2 ft avg	
- Stone Decking -		
Front Row:	8.0 ft avg	
Main Body:	0.0 ft avg	
# Decks:	2 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	57.2 ft avg	
Main Body:	65.2 ft avg	
- Charge Weight -		
Front Row:	166.8 kg/hole	
Main Body:	190.1 kg/hole	
Max. per delay:	230.0 kg/delay	
SD () Equation:	122.0 kg/delay	
Total kg Loaded:	11,951 kg	
Rock Density:	2.60 g/cc = te/m3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Drilling Information -

				Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	# Holes:	52	=	3,754.9 ft	(4 " diam)
Secondary Bit diam:	92.1	mm	# Holes:	1	=	72.2 ft	(3 5/8 " diam)
Tertiary Bit diam:		mm	# Holes:		=	0.0 ft	(" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,970	22,050	11,920

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	55	12.5
PENTEX 12 (OR EQUIVALENT)	0.34	55	18.7

total explosives weight in Blast (kg): 11,951

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			53
UNITRONIC 600 20M			2
UNITRONIC 600 25M			55

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	5.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

- Powder Factor -

1.897 lb/yd3	Yield PF:	0.433 kg/te (actual)
1.179 lb/yd3	Front row:	0.269 kg/te (theoretical)
1.791 lb/yd3	Main Body:	0.409 kg/te (theoretical)
1.587 lb/yd3	"KPI" PF:	0.362 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

2 Stone decks were added due to voids identified on drill log

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-009
P.O. #:		Orica Order #:	2491485
Blast Date:	2019-06-06	Blast Time:	12:07 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40362**	**79.88191**	0.757536	1.394202
Front Row Corner	43.40341	79.88199	0.757532	1.394204
Back Row Corner	43.40381	79.88183	0.757539	1.394201
Average (Centre of Blast)	43.40361	79.88191	0.757536	1.394202

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**331.4**	m			
Post Blast Data: ppV:	**9.7**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**11.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**116.9**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**1014.8**	m			
Post Blast Data: ppV:	**0.2**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**15.5**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**121.7**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1267.4**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(331.4)^2}{30^2} \text{ kg}$$

$$= \frac{109{,}826}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 122 kg

jim bray

Orica
Blaster-in-charge: *Mike derkinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

Event Report

Date/Time	Long at 12:07:12 June 6, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 #2 Sideroad
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

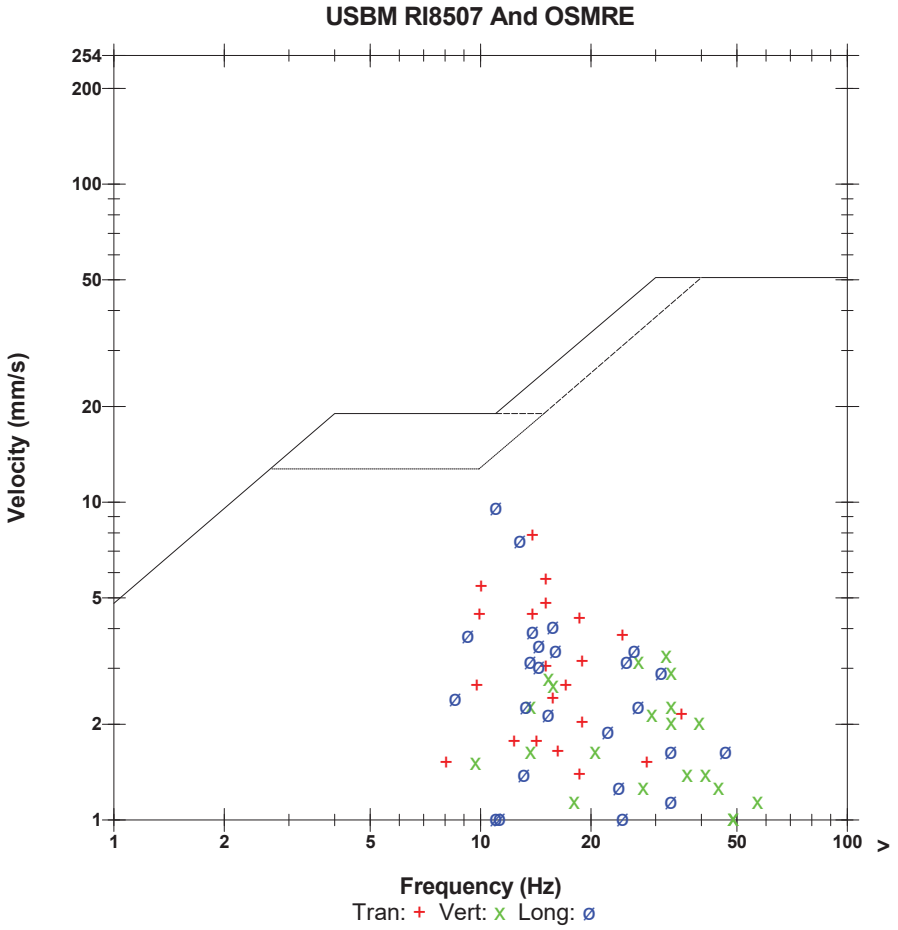
Extended Notes

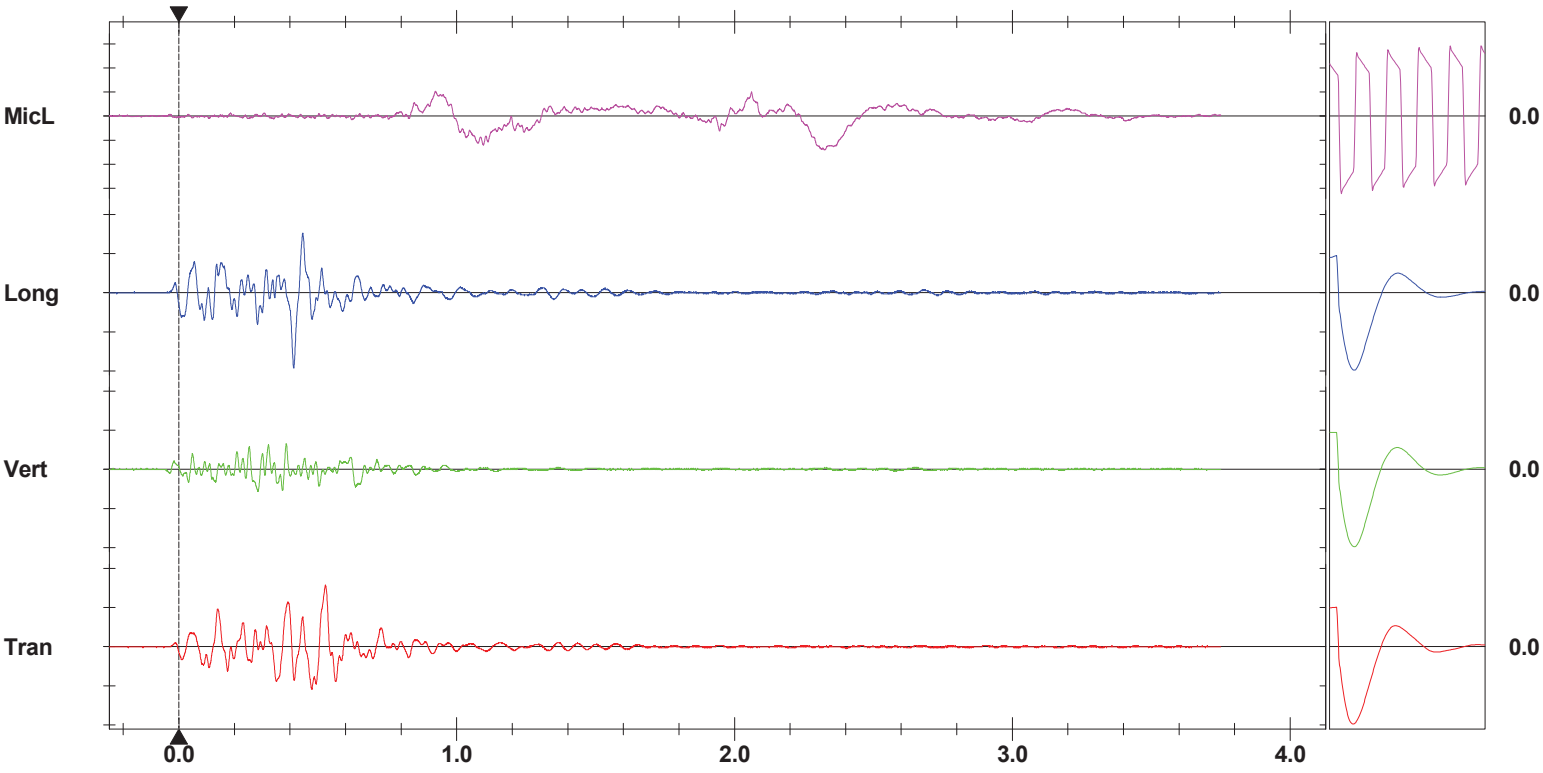
43.40245 -79.87814
Beside tree stump in front yard

Microphone	Linear Weighting
PSPL	116.9 dB(L) at 2.322 sec
ZC Freq	2.3 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 571 mv)

	Tran	Vert	Long	
PPV	7.874	3.302	9.652	mm/s
ZC Freq	13.8	32	11.0	Hz
Time (Rel. to Trig)	0.527	0.386	0.413	sec
Peak Acceleration	0.106	0.080	0.106	g
Peak Displacement	0.089	0.029	0.089	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.5	7.3	Hz
Overswing Ratio	3.8	3.6	4.0	

Peak Vector Sum 10.53 mm/s at 0.414 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time MicL at 12:07:14 June 6, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.353 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration January 15, 2019 by Instantel
File Name UM6857_20190606120714.IDFW

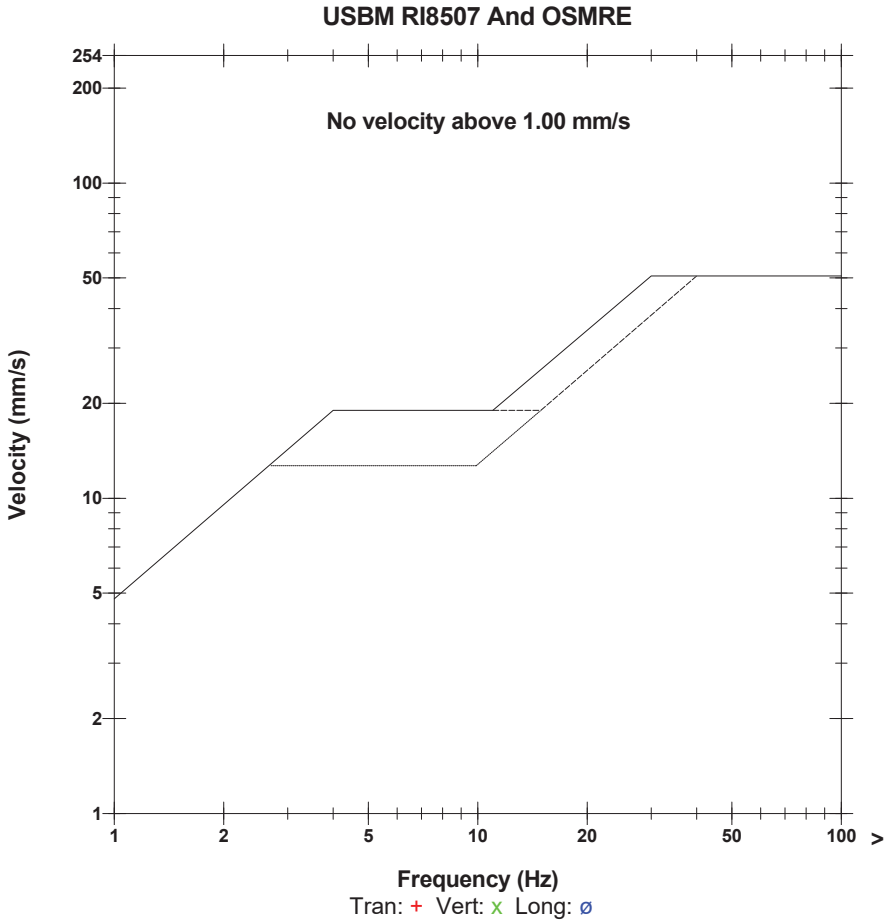
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

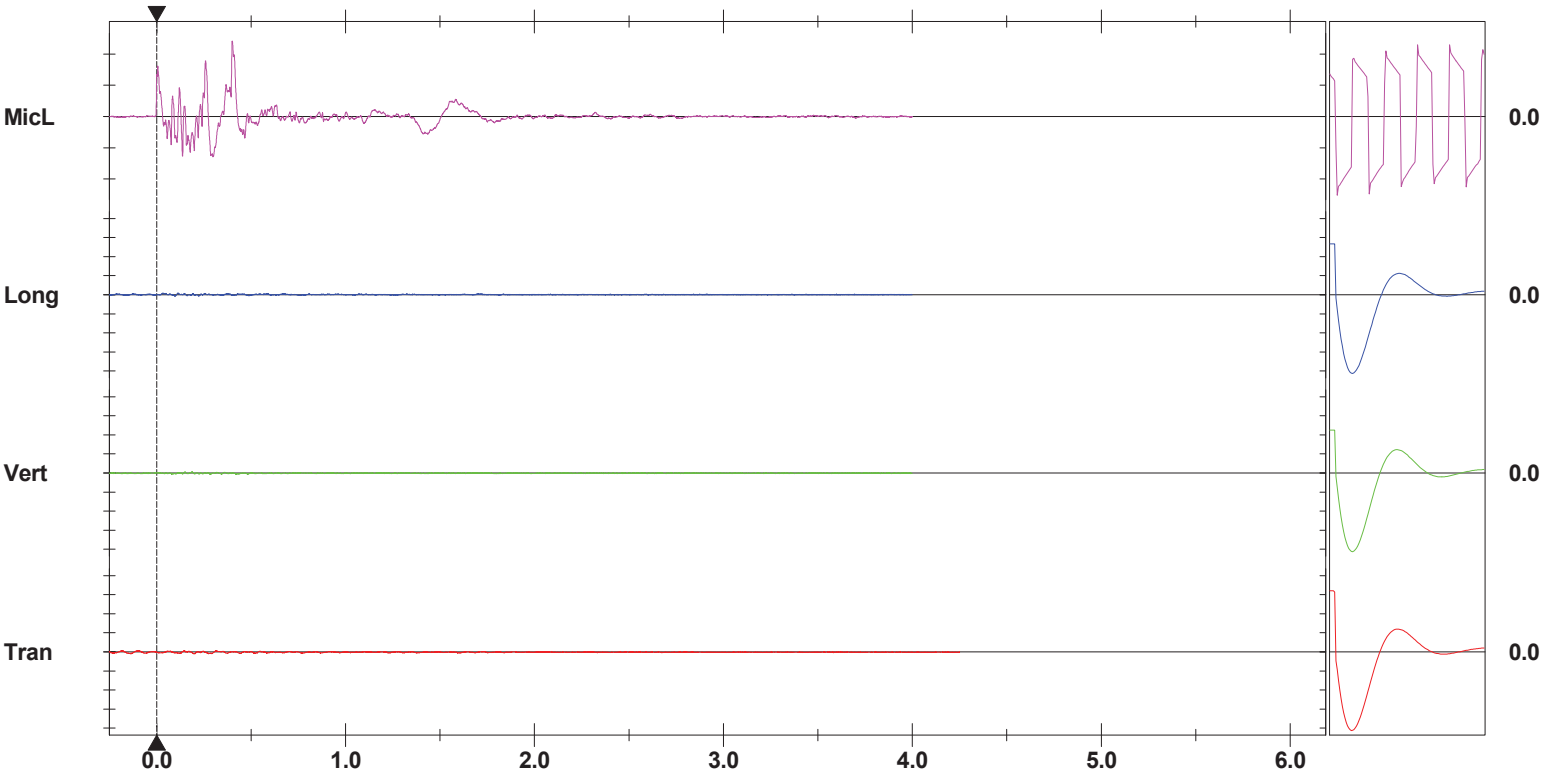
Extended Notes
N 43.31617
W 80.02664

Microphone Linear Weighting
PSPL 121.7 dB(L) at 0.400 sec
ZC Freq 5.6 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1345 mv)

	Tran	Vert	Long	
PPV	0.213	0.126	0.173	mm/s
ZC Freq	15.5	14.4	25	Hz
Time (Rel. to Trig)	0.200	0.081	0.114	sec
Peak Acceleration	0.010	0.012	0.016	g
Peak Displacement	0.009	0.002	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.4	3.7	

Peak Vector Sum 0.232 mm/s at 0.200 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Nelson Aggregate
SW Corner of Property
Burlington 2019-06-06 Blast 19-009 Upper Middle

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

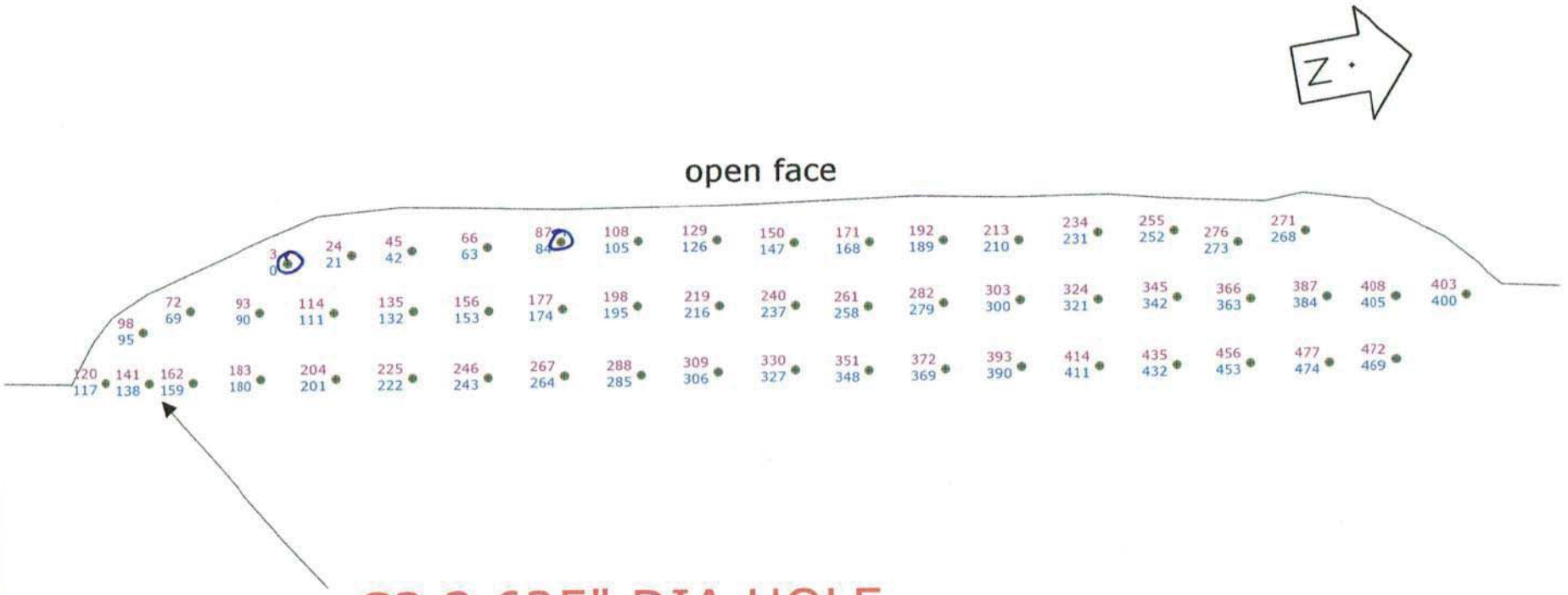
Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6859
Jun 6 /19 05:55:30		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jun 6 /19 12:29:39	Jun 6 /19 12:29:41	Event recorded. Trigger Level Long: 1.50 mm/s
Jun 6 /19 12:29:41	Jun 6 /19 12:29:49	Event recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 121.0 d

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 3827.1ft			

O = Deck



ORICA

Not to scale

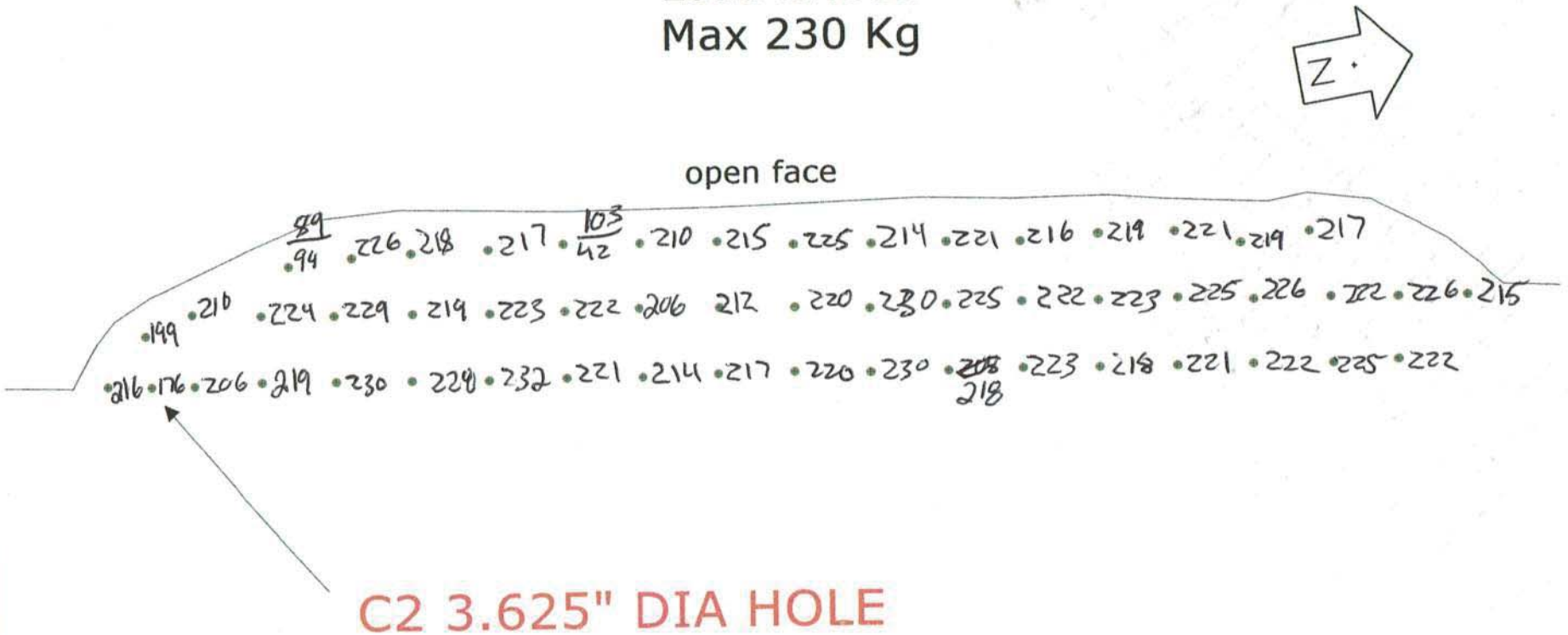
SHOTPlus™ Professional 5.7.4.4		6/5/2019
Mine	Burlington	
Location	UPPER MIDDLE	
Title/author	9UPMD009 Design Fnl	
Filename	Burlington 2019-06-06 Blast 19-009 Upper Mid	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 3827.1ft			

Load Sheet
Max 230 Kg



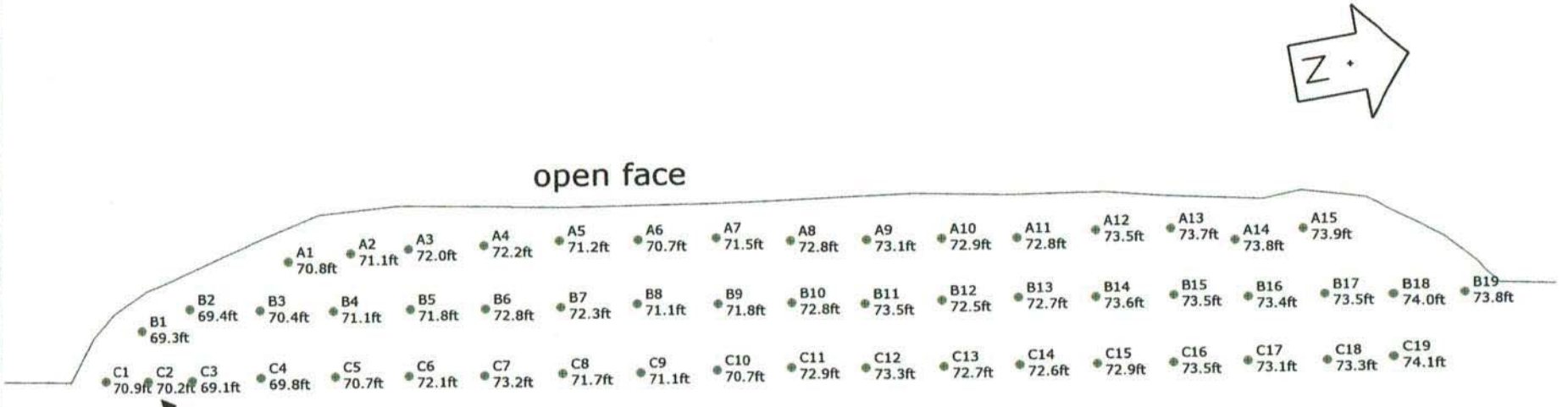
Not to scale

SHOTPlus™ Professional 5.7.4.4		6/5/2019
Mine	Burlington	
Location	UPPER MIDDLE	
Title/author	9UPMD009 Design Fnl	
Filename	Burlington 2019-06-06 Blast 19-009 Upper Mid	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 3827.1ft			



9UPMD009 Design Fnl - 3.625" and 4" Blast Holes 12x10 9x10 272 and 250 + .6 S

DRILLER NAME:_____

C2 3.625" DIA HOLE

ORICA

Not to scale

SHOTPlus™ Professional 5.7.4.4	6/5/2019
Mine	Burlington
Location	UPPER MIDDLE
Title/author	9UPMD009 Design Fnl
Filename	Burlington 2019-06-06 Blast 19-009 Upper Mi

Blast Design

Nelson Aggregate

Quarry: Burlington | Blast Number: 19-009
P.O. #: | Orica Order #:
Design Date: 2019-06-06

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)
GPS Coordinates: 43.40361 °N Latitude (Centre of Blast) 79.88191 °W Longitude (Centre of Blast)

Design te Blasted:	27,603	te
Total Holes Loaded:	53	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	3	rows

- Drilling Information -

			Angle from Vertical			Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 52	=	3,754.9 ft (4 " diam)
Secondary Bit diam:	92.1	mm	0 °	# Holes: 1	=	72.2 ft (3 5/8 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:	=	0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	19	front row

- Design Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	34	main body
Bench Height:	70.2	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	72.2	ft avg

- Design Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	.75" Clear	

Bulk Expl. Required:

		kg
CENTRA GOLD 70		12,500

Pkgd Expl. Required:

		kg
FORTEL PRO 75X400	2	50

Boosters Required:

	kg/u	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23		
PENTEX 12 (OR EQUIVALENT)	0.34		

total explosives weight in Blast (kg):	12,550
Pkgd Prod (50 kg) % of Total kg:	0.4%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		
UNITRONIC 600 25M		

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)		1
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

- Design Charge Length -

Front Row:	65.2	ft avg
Main Body:	65.2	ft avg

- Design Charge Weight -

Front Row:	190.1	kg/hole
Main Body:	190.1	kg/hole
Max Chge Wt / delay:	230.0	kg/delay

Required kg Loaded:	12,550	kg
Rock Density:	2.60	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.455	kg/te (actual)
1.343 lb/yd³	Front row:	0.307	kg/te (theoretical)
1.791 lb/yd³	Main Body:	0.409	kg/te (theoretical)
1.642 lb/yd³	"KPI" PF:	0.375	kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-010
P.O. #:		Orica Order #:	2496865
Blast Date:	2019-06-20	Blast Time:	12:11 PM

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor 011 (Bench / Face)

GPS Coordinates: 43.40226 °N Latitude (Centre of Blast) 79.88668 °W Longitude (Centre of Blast)

Wind from the: N at 5 kph Temperature: 16 to 20 °C

Clear:		Rain:		Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	45,552 te	17,520 m3
Total tonnes per day:	45,552 te	NF-02 (Rate Code)
Total Holes Loaded:	272 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	17 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	272	=	4,678.4 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	35,630	29,410	6,220

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	272	92.5

total explosives weight in Blast (kg): 6,312

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 12m		25/500	24
CONNECTADET 9M		25 ms	11
CONNECTADET 9M		33 ms	2
CONNECTADET 9M		65 ms	36
EXEL HANDIDET 9m		25/500	248

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.5
HELPER HOURS	Enter total Helper man-hours	12.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Theoretical PF (Based on a single hole)

- Pattern (Front Row)-

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	40	front row

- Pattern (Main Body) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	232	main body
Bench Height:	17.2	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	17.2	ft avg

- Stone Decking -

Front Row:		ft avg
Main Body:		ft avg
# Decks:	0	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	1/2" Clear	

- Charge Length -

Front Row:	10.2	ft avg
Main Body:	10.2	ft avg

- Charge Weight -

Front Row:	29.7	kg/hole
Main Body:	29.7	kg/hole
Max. per delay:	32.0	kg/delay
SD () Equation:	530.4	kg/delay
Total kg Loaded:	6,312	kg
Rock Density:	2.60	g/cc = te/m^3

Yield Powder Factor (kg Loaded / te Blastec)

- Powder Factor -

0.607 lb/yd^3	Yield PF:	0.139	kg/te (actual)
0.778 lb/yd^3	Front row:	0.178	kg/te (theoretical)
0.778 lb/yd^3	Main Body:	0.178	kg/te (theoretical)
0.778 lb/yd^3	"KPI" PF:	0.178	kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

helper hours 2x6=12hrs

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-010
P.O. #:		Orica Order #:	2496865
Blast Date:	2019-06-20	Blast Time:	12:11 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40226**	**79.88684**	0.757512	1.394288
Front Row Corner	43.40197	79.88588	0.757507	1.394272
Back Row Corner	43.40255	79.88732	0.757517	1.394297
Average (Centre of Blast)	43.40226	79.88668	0.757512	1.394286

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**690.9**	m				
Post Blast Data: ppV:	**did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**trigger**	dB	Trigger set at:	**115**	dB	

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	**1002.0**	m				
Post Blast Data: ppV:	**did**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**trigger**	dB	Trigger set at:	**115**	dB	

SouthWest Corner of Property

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	**0.0**	m				
Post Blast Data: ppV:	**0.0**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**0.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**0.0**	dB	Trigger set at:	**115**	dB	

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(690.9)^2}{30^2} \text{ kg}$$

$$= \frac{477{,}343}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 530 kg

jim bray

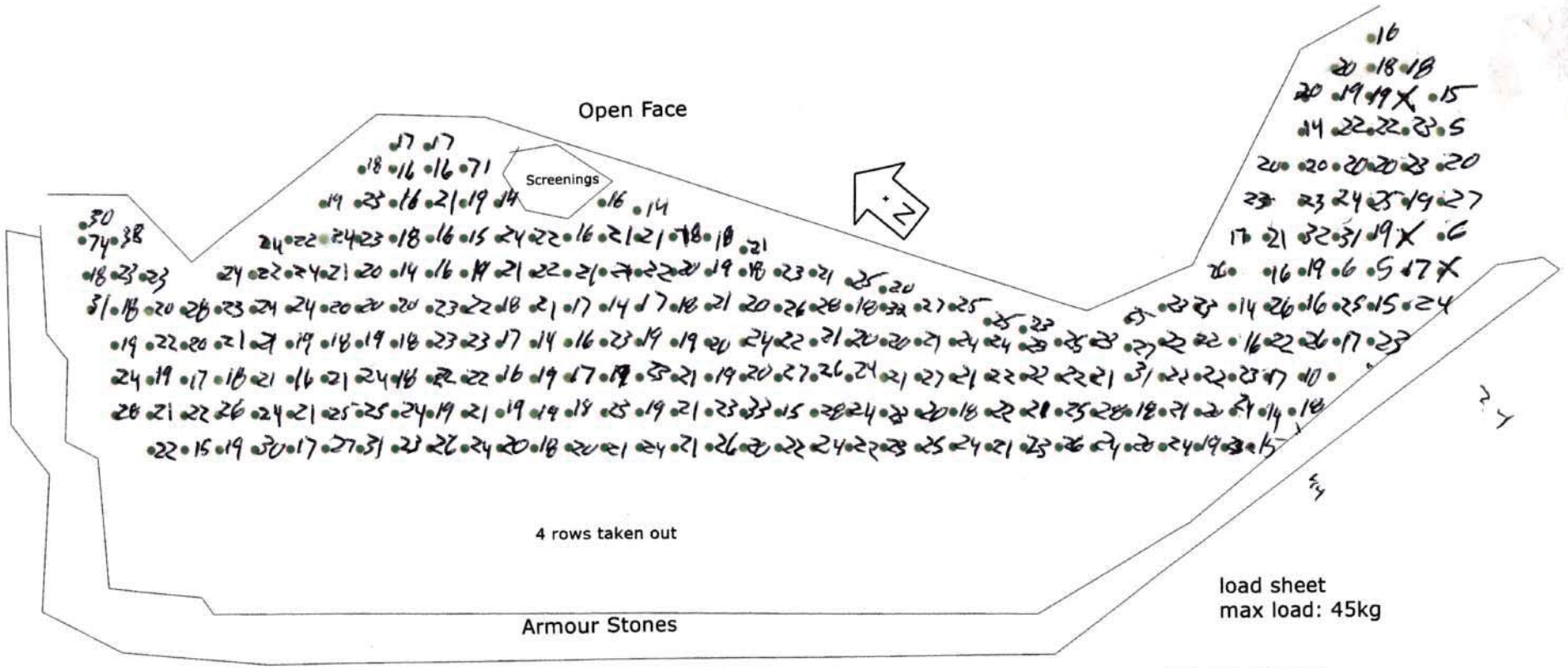
Orica
Blaster-in-charge: Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 273	Hole angle: 0.0°
Total drilled: 4368.0ft			



load sheet
max load: 45kg

9FLR11 Design
4" Blasthole
11.5' X 11.5' Pattern
DRILL TO SHALE

ORICA

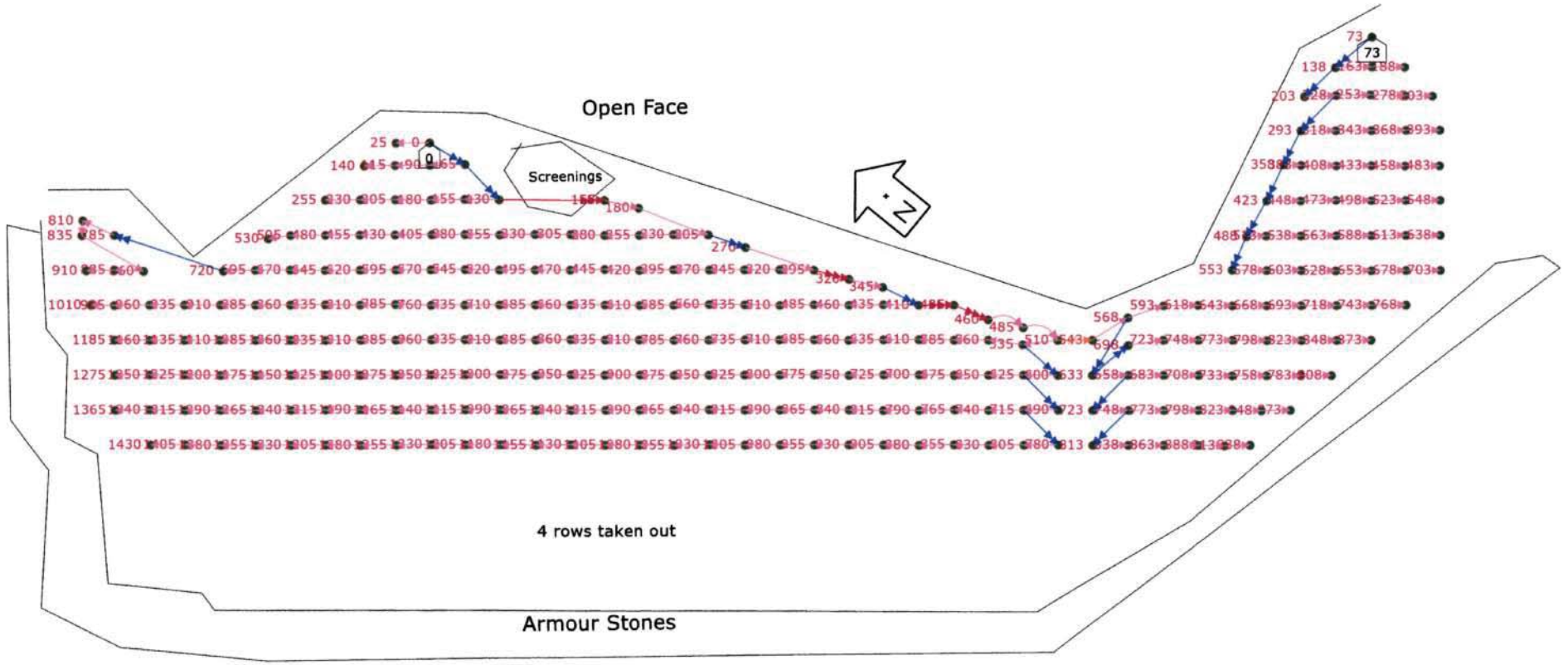
Not to scale

SHOTPlus™ Professional 5.7.7.8		6/19/2019
Mine	Burlington	
Location		
Title/author	9FLR11 Design	
Filename	Burlington 2019-06-20 Blast 19-010 Floor.spf	

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 273	Hole angle: 0.0°
Total drilled: 4368.0ft			



9FLR11 Design
4" Blasthole
11.5' X 11.5' Pattern
DRILL TO SHALE

ORICA

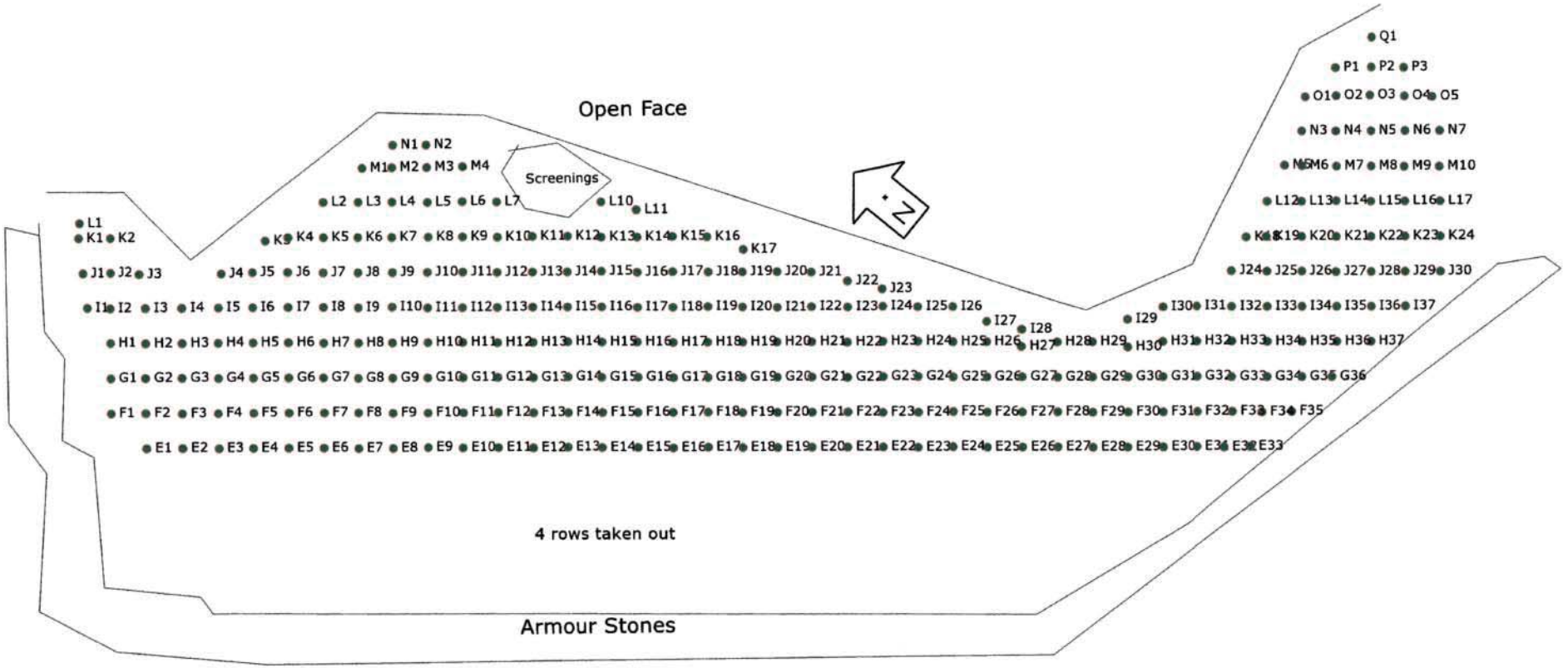
Not to scale

SHOTPlus™ Professional 5.7.7.8		6/20/2019
Mine	Burlington	
Location		
Title/author	9FLR11 Design	
Filename	Burlington 2019-06-20 Blast 19-010 Floor.spf	

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 273	Hole angle: 0.0°
Total drilled: 4368.0ft			



9FLR11 Design
4" Blasthole
11.5' X 11.5' Pattern
DRILL TO SHALE

SHOTPlus™ Professional 5.7.7.8		6/19/2019
Mine	Burlington	
Location		
Title/author	9FLR11 Design	
Filename	Burlington 2019-06-20 Blast 19-010 Floor.spf	

ORICA

Not to scale

Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2019-06-20

Blast Number: 19-010
Orica Order #:

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor 011 (Bench / Face)
GPS Coordinates: 43.40226 °N Latitude (Centre of Blast) 79.88668 °W Longitude (Centre of Blast)

Design te Blasted:	61,536	te
Total Holes Loaded:	395	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	17	rows

- Drilling Information -

		mm	Angle from Vertical	# Holes:		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0°	# Holes:	395	= 6,320.0 ft (4 " diam)
Secondary Bit diam:		mm	0°	# Holes:		= 0.0 ft (" diam)
Tertiary Bit diam:		mm	0°	# Holes:		= 0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	40	front row

- Design Pattern (Main Body) -

Burden:	11.5	ft avg
Spacing:	11.5	ft avg
# Holes:	355	main body
Bench Height:	16.0	ft avg
Sub-drill:	0.0	ft avg
Hole Depth:	16.0	ft avg

- Design Stone Decking -

Front Row:		ft avg
Main Body:		ft avg

- Design Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	3/4" Clear	

Bulk Expl. Required:

		kg
CENTRA GOLD 70		

Pkgd Expl. Required:

		kg
FORTEL PRO 75X400	2	50

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	395	134.3

total explosives weight in Blast (kg):	184
Pkgd Prod (50 kg) % of Total kg:	27.1%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		2
EXEL HANDIDET 12m	25/500	395
CONNECTADET 9M	25 ms	3
CONNECTADET 9M	33 ms	1
CONNECTADET 9M	65 ms	24

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

- Design Charge Length -

Front Row:	9.0	ft avg
Main Body:	9.0	ft avg

- Design Charge Weight -

Front Row:	26.2	kg/hole
Main Body:	26.2	kg/hole
Max Chge Wt / delay:	45.0	kg/delay

Required kg Loaded:	184	kg
Rock Density:	2.60	g/cc = te/m³

- Design Powder Factor -

	Expected Yield PF:	0.003	kg/te (actual)
0.738 lb/yd³	Front row:	0.168	kg/te (theoretical)
0.738 lb/yd³	Main Body:	0.168	kg/te (theoretical)
0.738 lb/yd³	"KPI" PF:	0.168	kg/te (theoretical)

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

Drilling to shale, final depths to be determined once shot has been measured

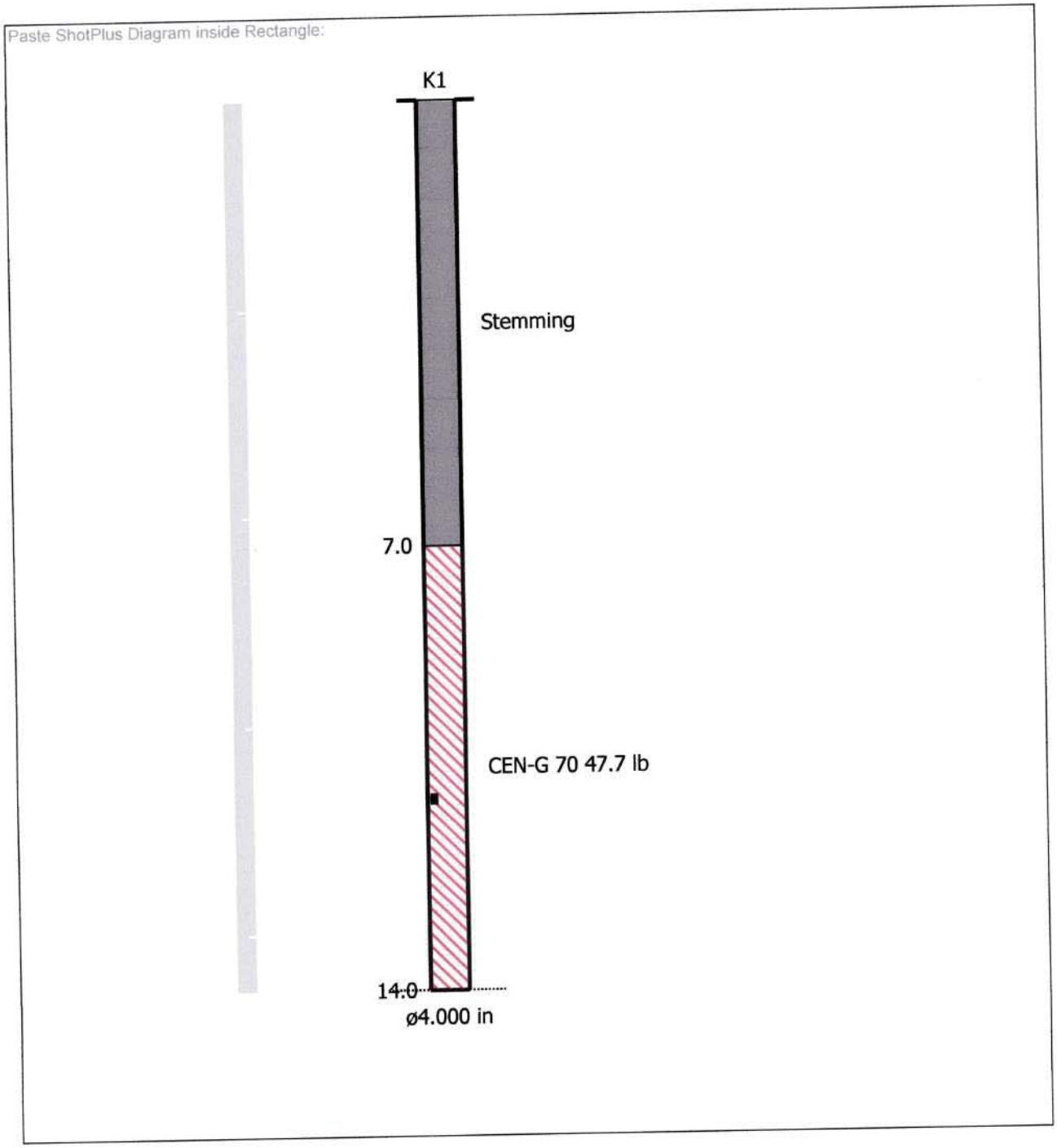
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-010
P.O. #:		Orica Order #:	
Blast Date:	6/20/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica
Blaster-in-charge: Kevin Toplis

Quarry Manager: Nick Heap

Signature required, indicating sign off on Blast Design.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-011
P.O. #:		Orica Order #:	2503180
Blast Date:	2019-07-04	Blast Time:	11:04 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle North (Bench / Face)

GPS Coordinates: 43.40499 °N Latitude (Centre of Blast) 79.88175 °W Longitude (Centre of Blast)

Wind from the: SE at 10 kph Temperature: 26 to 30 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	23,372 te	8,989 m3	
Total tonnes per day:	23,372 te	NB60-07	Rate Code
Total Holes Loaded:	57 holes		
… including:	3 Dead Holes		
… and:	0 Helper Holes		
Helper Hole Collar:	0.0 ft avg		
# Rows Blasted:	3 rows		

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	53	=	3,205.4 ft (4 " diam)
Secondary Bit diam:	92.1	mm	0 °	# Holes:	4	=	241.9 ft (3 5/8 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	20	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	37	main body
Bench Height:	58.5	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	60.5	ft avg

- Stone Decking -

Front Row:	0.0	ft avg
Main Body:	0.0	ft avg
# Decks:	0	per blast

- Collar Stemming -

Front Row:	8.0	ft avg
Main Body:	8.0	ft avg
Material used:	3/4" Clear	

- Charge Length -

Front Row:	52.5	ft avg
Main Body:	52.5	ft avg

- Charge Weight -

Front Row:	153.0	kg/hole
Main Body:	153.0	kg/hole
Max. per delay:	187.0	kg/delay
SD () Equation:	183.3	kg/delay
Total kg Loaded:	9,402	kg
Rock Density:	2.60	g/cc = te/m^3

- Powder Factor -

1.763 lb/yd^3	Yield PF:	0.402	kg/te (actual)
1.298 lb/yd^3	Front row:	0.296	kg/te (theoretical)
1.731 lb/yd^3	Main Body:	0.395	kg/te (theoretical)
1.586 lb/yd^3	"KPI" PF:	0.362	kg/te (theoretical)

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,440	19,700	7,740
CENTRA GOLD 70	34,450	32,820	1,630

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	57	12.9
PENTEX 12 (OR EQUIVALENT)	0.34	57	19.4

total explosives weight in Blast (kg): 9,402

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			57
UNITRONIC 600 20M			25
UNITRONIC 600 25M			32

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

F-16 Was measured at 61' the morning of the blast and brought to Nick Heap's attention

8' Collars were used due to excessive over burden

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-011
P.O. #:		Orica Order #:	2503180
Blast Date:	2019-07-04	Blast Time:	11:04 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40505**	**79.88168**	0.757561	1.394198
Front Row Corner	43.40470	79.88175	0.757555	1.394200
Back Row Corner	43.40521	79.88182	0.757564	1.394201
Average (Centre of Blast)	43.40499	79.88175	0.757560	1.394199

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**406.2**	m			
Post Blast Data: ppV:	**3.3**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**20.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**113.5**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**998.1**	m			
Post Blast Data: ppV:	**0.2**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**9.1**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**115.3**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1411.7**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(406.2)^2}{30^2} \text{ kg}$$

$$= \frac{164{,}998}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 183 kg

jim bray

Orica
Blaster-in-charge: *Mike derkinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

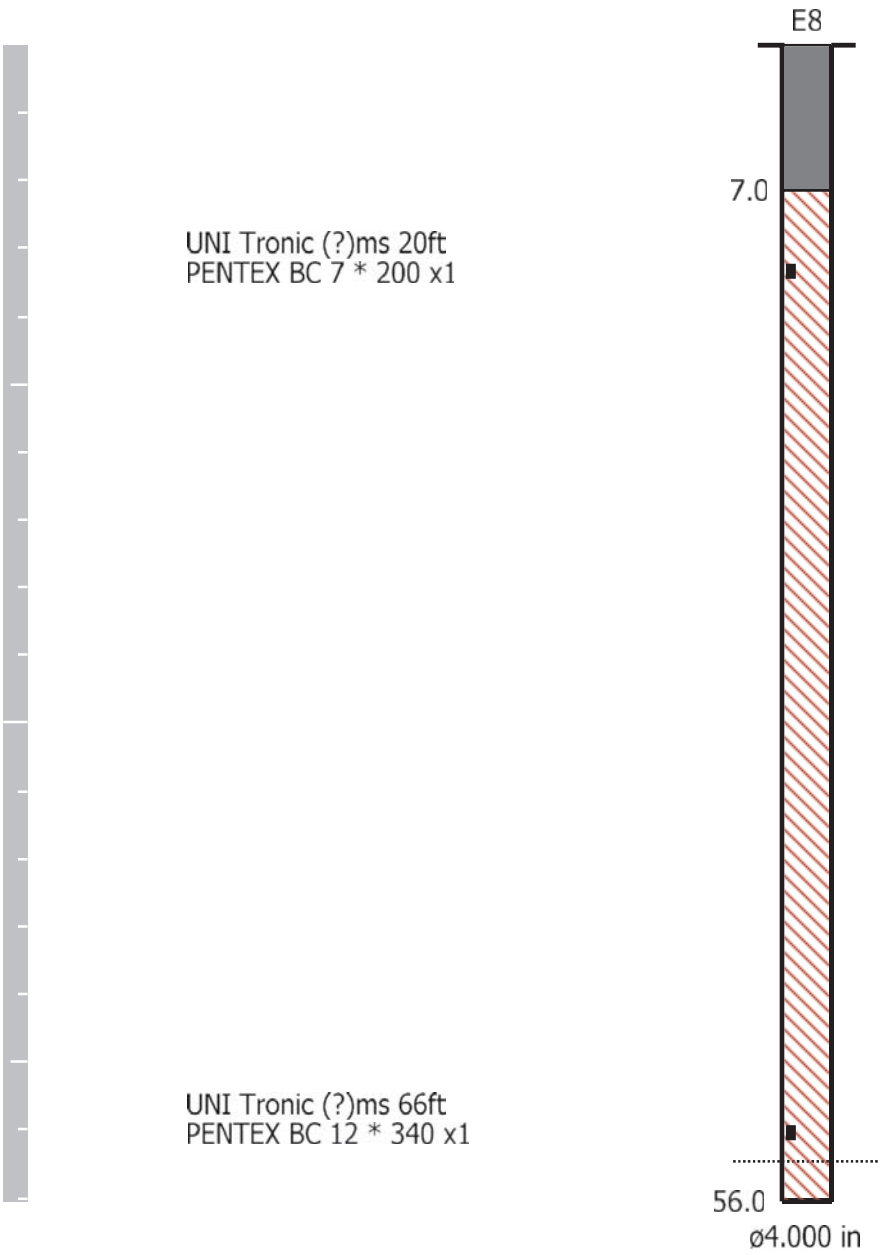
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-011
P.O. #:		Orica Order #:	2503180
Blast Date:	7/4/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike derkinderen
Quarry Manager:	Nick Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 11:04:45 July 4, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

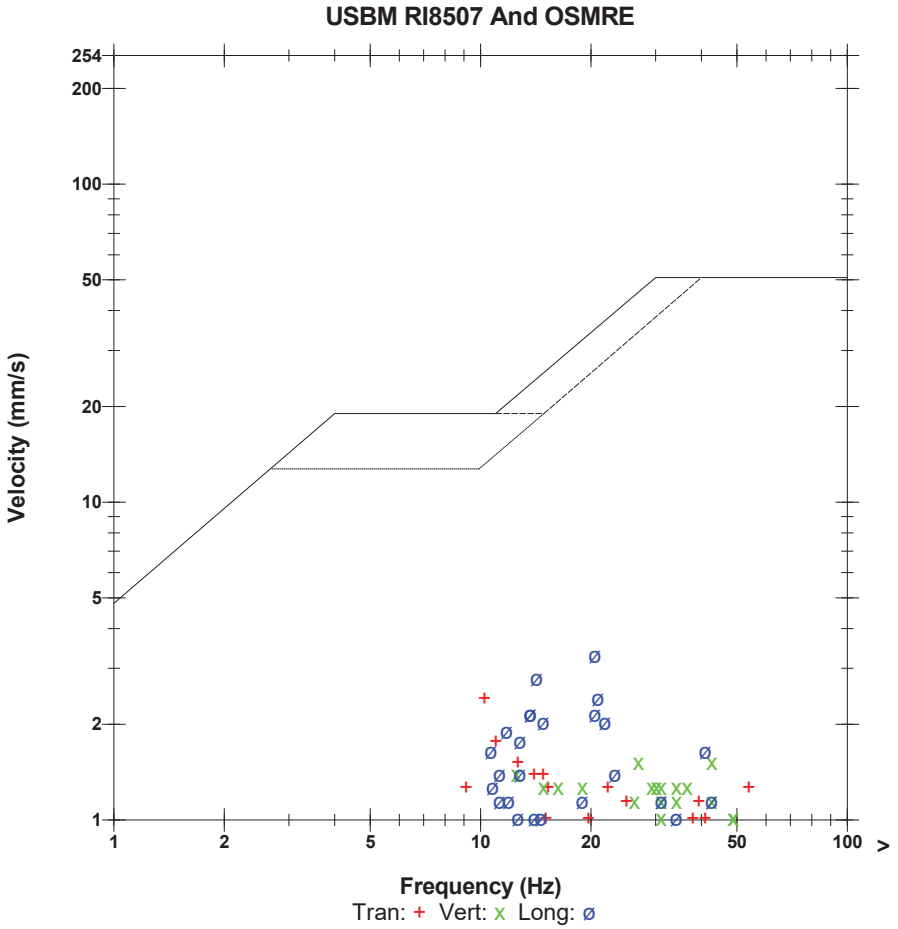
Location:	2450 #2 Road
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

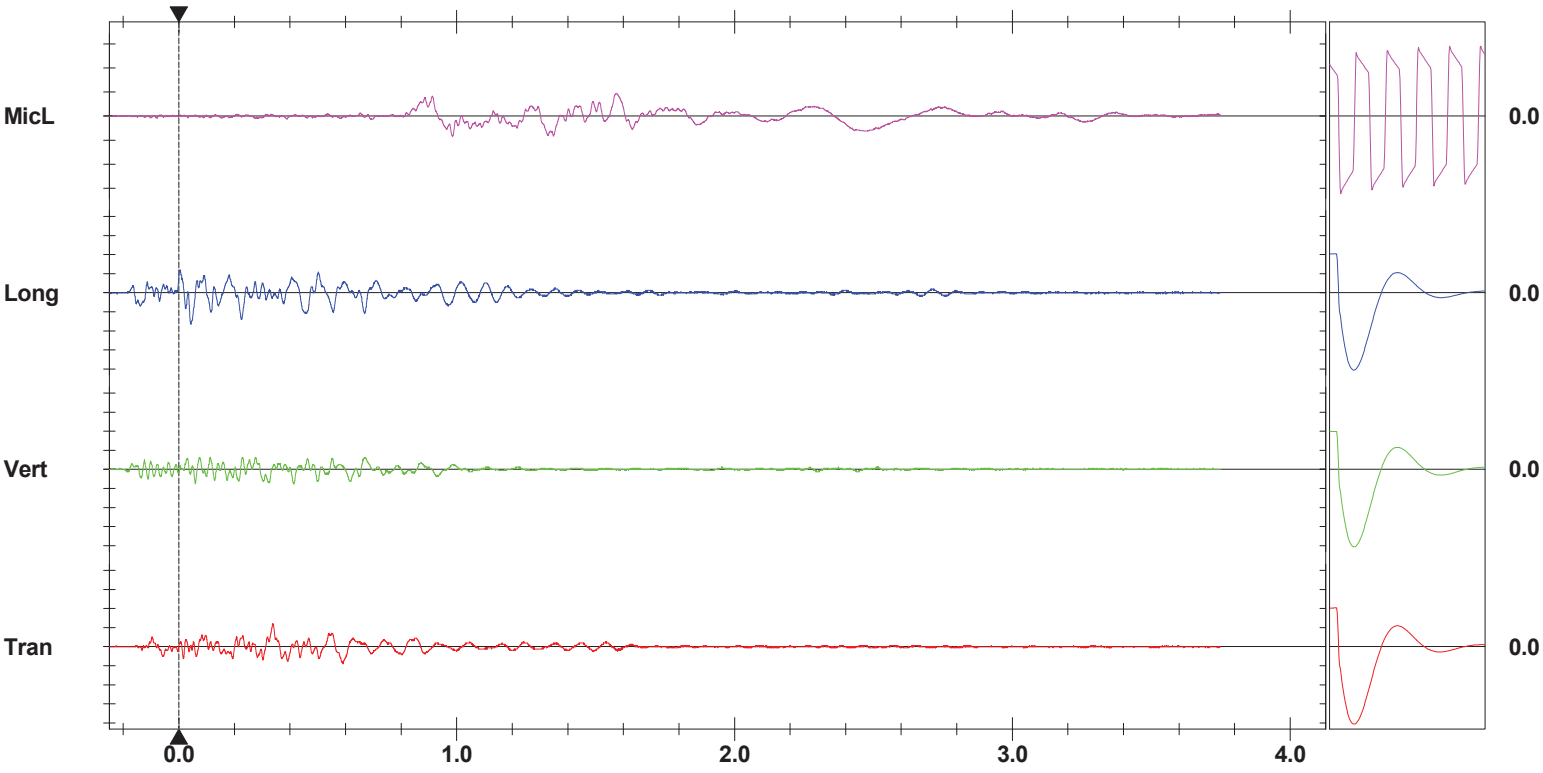
Extended Notes
N43.40245;W-79.87814

Microphone	Linear Weighting
PSPL	113.5 dB(L) at 1.575 sec
ZC Freq	9.1 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 514 mv)

	Tran	Vert	Long	
PPV	2.413	1.524	3.302	mm/s
ZC Freq	10.2	43	20	Hz
Time (Rel. to Trig)	0.338	0.059	0.042	sec
Peak Acceleration	0.053	0.053	0.080	g
Peak Displacement	0.026	0.019	0.029	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.4	Hz
Overswing Ratio	3.8	3.6	3.9	

Peak Vector Sum 3.326 mm/s at 0.042 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	MicL at 11:04:45 July 4, 2019	**Serial Number**	UM6857 V 10-89 Micromate ISEE
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)	**Battery Level**	3.7 Volts
Range	Geo: 254.0 mm/s	**Unit Calibration**	January 15, 2019 by Instantel
Record Time	5.009 sec (Auto=5Sec) at 2048 sps	**File Name**	UM6857_20190704110445.IDFW
Operator/Setup:	MIKE DERKNDEREN/Burlington Bruce TRL.MMB		

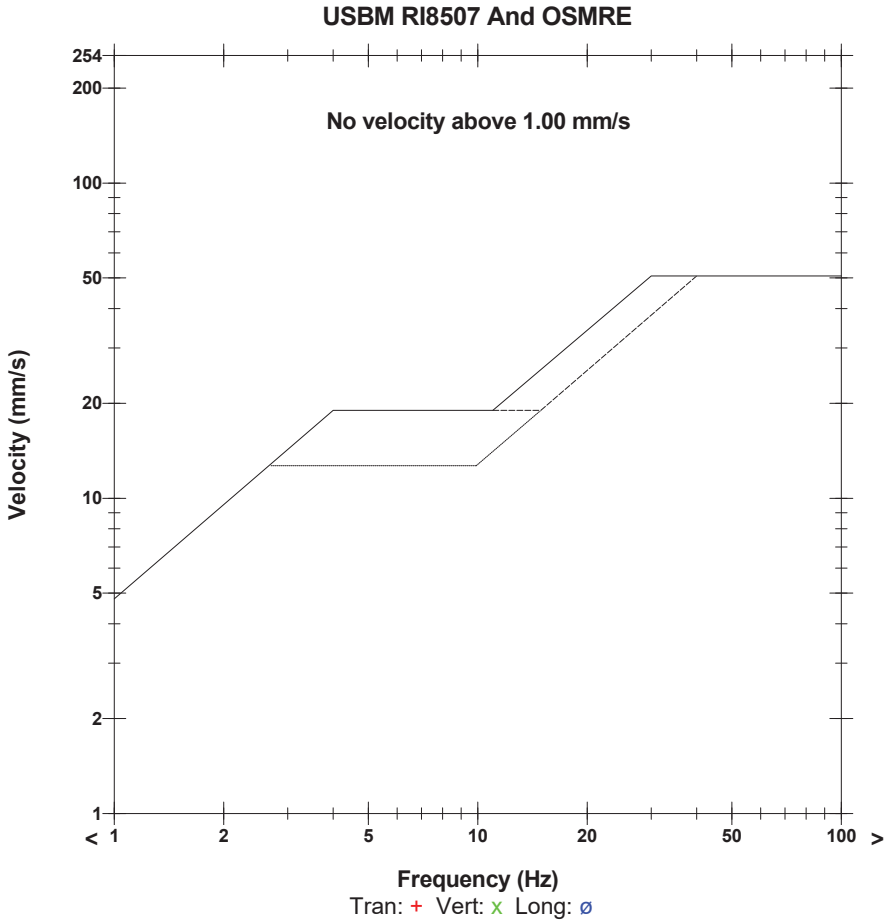
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

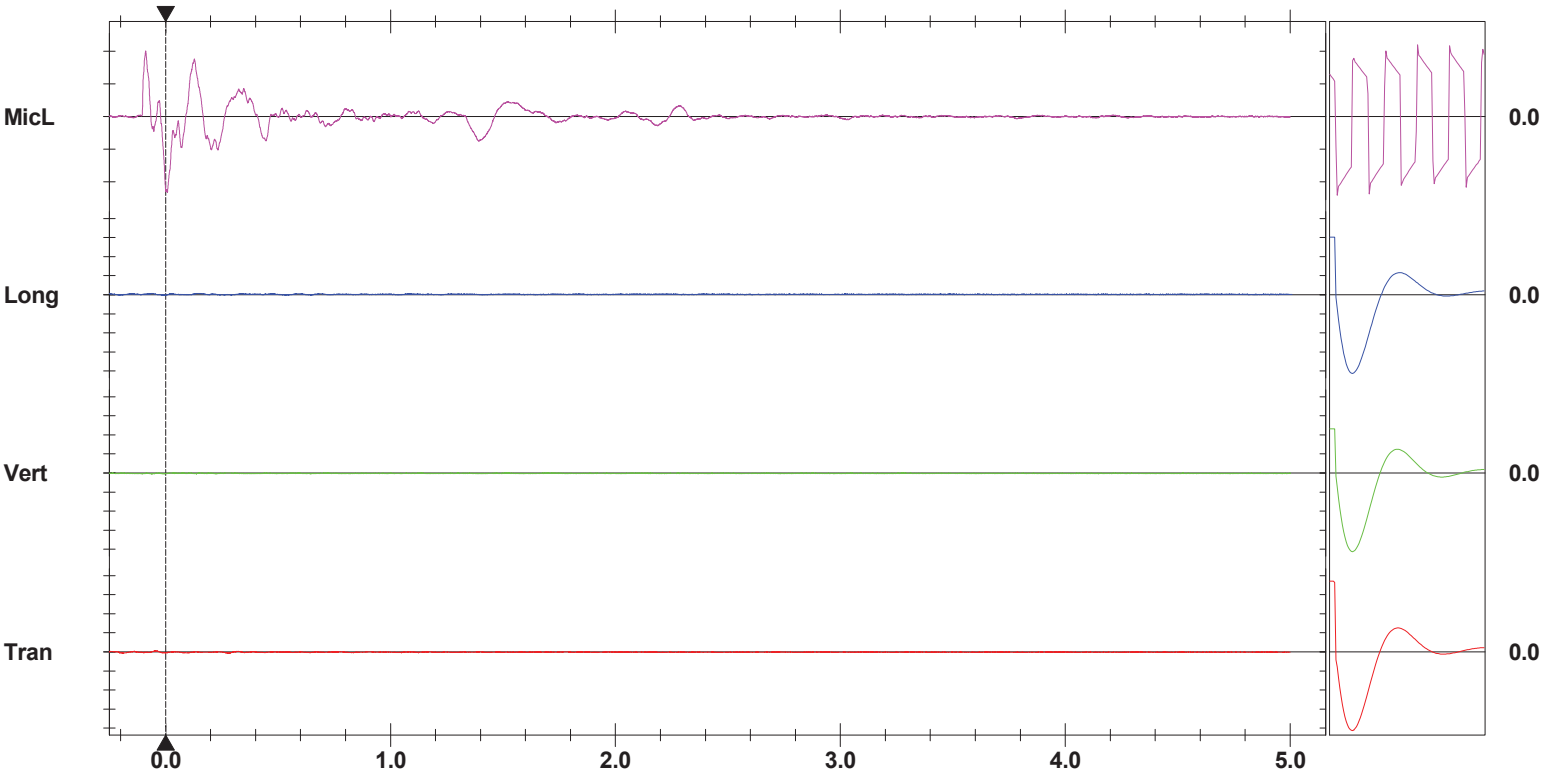
Extended Notes
N 43.31617
W 80.02664

Microphone Linear Weighting
PSPL 115.3 dB(L) at 0.007 sec
ZC Freq 4.5 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1273 mv)

	Tran	Vert	Long	
PPV	0.150	0.102	0.150	mm/s
ZC Freq	9.1	4.9	7.2	Hz
Time (Rel. to Trig)	-0.188	-0.104	0.141	sec
Peak Acceleration	0.010	0.012	0.012	g
Peak Displacement	0.003	0.016	0.012	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.3	3.3	3.5	

Peak Vector Sum 0.166 mm/s at -0.060 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

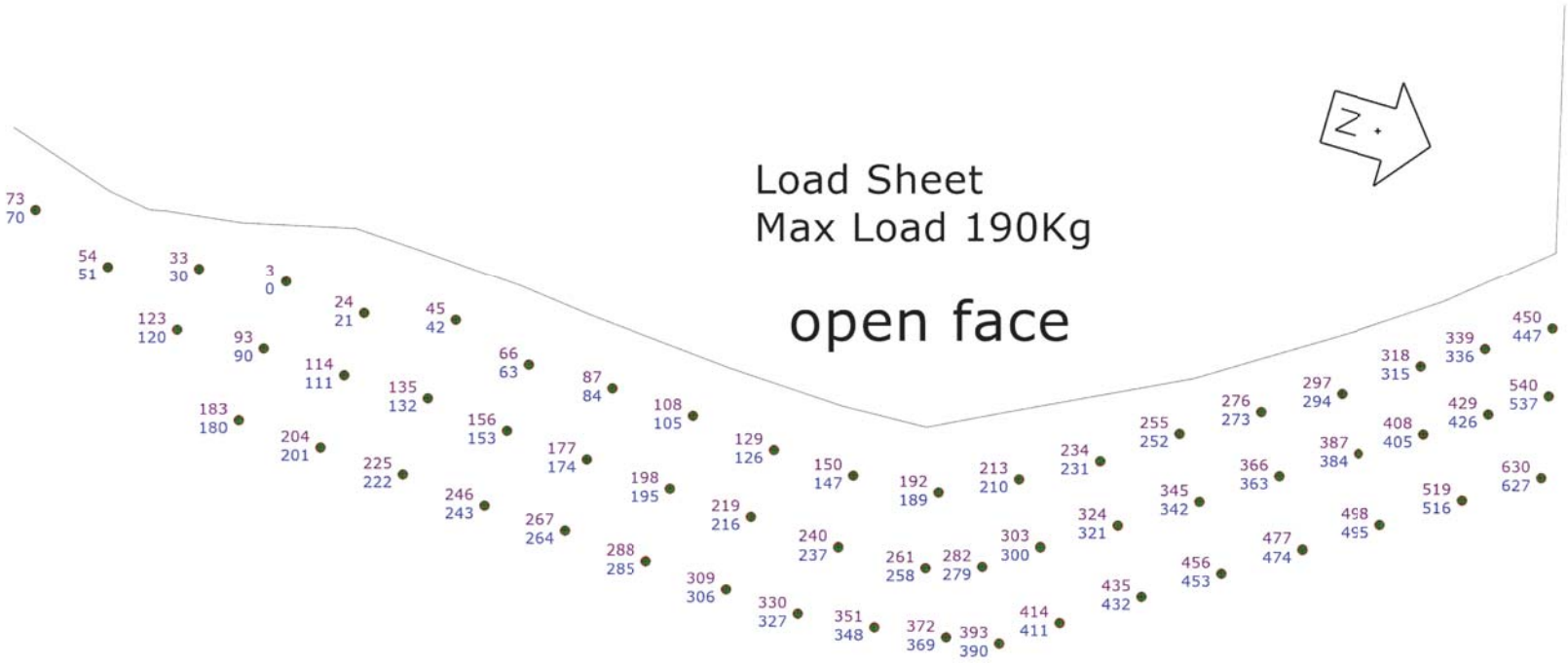
Southwest Corner of property
Nelson Aggregate
Burlington 2019-07-04 Blast 19-011 Upper Middle

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
---	---	SERIAL NUMBER: UM6859
Jul 4 /19 10:13:22		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jul 4 /19 10:13:22	Jul 4 /19 11:37:50	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 121.

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 57	Hole angle: 0.0°
Total drilled: 3447.4ft			



9NECRNR010 Design Fnl- 3.625" and 4" Blast Holes 12x10 9x10 266 and 2

E19 F11 F18 G10 G11 are 3.625" DIA HOLES
PAINTED PINK MARKER STONES

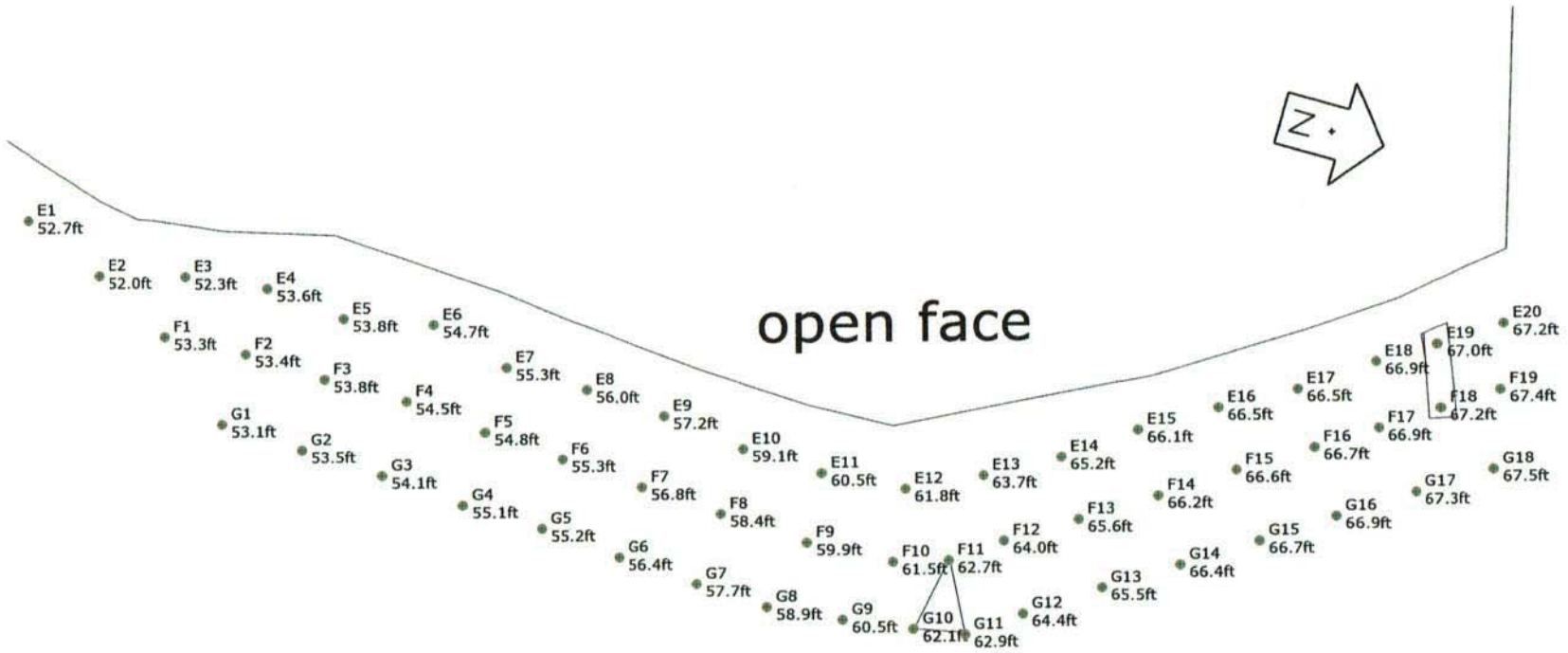
ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 57	Hole angle: 0.0°
Total drilled: 3447.4ft			



E19 F11 F18 G10 G11 are 3.625" DIA HOLES
PAINTED PINK MARKER STONES

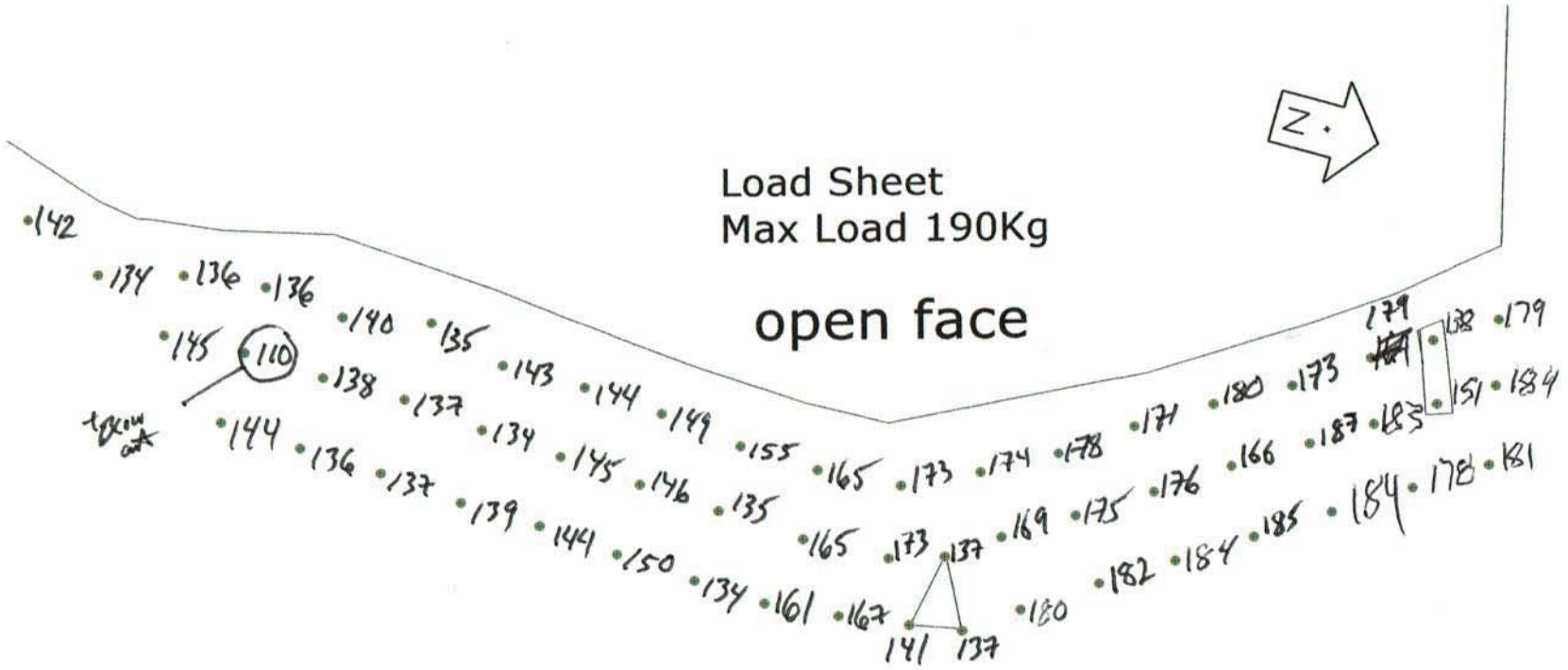
ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 57	Hole angle: 0.0°
Total drilled: 3447.4ft			



E19 F11 F18 G10 G11 are 3.625" DIA HOLES
PAINTED PINK MARKER STONES

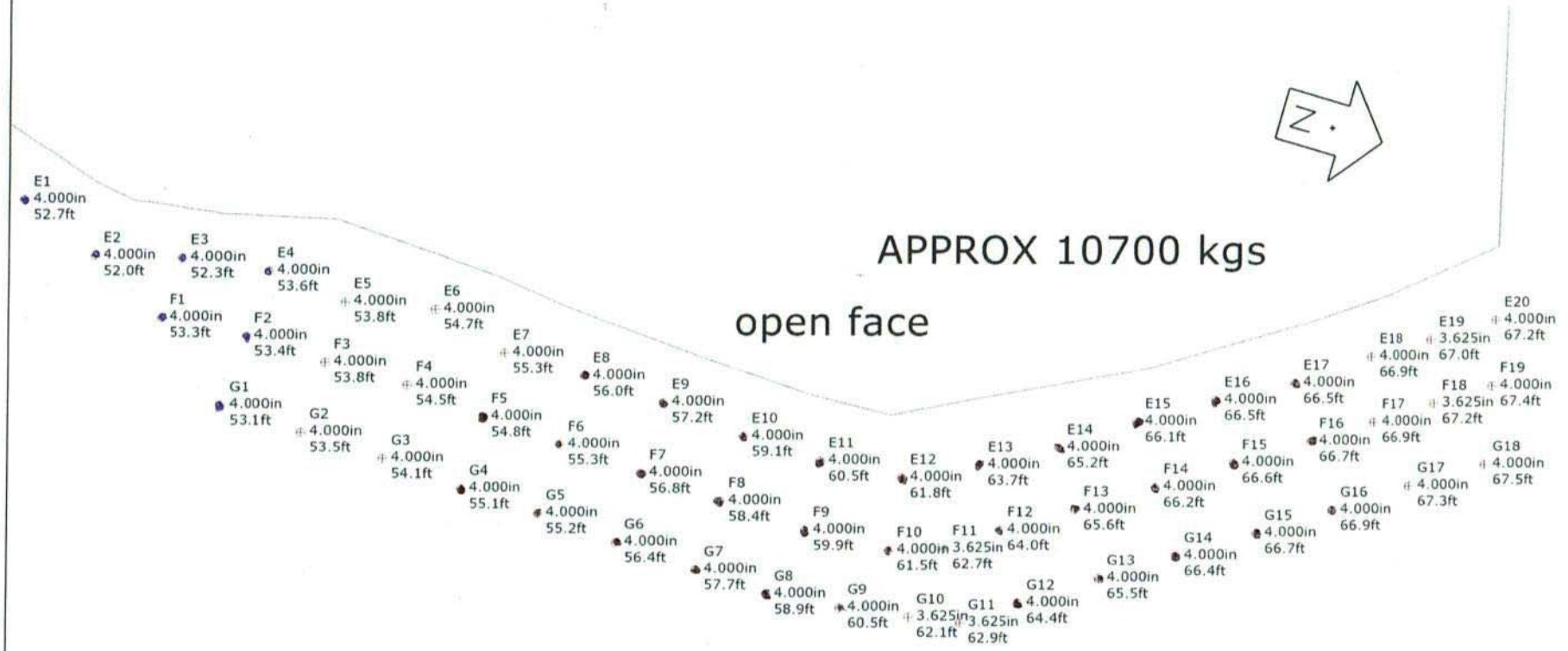
ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 57	Hole angle: 0.0°
Total drilled: 3447.4ft			



9NECRNR010 Design Fnl- 3.625" and 4" Blast Holes 12x10 9x10 266 and 250 + .6 SUB ELEV

E19 F11 F18 G10 G11 are 3.625" DIA HOLES
PAINTED PINK MARKER STONES

ORICA

Scale 1:250

SHOTPlus™ Professional 5.7.4.4		6/12/2019
Mine	Burlington	
Location	N E Corner along haul road	
Title/author	9NECRNR010 Design Fnl	
Filename		

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-012
P.O. #:		Orica Order #:	2505549
Blast Date:	2019-07-11	Blast Time:	11:01 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40358 °N Latitude (Centre of Blast) 79.88181 °W Longitude (Centre of Blast)

Wind from the: SW at 5 kph Temperature: 26 to 30 °C

		x		x	
Clear:		Rain:	x	Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 29,209 ft

Tonnes Blasted:	24,817 te	9,545 m3
Total tonnes per day:	24,817 te	NB80-02 Rate Code
Total Holes Loaded:	51 holes	
… including:	3 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	18 front row	
- Pattern (Main Body) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	33 main body	
Bench Height:	69.8 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	71.8 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Main Body:	4.0 ft avg	
# Decks:	3 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	60.8 ft avg	
Main Body:	60.8 ft avg	
- Charge Weight -		
Front Row:	177.3 kg/hole	
Main Body:	177.3 kg/hole	
Max. per delay:	242.0 kg/delay	
SD () Equation:	115.2 kg/delay	
Total kg Loaded:	11,260 kg	
Rock Density:	2.60 g/cc = te/m^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	51	=	3,662.6 ft (4 " diam)
Secondary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,890	22,660	11,230

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	52	11.8
PENTEX 12 (OR EQUIVALENT)	0.34	53	18.0

total explosives weight in Blast (kg): 11,260

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			48
UNITRONIC 600 15M			4
UNITRONIC 600 25M			53

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

1.988 lb/yd^3	Yield PF:	0.454 kg/te (actual)
1.260 lb/yd^3	Front row:	0.287 kg/te (theoretical)
1.680 lb/yd^3	Main Body:	0.383 kg/te (theoretical)
1.540 lb/yd^3	"KPI" PF:	0.351 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Hole E18's top detonator showed an error at blast time (NCO) All holes are double primed so we continued to fire the blast.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-012
P.O. #:		Orica Order #:	2505549
Blast Date:	2019-07-11	Blast Time:	11:01 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40361**	**79.88180**	0.757536	1.394200
Front Row Corner	43.40336	79.88190	0.757532	1.394202
Back Row Corner	43.40377	79.88172	0.757539	1.394199
Average (Centre of Blast)	43.40358	79.88181	0.757535	1.394201

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**322.0**	m			
Post Blast Data: ppV:	**7.9**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**13.1**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**119.7**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**1024.0**	m			
Post Blast Data: ppV:	**0.3**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**10.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**120.3**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1267.6**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(322)^2}{30^2} \text{ kg}$$

$$= \frac{103{,}684}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 115 kg

jim bray

Orica
Blaster-in-charge:

Signature required, indicating that
Blast Report is Complete & Accurate.

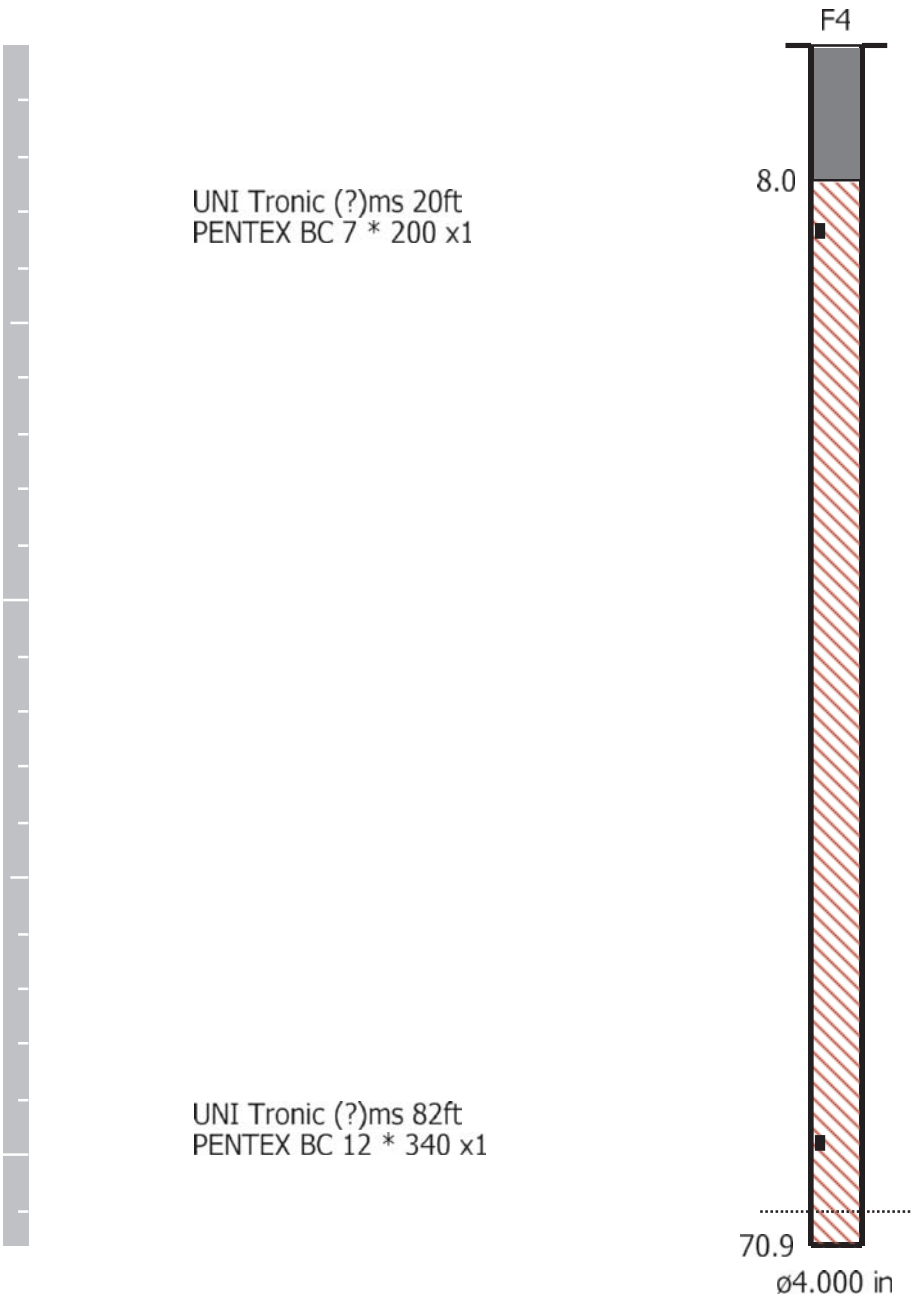
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-012
P.O. #:		Orica Order #:	2505549
Blast Date:			

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 11:01:03 July 11, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.0 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 #2 Road
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

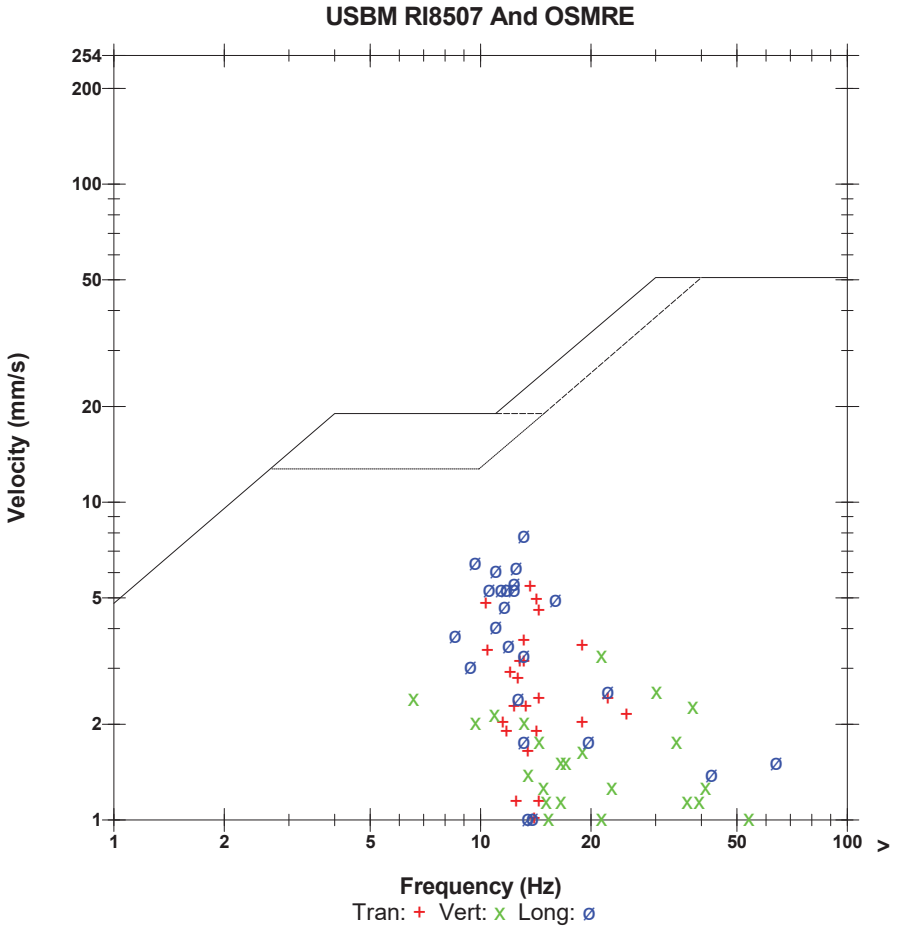
Extended Notes

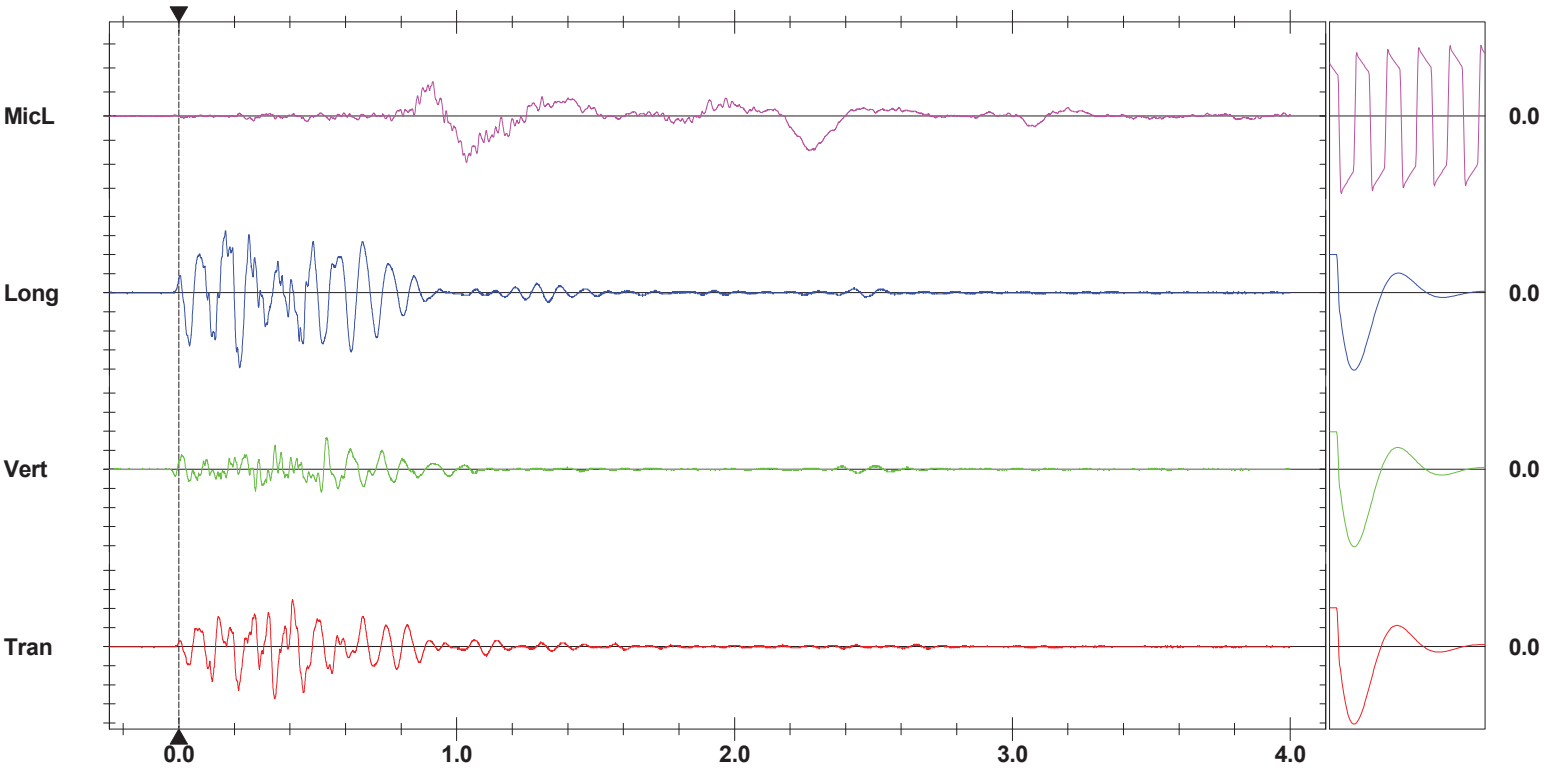
N43.40245;W-79.87814

Microphone	Linear Weighting
PSPL	119.7 dB(L) at 1.034 sec
ZC Freq	1.9 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 543 mv)

	Tran	Vert	Long	
PPV	5.461	3.302	7.874	mm/s
ZC Freq	13.7	21	13.1	Hz
Time (Rel. to Trig)	0.344	0.530	0.218	sec
Peak Acceleration	0.080	0.080	0.133	g
Peak Displacement	0.063	0.037	0.111	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.7	3.6	4.0	

Peak Vector Sum 8.807 mm/s at 0.218 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check

Trigger = ▶----------◀

Event Report

Date/Time	MicL at 11:01:04 July 11, 2019
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.133 sec (Auto=5Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.6 Volts
Unit Calibration	January 15, 2019 by Instantel
File Name	UM6857_20190711110104.IDFW

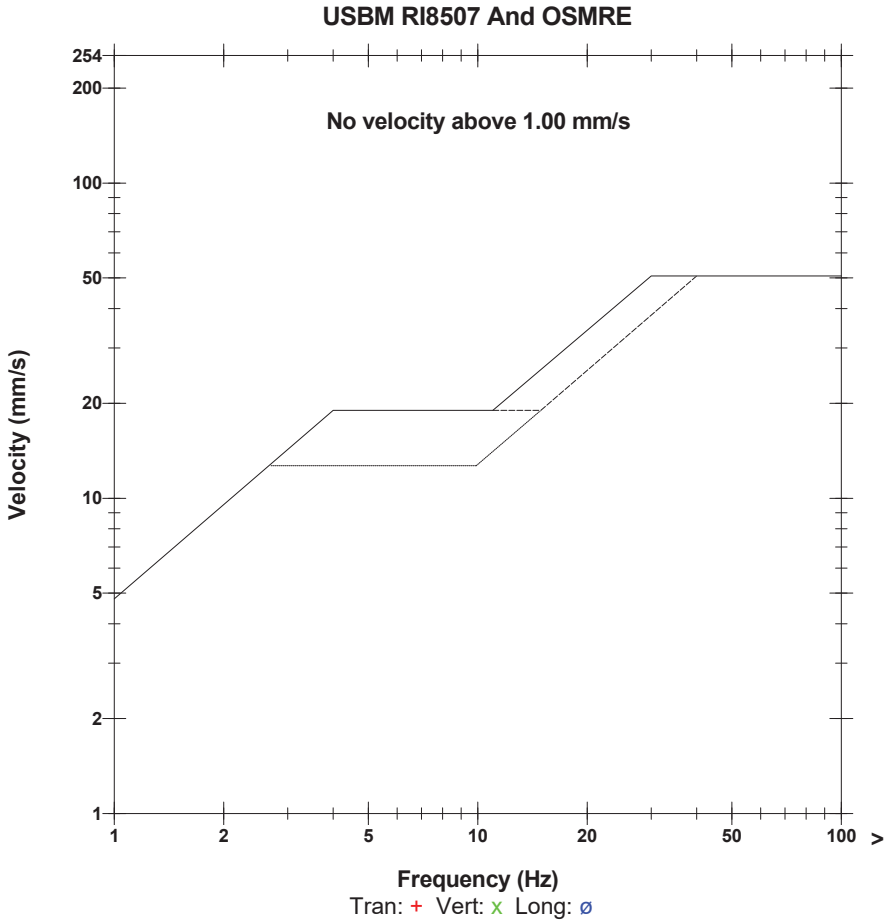
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

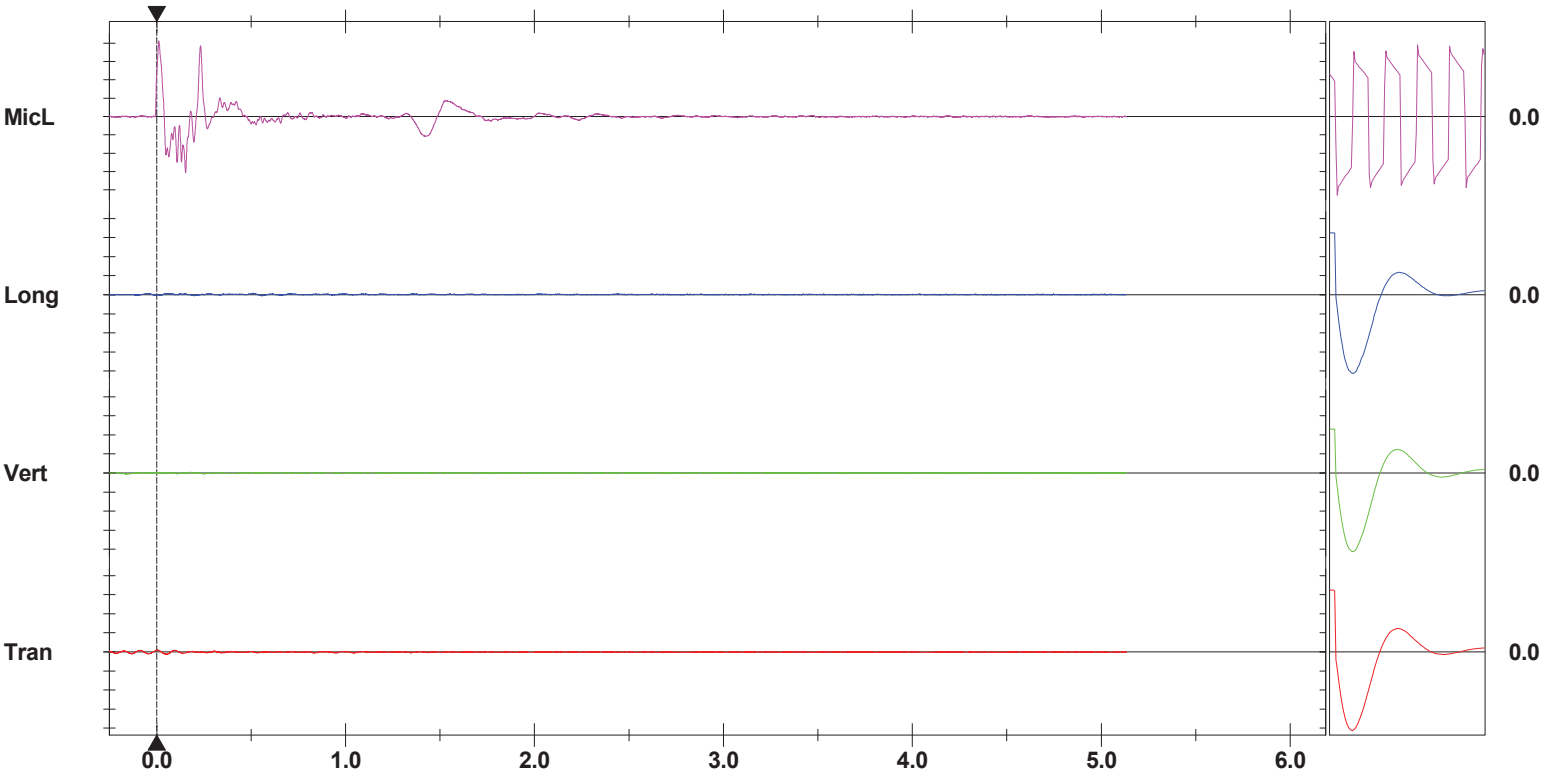
Extended Notes
N 43.31617
W 80.02664

Microphone	Linear Weighting
PSPL	120.3 dB(L) at 0.011 sec
ZC Freq	10.6 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1329 mv)

	Tran	Vert	Long	
PPV	0.252	0.102	0.158	mm/s
ZC Freq	10.0	6.4	9.0	Hz
Time (Rel. to Trig)	0.046	-0.164	0.511	sec
Peak Acceleration	0.010	0.010	0.012	g
Peak Displacement	0.004	0.002	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.3	3.5	

Peak Vector Sum 0.275 mm/s at 0.053 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Southwest Corner of property
Nelson Aggregate
Burlington 2019-07-11 Blast 19-12 Upper Middle

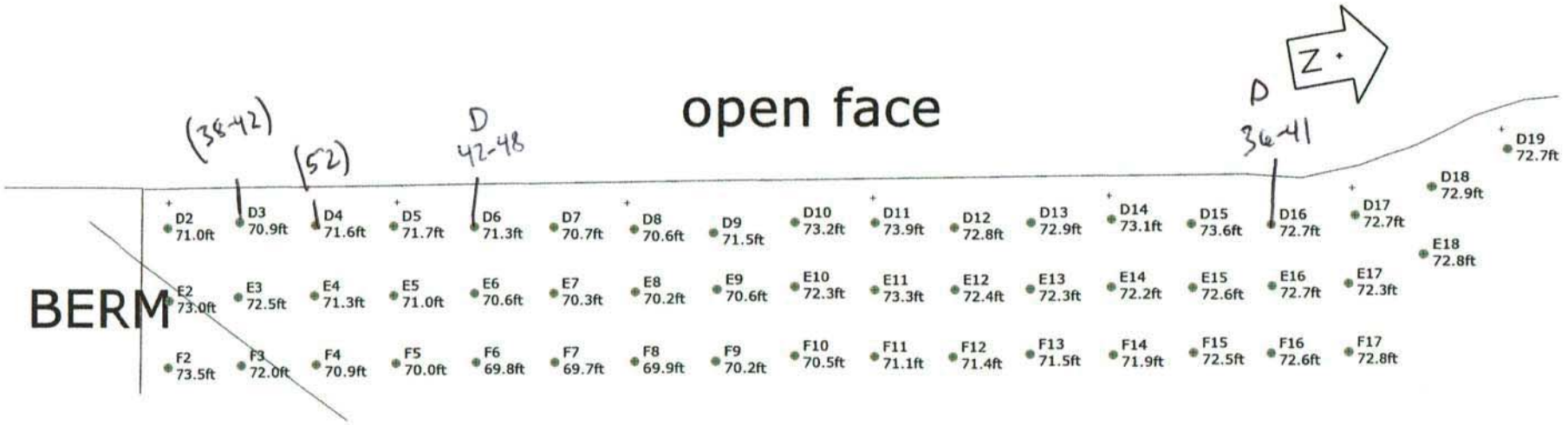
Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6859
Jul 11 /19 06:21:03		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jul 11 /19 06:21:02	Jul 11 /19 11:33:15	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 12

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 51	Hole angle: 0.0°
Total drilled: 3662.6ft			



ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 51	Hole angle: 0.0°
Total drilled: 3662.6ft			

0 = DECK

PLANT

N

open face

BERM

218 215	108 105	87 84	66 63	45 42	24 21	3 0	14 11	35 32	56 53	77 74	98 95	119 116	140 137	161 158	182 179	219 216	240 237
218	197 194	176 173	155 152	134 131	113 110	92 89	103 100	124 121	145 142	166 163	187 184	208 205	229 226	250 247	271 268	292 289	ERROR I/N
408 405	297 294	276 273	255 252	234 231	213 210	192 189	203 200	224 221	245 242	266 263	287 284	308 305	329 326	350 347	371 368		

ORICA

Not to scale

SHOTPlus 5 Plan

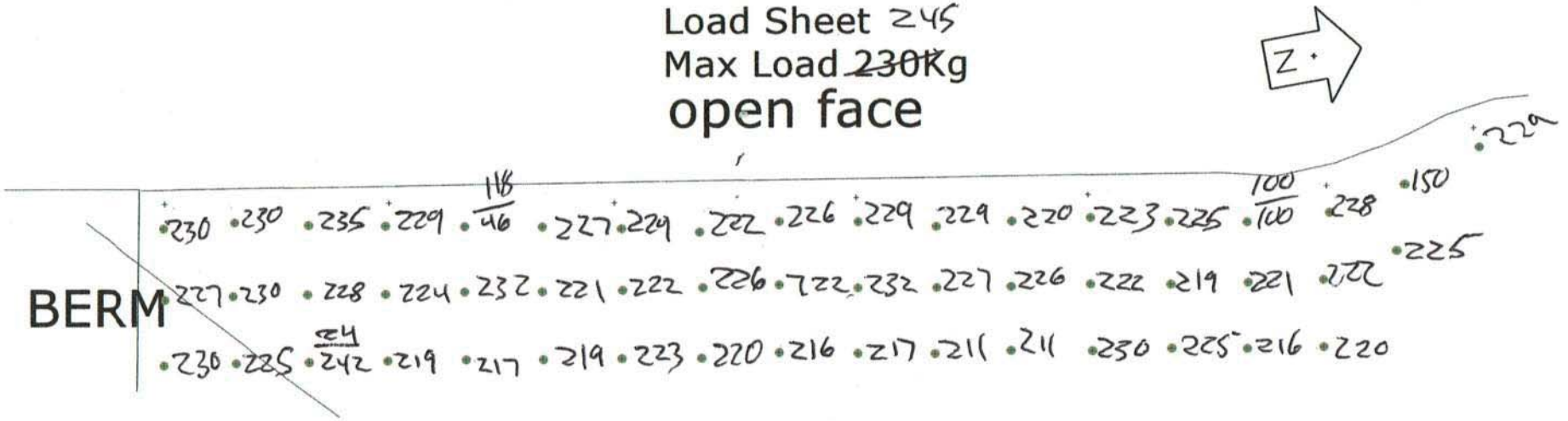
Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 51	Hole angle: 0.0°
Total drilled: 3662.6ft			

Load Sheet 245

Max Load ~~230~~Kg

open face

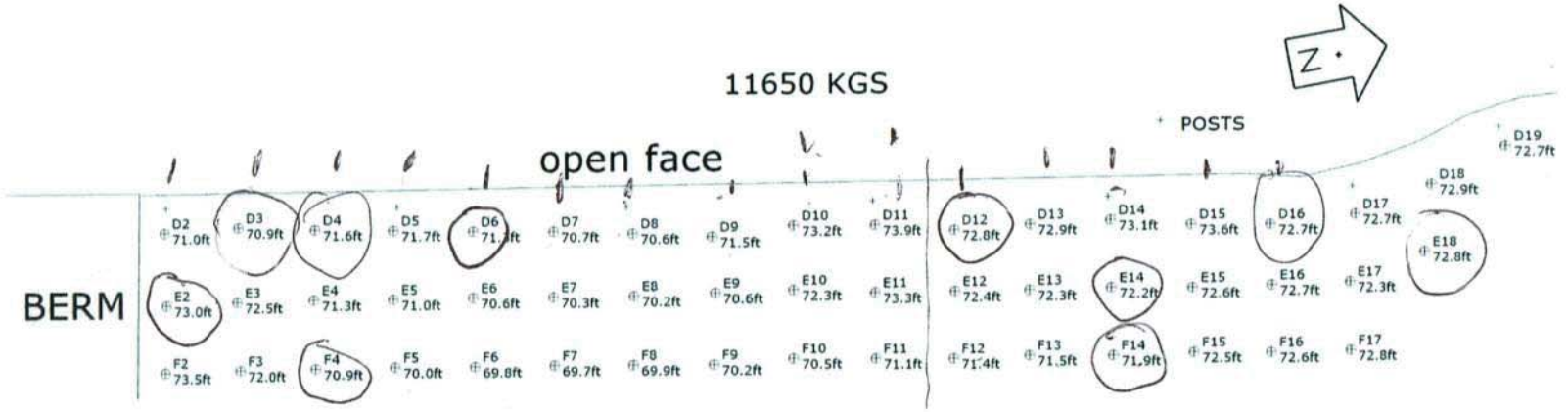


ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 51	Hole angle: 0.0°
Total drilled: 3662.6ft			



9UPMD012 Design Fnl - 4" Blast Hole 12x10 9x10 271.5 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

Scale 1:300

SHOTPlus™ Professional 5.7.4.4	7/5/2019
Mine	Burlington
Location	UPPER MIDDLE NEXT TO OLD WHEEL WASH
Title/author	9UPMD012 Design Fnl
Filename	

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-014
P.O. #:		Orica Order #:	2512320
Blast Date:	2019-07-30	Blast Time:	12:20 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40355 °N Latitude (Centre of Blast) 79.88169 °W Longitude (Centre of Blast)

Wind from the: W at 5 kph Temperature: 26 to 30 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 2,552 ft

Tonnes Blasted:	21,052 te	8,097 m3
Total tonnes per day:	21,052 te	NB60-07 Rate Code
Total Holes Loaded:	45 holes	
… including:	3 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	45	=	3,113.3 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	36,290	26,610	9,680

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	1	25

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	46	10.4
PENTEX 12 (OR EQUIVALENT)	0.34	46	15.6

total explosives weight in Blast (kg): 9,731

Pkgd Prod (25 kg) % of Total kg: 0.3%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			45
UNITRONIC 600 15M			2
UNITRONIC 600 25M			45

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	11.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Theoretical PF (Based on a single hole)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	17	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	28	main body
Bench Height:	67.2	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	69.2	ft avg

- Stone Decking -

Front Row:	0.0	ft avg
Main Body:	5.0	ft avg
# Decks:	1	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	3/4" Clear	

- Charge Length -

Front Row:	62.2	ft avg
Main Body:	57.2	ft avg

- Charge Weight -

Front Row:	181.3	kg/hole
Main Body:	166.7	kg/hole
Max. per delay:	209.0	kg/delay
SD () Equation:	108.4	kg/delay
Total kg Loaded:	9,731	kg
Rock Density:	2.60	g/cc = te/m^3

- Powder Factor -

2.026 lb/yd^3	Yield PF:	0.462	kg/te (actual)
1.339 lb/yd^3	Front row:	0.305	kg/te (theoretical)
1.641 lb/yd^3	Main Body:	0.375	kg/te (theoretical)
1.541 lb/yd^3	"KPI" PF:	0.352	kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blastec

NOTES (ANY VARIATION FROM STANDARD):

Hole I5 received a 5' stone deck due to void identified while loading

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-014
P.O. #:		Orica Order #:	2512320
Blast Date:	2019-07-30	Blast Time:	12:20 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40354**	**79.88170**	0.757535	1.394199
Front Row Corner	43.40376	79.88168	0.757539	1.394198
Back Row Corner	43.40336	79.88170	0.757532	1.394199
Average (Centre of Blast)	43.40355	79.88169	0.757535	1.394199

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**312.4**	m			
Post Blast Data: ppV:	**7.7**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**12.8**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**120.7**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**1033.6**	m			
Post Blast Data: ppV:	**0.2**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**8.9**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**120.5**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast)	**1269.2**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(312.4)^2}{30^2} \text{ kg}$$

$$= \frac{97{,}594}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 108 kg

jim bray

Orica
Blaster-in-charge: *Mike derkinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

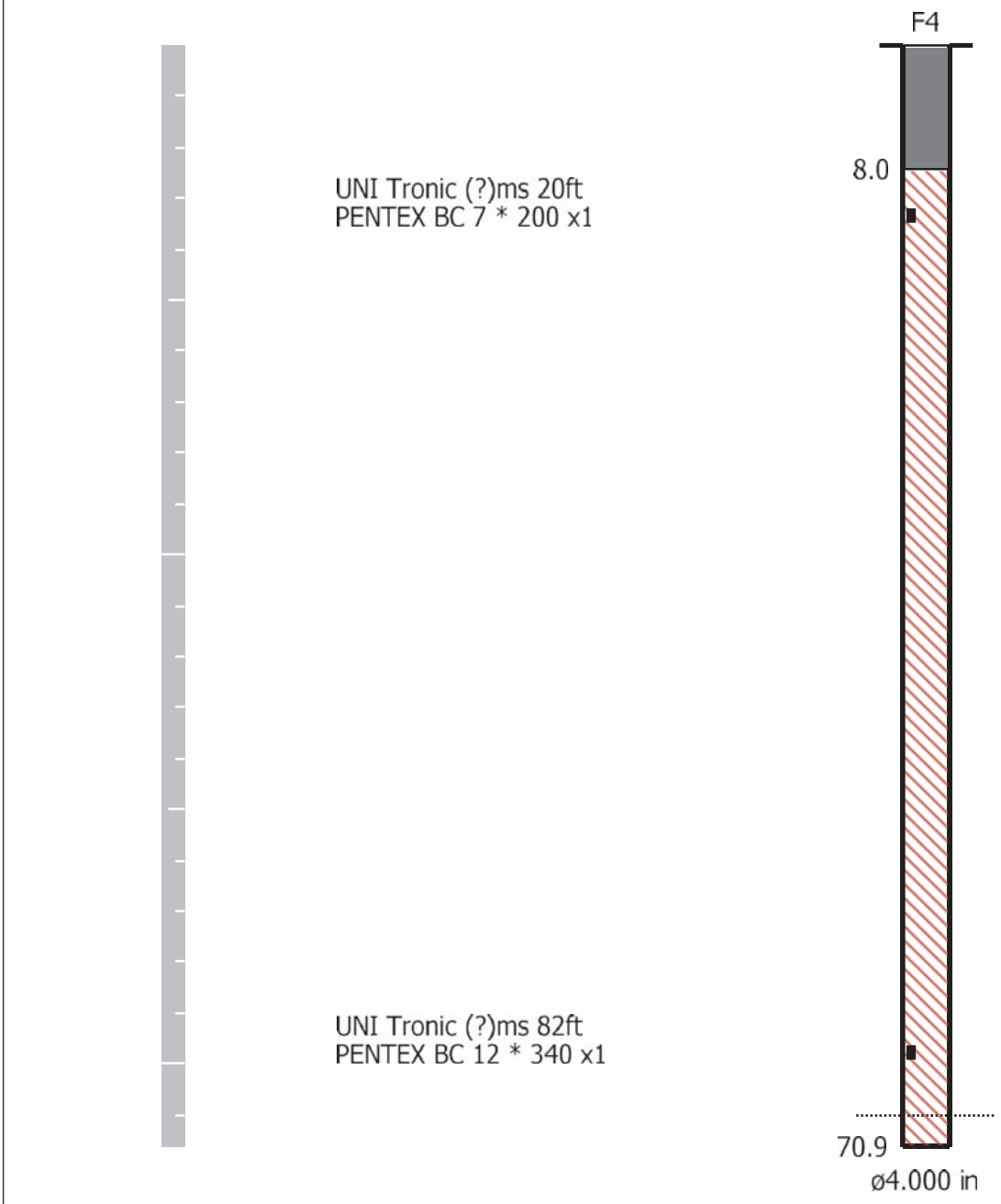
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-014
P.O. #:		Orica Order #:	2512320
Blast Date:	7/30/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 12:20:36 July 30, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.0 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

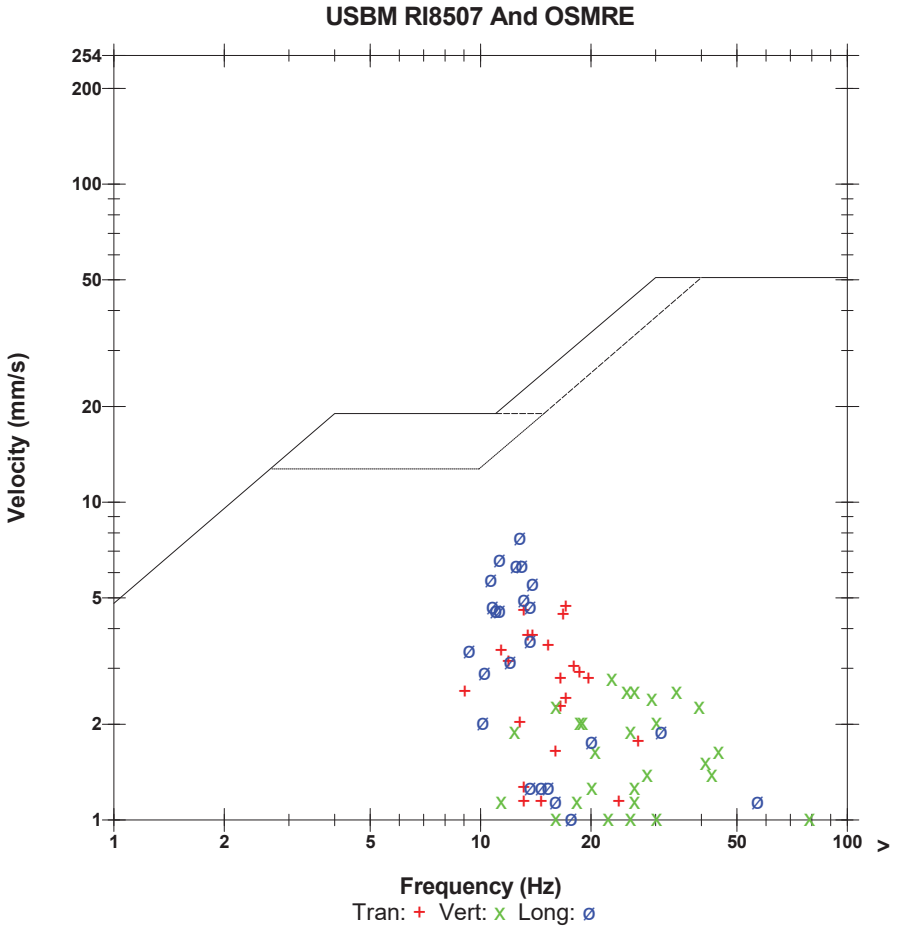
Notes
Location: 2450 #2 Sideroad
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

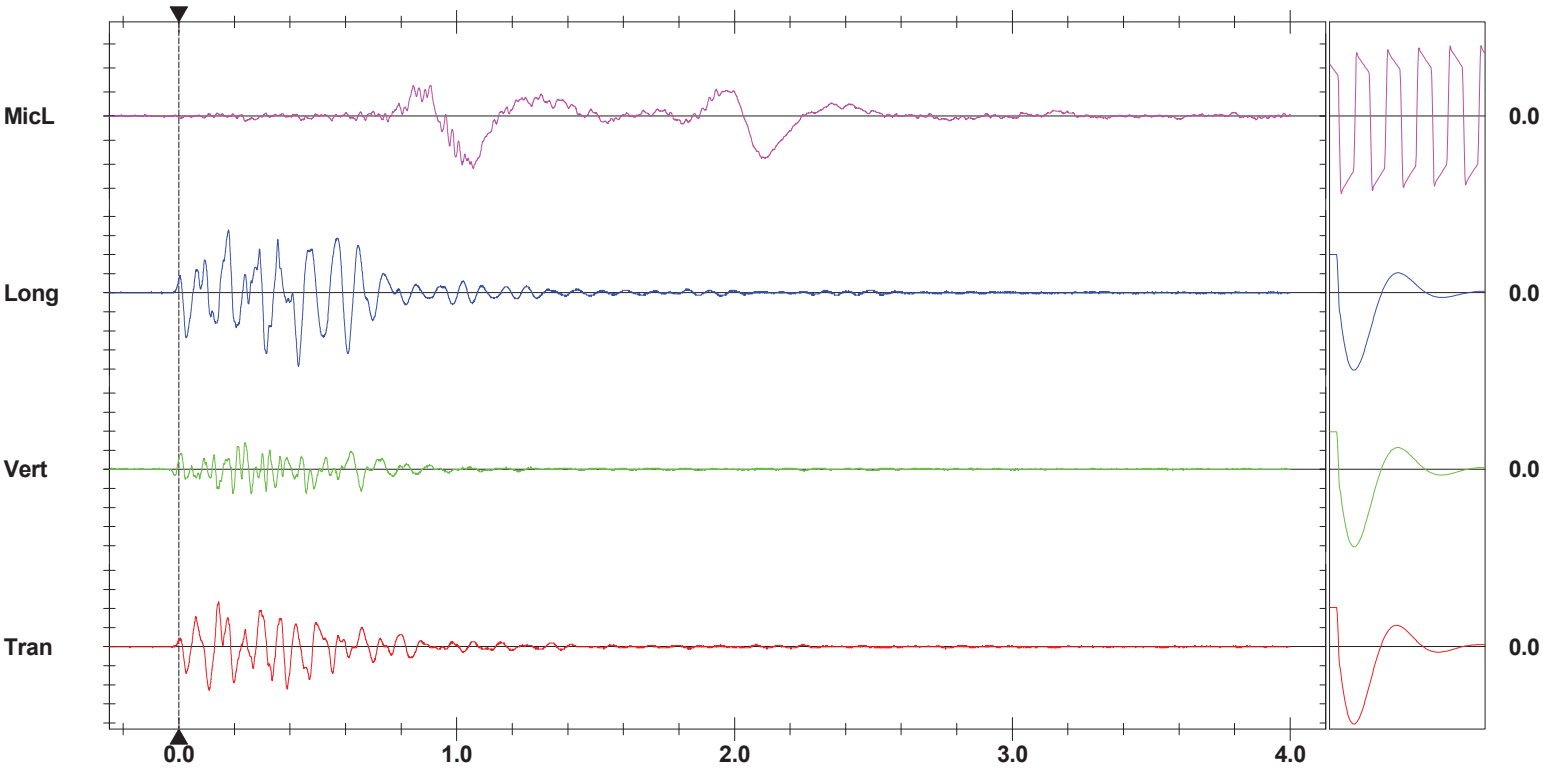
Extended Notes
Sand Bagged
N43.40245W-79.87814

Microphone	Linear Weighting
PSPL	120.7 dB(L) at 1.059 sec
ZC Freq	2.7 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 556 mv)

	Tran	Vert	Long	
PPV	4.699	2.794	7.747	mm/s
ZC Freq	17.1	23	12.8	Hz
Time (Rel. to Trig)	0.143	0.237	0.430	sec
Peak Acceleration	0.080	0.080	0.106	g
Peak Displacement	0.049	0.023	0.091	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.3	Hz
Overswing Ratio	3.7	3.6	4.0	

Peak Vector Sum 7.832 mm/s at 0.430 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	MicL at 12:20:37 July 30, 2019
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.147 sec (Auto=5Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.5 Volts
Unit Calibration	January 15, 2019 by Instantel
File Name	UM6857_20190730122037.IDFW

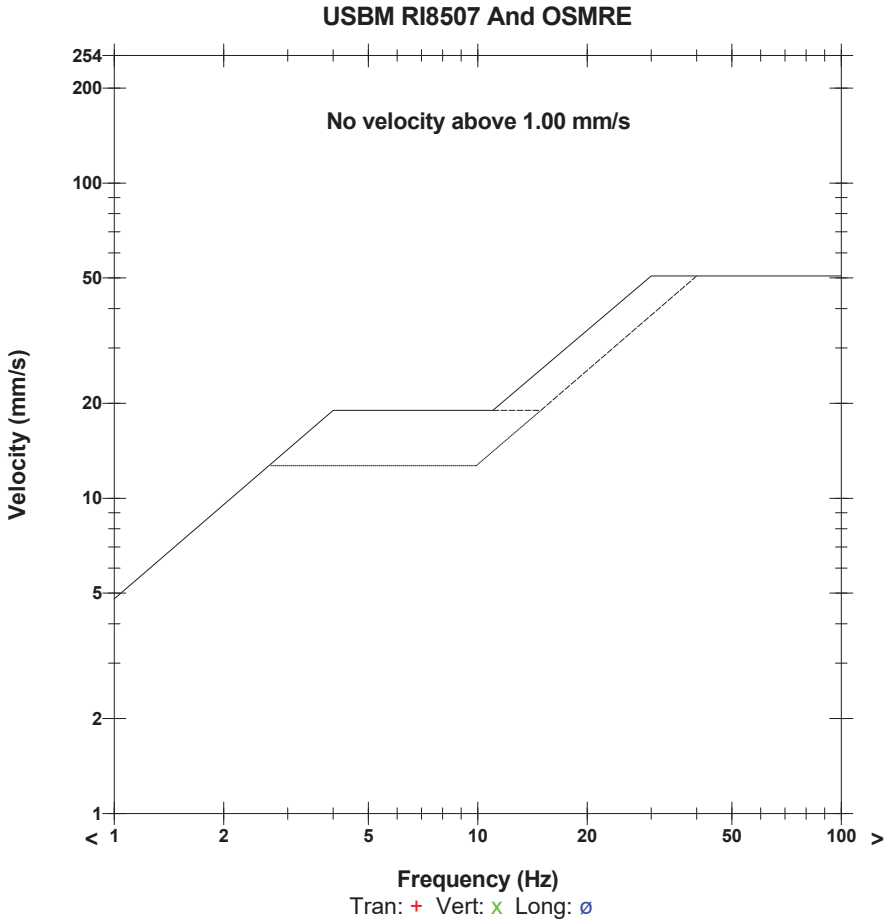
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

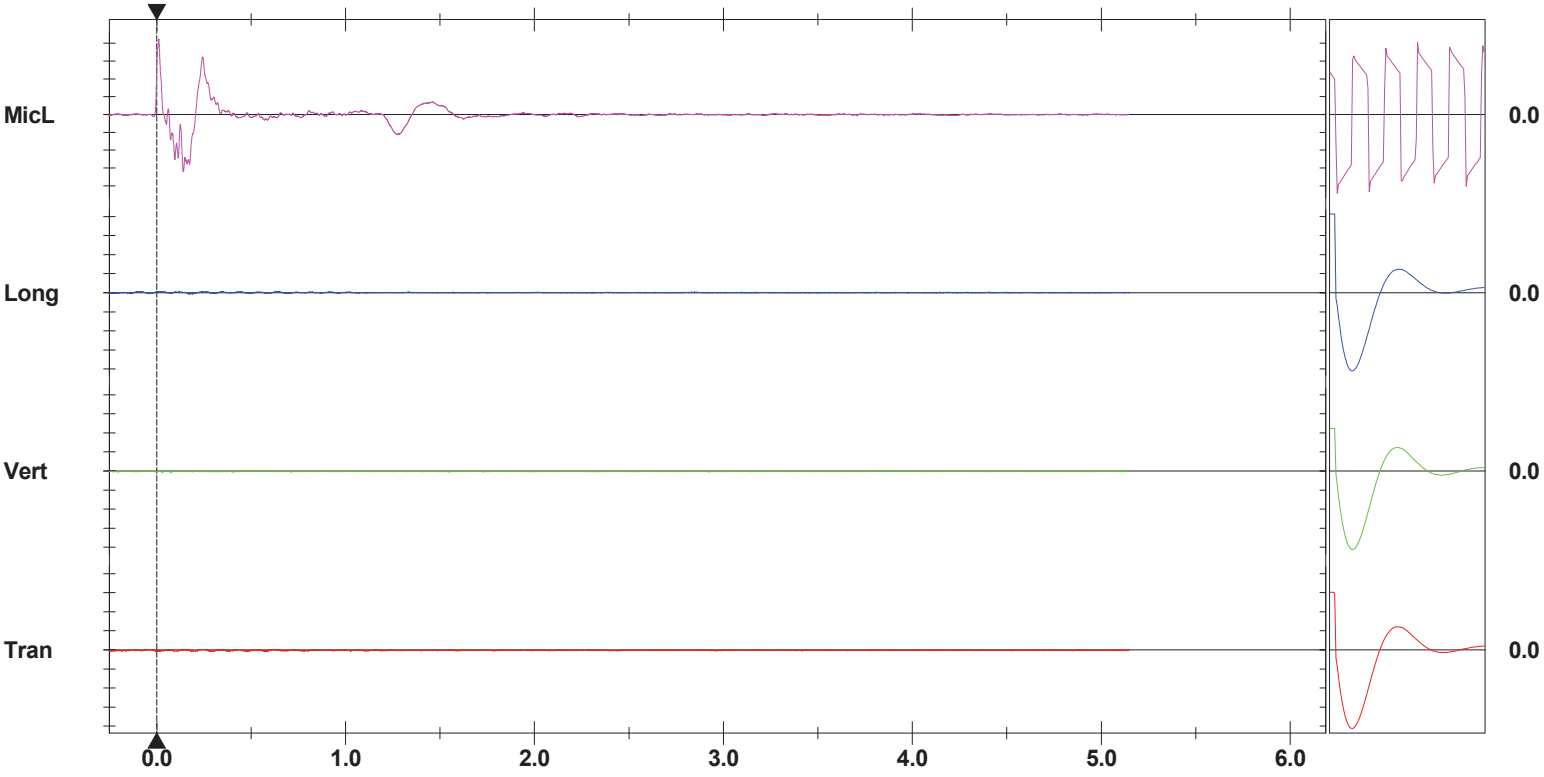
Extended Notes
N 43.31617
W 80.02664

Microphone Linear Weighting
PSPL 120.5 dB(L) at 0.011 sec
ZC Freq 11.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1301 mv)

	Tran	Vert	Long	
PPV	0.166	0.102	0.150	mm/s
ZC Freq	8.9	5.4	8.1	Hz
Time (Rel. to Trig)	0.185	-0.232	0.012	sec
Peak Acceleration	0.010	0.010	0.013	g
Peak Displacement	0.018	0.044	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.4	3.3	3.3	

Peak Vector Sum 0.209 mm/s at 0.185 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

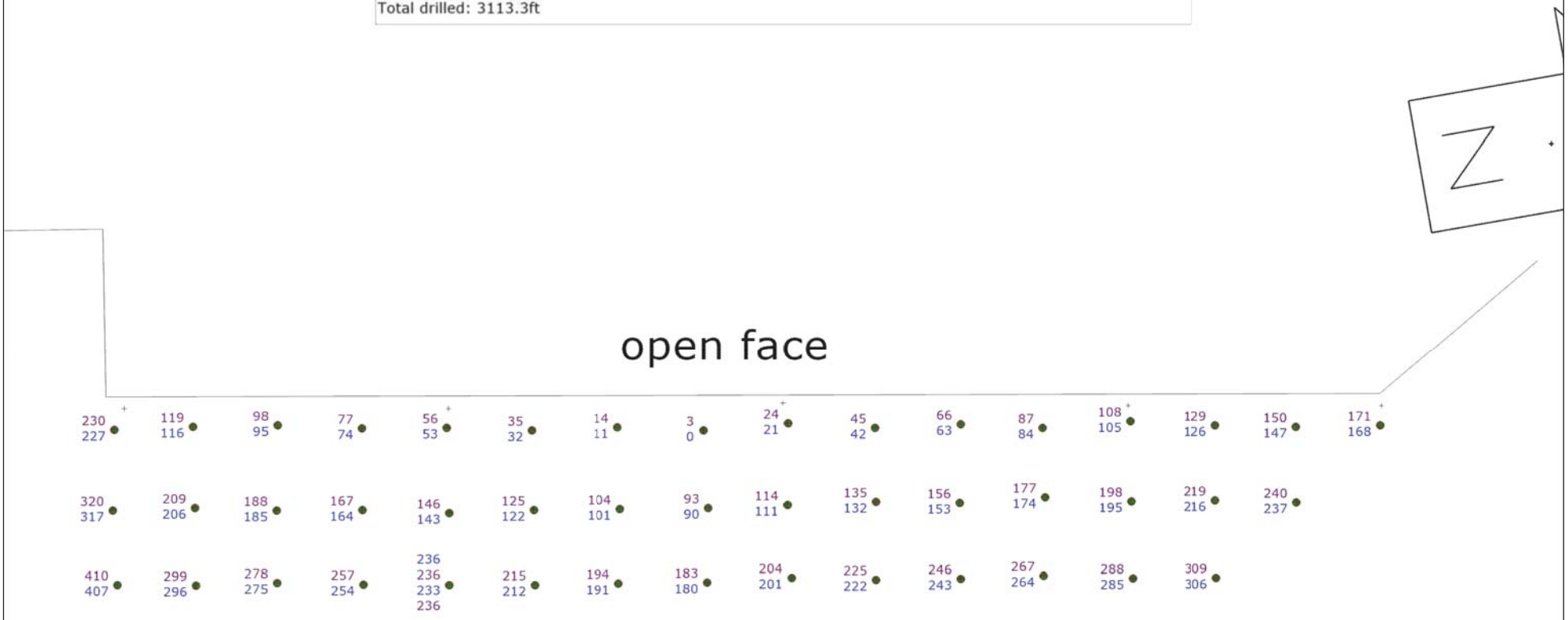
South west corner of property(N43.39339W-79.88880)
Nelson Aggregate
Burlington 2019-07-30 Blast 19-014

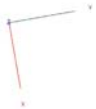
Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6859
Jul 30 /19 05:43:58		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jul 30 /19 11:20:23	Jul 30 /19 11:20:26	Event recorded. Trigger Level Long: 1.50 mm/s
Jul 30 /19 12:43:42	Jul 30 /19 12:43:46	Event recorded. Trigger Level Tran: 1.50 mm/s
Jul 30 /19 12:43:46	Jul 30 /19 12:43:53	Event recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 121.0

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 45	Hole angle: 0.0°
Total drilled: 3113.3ft			





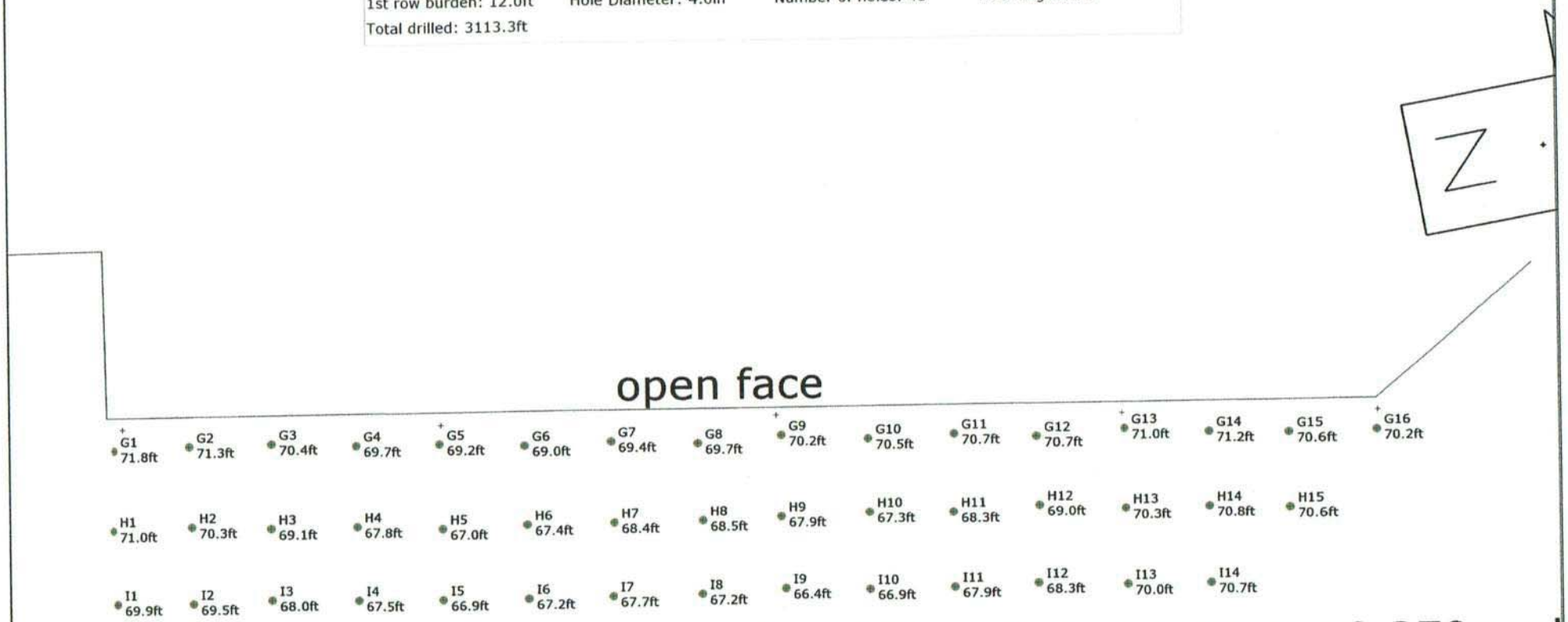
ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 45	Hole angle: 0.0°
Total drilled: 3113.3ft			



9UPMD015 Design Fnl - 4" Blast Hole 12x10 9x10 270 and

DRILLER NAME: _____

ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 45	Hole angle: 0.0°
Total drilled: 3113.3ft			

Z

Load Sheet 230Kg Max

open face

214	203	241	207	197	197	209	214	203	196	203	197	194	181	202	198
210	238	206	212	180 +15 PLUG	184	203	196	192	196	197	198	203	207	203	
204	190	200	198	198	120	196	205	196	187	187	198	211	195 + BLOW		

ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 45	Hole angle: 0.0°
Total drilled: 3113.3ft			

N

APPROX 10000 KGS

open face

POSTS

G1 71.8ft	G2 71.3ft	G3 70.4ft	G4 69.7ft	G5 69.2ft	G6 69.0ft	G7 69.4ft	G8 69.7ft	G9 70.2ft	G10 70.5ft	G11 70.7ft	G12 70.7ft	G13 71.0ft	G14 71.2ft	G15 70.6ft	G16 70.2ft
H1 71.0ft	H2 70.3ft	H3 69.1ft	H4 67.8ft	H5 67.0ft	H6 67.4ft	H7 68.4ft	H8 68.5ft	H9 67.9ft	H10 67.3ft	H11 68.3ft	H12 69.0ft	H13 70.3ft	H14 70.8ft	H15 70.6ft	
I1 69.9ft	I2 69.5ft	I3 68.0ft	I4 67.5ft	I5 66.9ft	I6 67.2ft	I7 67.7ft	I8 67.2ft	I9 66.4ft	I10 66.9ft	I11 67.9ft	I12 68.3ft	I13 70.0ft	I14 70.7ft		

9UPMD015 Design Fnl - 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV

DRILLER NAME: Mike Keller

Start July 25/19

Finish July 29/19

ORICA

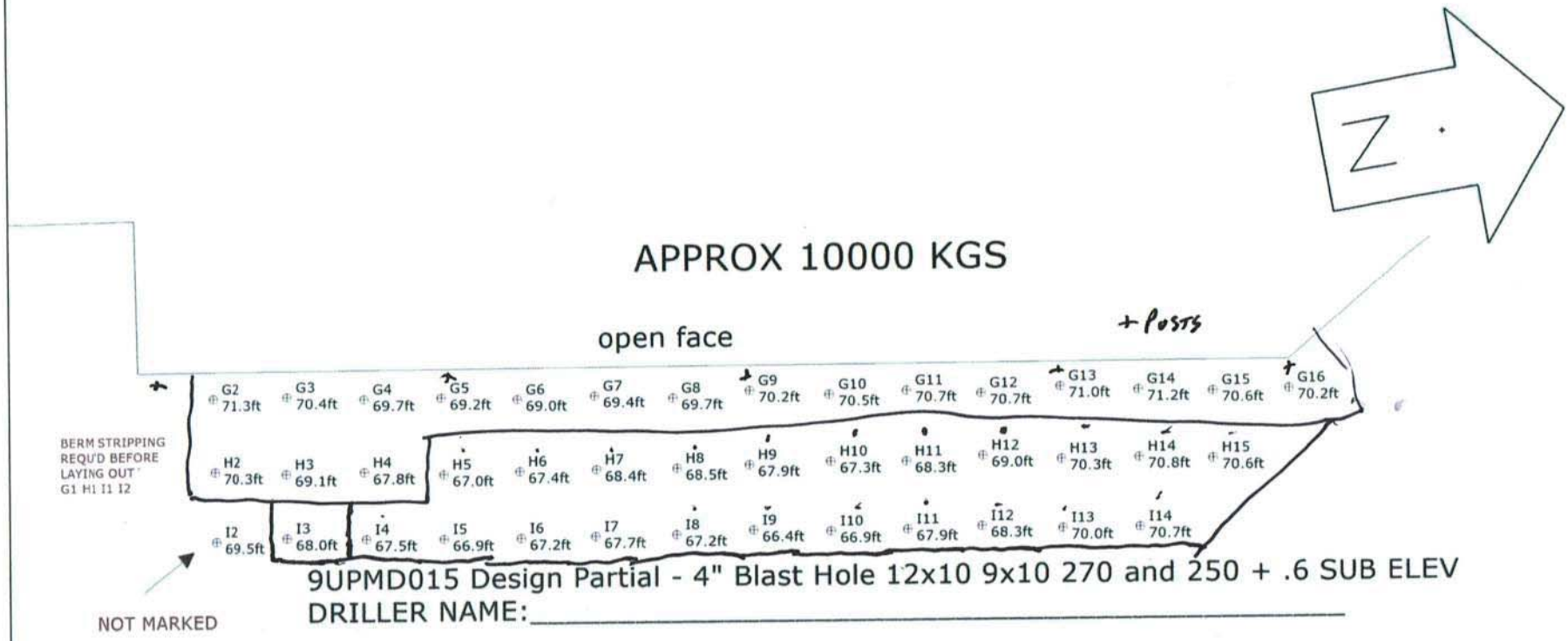
Scale 1:250

SHOTPlus™ Professional 5.7.4.4		7/29/2019
Mine	Burlington	
Location		
Title/author	9UPMD015 Design Partial	
Filename	9UPMD015 Design Fnl.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 42	Hole angle: 0.0°
Total drilled: 2900.7ft			



9UPMD015 Design Partial - 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

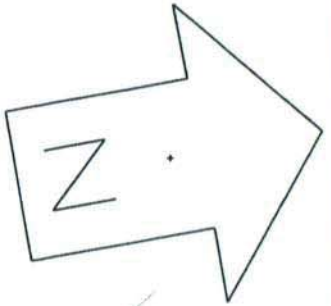
Scale 1:275

SHOTPlus™ Professional 5.7.4.4	7/26/2019
Mine	Burlington
Location	
Title/author	9UPMD015 Design Partial
Filename	9UPMD015 Design Partial Fnl.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 29	Hole angle: 0.0°
Total drilled: 2016.5ft			



G1 to be added H1 after str.ripping crew done

open face

G2 71.3ft	G3 70.4ft	G4 69.7ft	G5 69.2ft	G6 69.0ft	G7 69.4ft	G8 69.7ft	G9 70.2ft	G10 70.5ft	G11 70.7ft	G12 70.7ft	G13 71.0ft	G14 71.2ft	G15 70.6ft	G16 70.2ft
H2 70.3ft	H3 69.1ft	H4 67.8ft	H5 67.0ft	H6 67.4ft	H7 68.4ft	H8 68.5ft	H9 67.9ft	H10 67.3ft	H11 68.3ft	H12 69.0ft	H13 70.3ft	H14 70.8ft	H15 70.6ft	

9UPMD015 Design Partial - 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV

DRILLER NAME: Michael Keller

Start July 25/19

ORICA

Scale 1:250

SHOTPlus™ Professional 5.7.4.4		7/25/2019
Mine	Burlington	
Location		
Title/author	9UPMD015 Design Partial	
Filename		

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-015
P.O. #:		Orica Order #:	2517100
Blast Date:	2019-08-12	Blast Time:	12:10 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40432 °N Latitude (Centre of Blast) 79.88176 °W Longitude (Centre of Blast)

Wind from the: N at 0 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	28,893 te	11,113 m3
Total tonnes per day:	28,893 te	NB60-06 Rate Code
Total Holes Loaded:	66 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	64	=	3,799.9 ft (4 " diam)
Secondary Bit diam:	92.1	mm	0 °	# Holes:	2	=	118.7 ft (3 5/8 " diam)
Tertiary Bit diam:		mm	0 °	# Holes:		=	0.0 ft (" diam)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	30	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	36	main body
Bench Height:	57.4	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	59.4	ft avg

- Stone Decking -

Front Row:	8.0	ft avg
Main Body:	0.0	ft avg
# Decks:	3	per blast

- Collar Stemming -

Front Row:	8.0	ft avg
Main Body:	7.0	ft avg
Material used:	3/4" Clear	

- Charge Length -

Front Row:	43.4	ft avg
Main Body:	52.4	ft avg

- Charge Weight -

Front Row:	126.5	kg/hole
Main Body:	152.7	kg/hole
Max. per delay:	238.0	kg/delay
SD () Equation:	143.8	kg/delay
Total kg Loaded:	11,199	kg
Rock Density:	2.60	g/cc = te/m3

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

1.699 lb/yd3	Yield PF:	0.388	kg/te (actual)
1.093 lb/yd3	Front row:	0.250	kg/te (theoretical)
1.760 lb/yd3	Main Body:	0.402	kg/te (theoretical)
1.538 lb/yd3	"KPI" PF:	0.351	kg/te (theoretical)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,850	22,690	11,160

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	69	15.7
PENTEX 12 (OR EQUIVALENT)	0.34	69	23.5

total explosives weight in Blast (kg): 11,199

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			65
UNITRONIC 600 20M			43
UNITRONIC 600 25M			30

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	2
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

3 Stone decks were added due to voids identified by driller on the drill log.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-015
P.O. #:		Orica Order #:	2517100
Blast Date:	2019-08-12	Blast Time:	12:10 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40437**	**79.88178**	0.757549	1.394200
Front Row Corner	43.40390	79.88181	0.757541	1.394201
Back Row Corner	43.40470	79.88170	0.757555	1.394199
Average (Centre of Blast)	43.40432	79.88176	0.757548	1.394200

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**359.7**	m			
Post Blast Data: ppV:	**3.9**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**11.6**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**112.8**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance **(2nd Seis. From Centre of Blast)**	**1008.2**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

Colling Rd & Blind Line Bruce Trail

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39329	79.88868	0.757356	1.394321
2nd Reading				
Average	43.39329	79.88868	0.757356	1.394321

Distance (3rd Seis. From Centre of Blast)	**1349.6**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(359.7)^2}{30^2} \text{ kg}$$

$$= \frac{129{,}384}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 144 kg

jim bray

Orica
Blaster-in-charge:

Signature required, indicating that
Blast Report is Complete & Accurate.

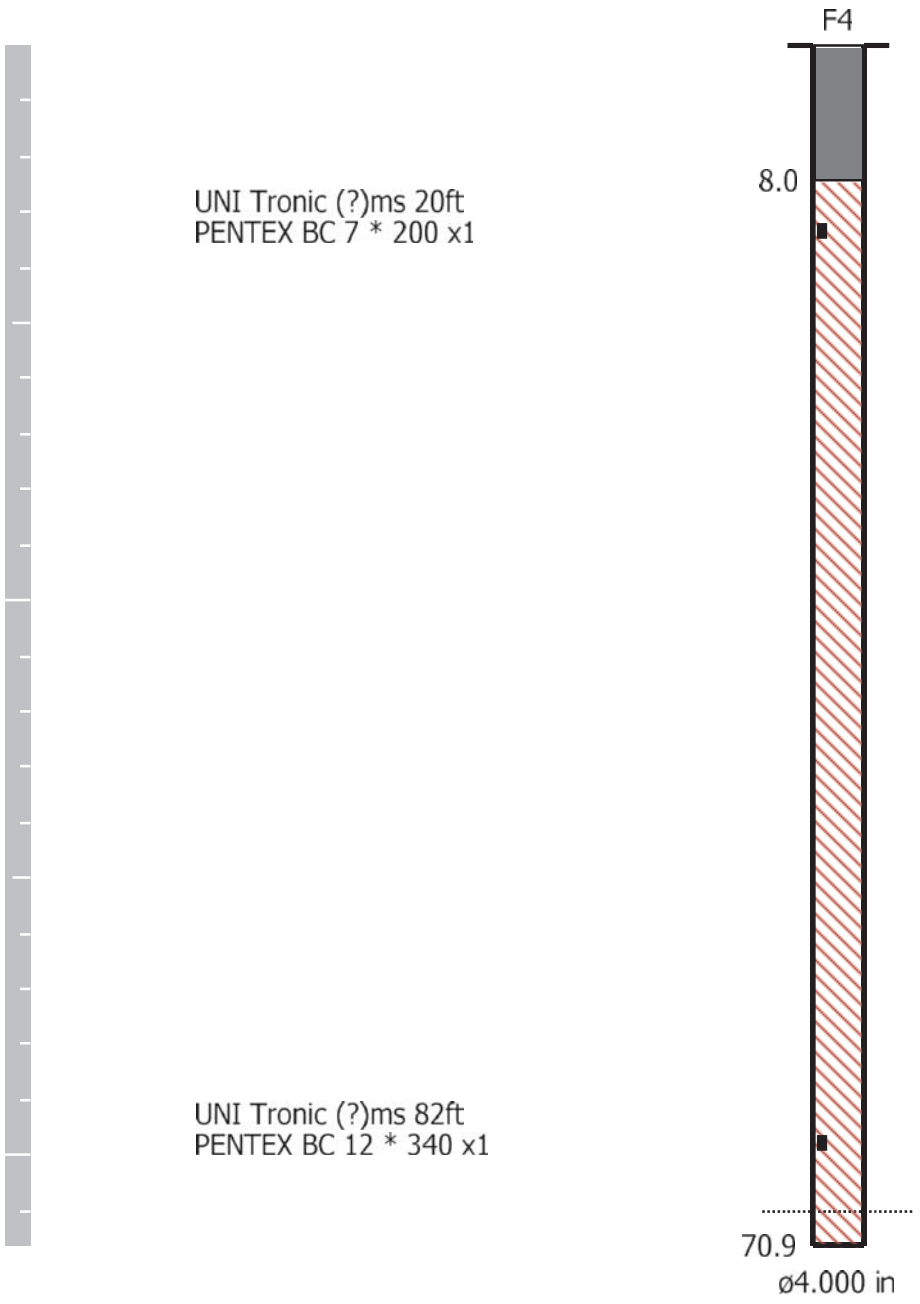
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-015
P.O. #:		Orica Order #:	2517100
Blast Date:	8/12/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 12:10:05 August 12, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.25 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 2nd Line, Burlington,On
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

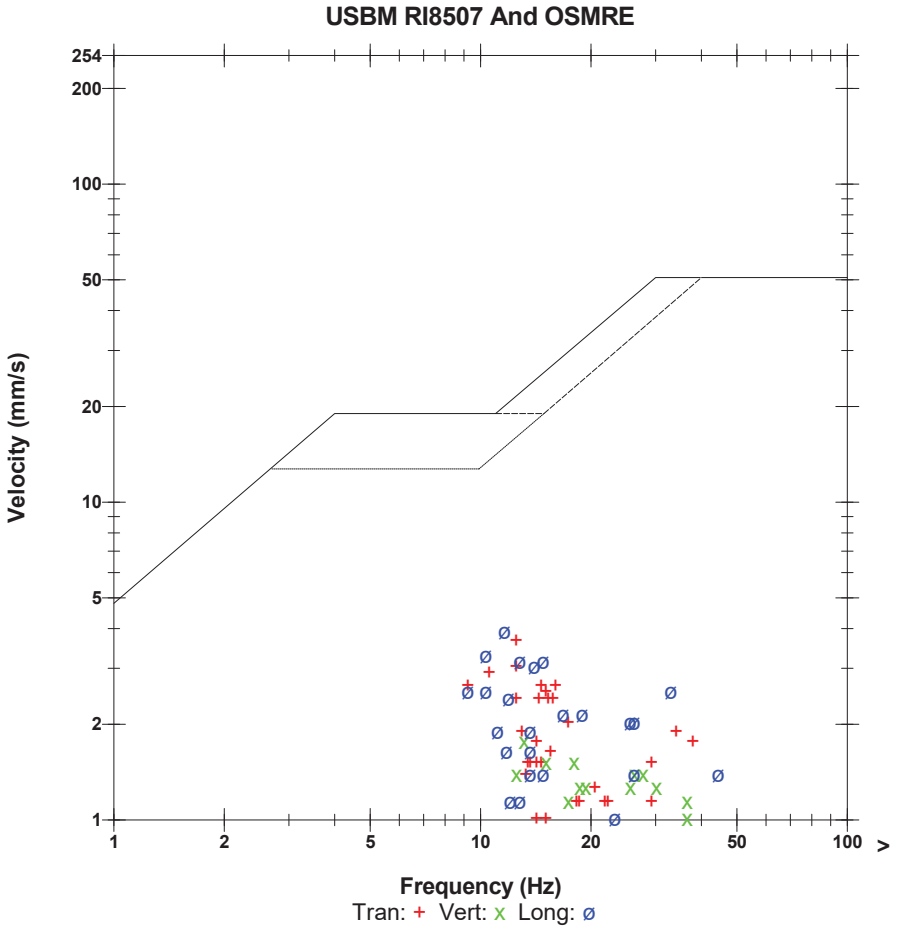
Extended Notes

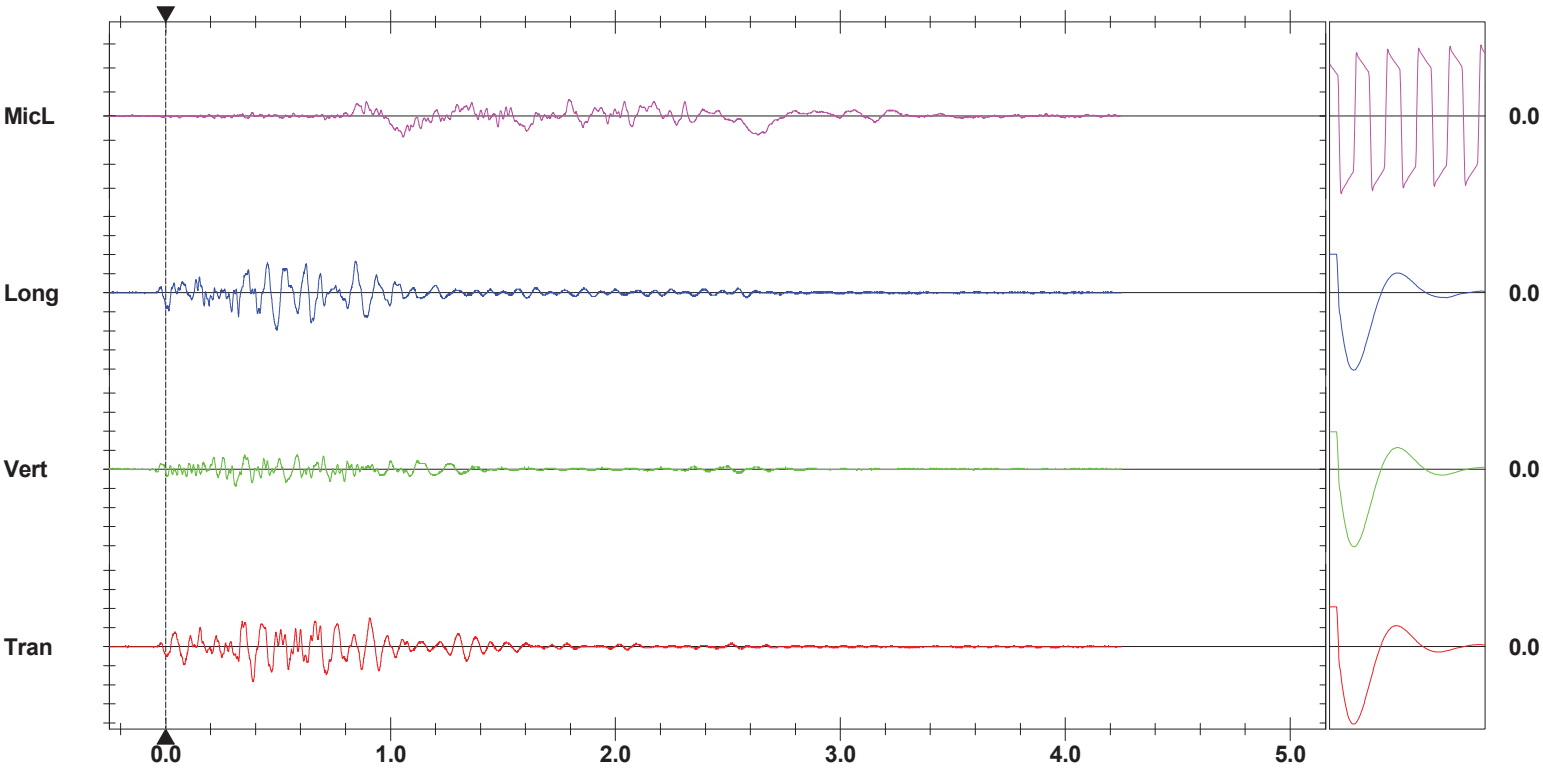
Sand Bagged
N43.40245:W-79.87814

Microphone	Linear Weighting
PSPL	112.8 dB(L) at 1.056 sec
ZC Freq	2.4 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 533 mv)

	Tran	Vert	Long	
PPV	3.683	1.778	3.937	mm/s
ZC Freq	12.5	13.1	11.6	Hz
Time (Rel. to Trig)	0.388	0.312	0.494	sec
Peak Acceleration	0.053	0.053	0.080	g
Peak Displacement	0.044	0.018	0.052	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.4	Hz
Overswing Ratio	3.8	3.6	4.0	

Peak Vector Sum 4.111 mm/s at 0.491 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Coling rd & Blind Line (Bruce Trail)
Nelson Aggregate
Burlington 2019-08-12 Blast 19-015 Upper Middle

Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
---	---	SERIAL NUMBER: UM6857
Aug 12 /19 06:04:45		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Aug 12 /19 06:04:45	Aug 12 /19 12:42:41	No events recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic:

SW Corner of Property
Nelson Aggregate
Burlington 2019-08-12 Blast 19-015 Upper Middle

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6859
Aug 12 /19 06:09:14		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 115.0 dB
Aug 12 /19 06:09:14	Aug 12 /19 12:38:37	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic:

SHOTPlus Plan

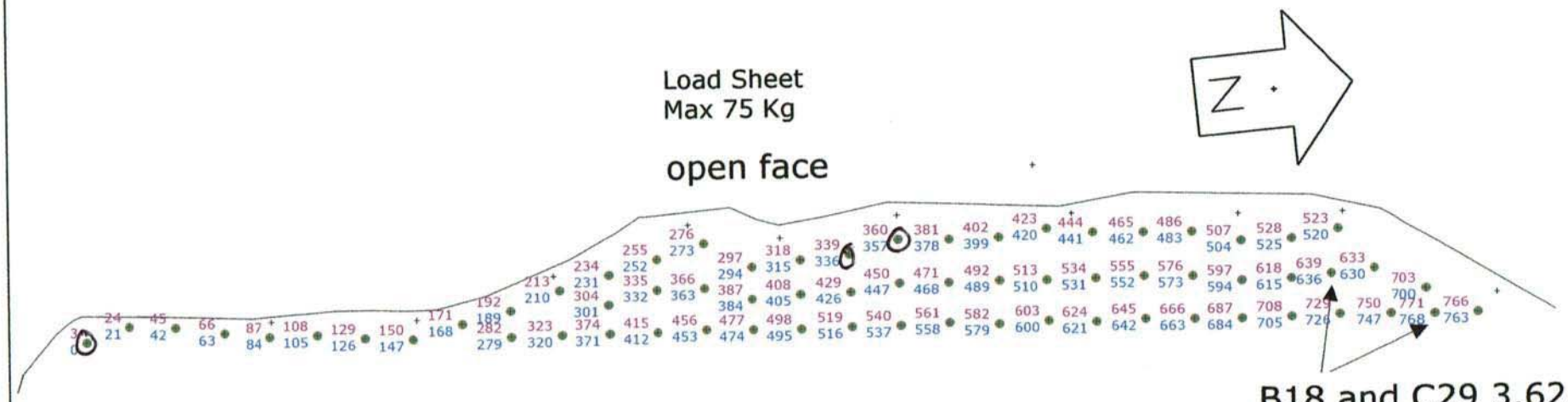
Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 66	Hole angle: 0.0°
Total drilled: 3918.7ft			

0 = Deck

Load Sheet
Max 75 Kg

open face



B18 and C29 3.625" DIA

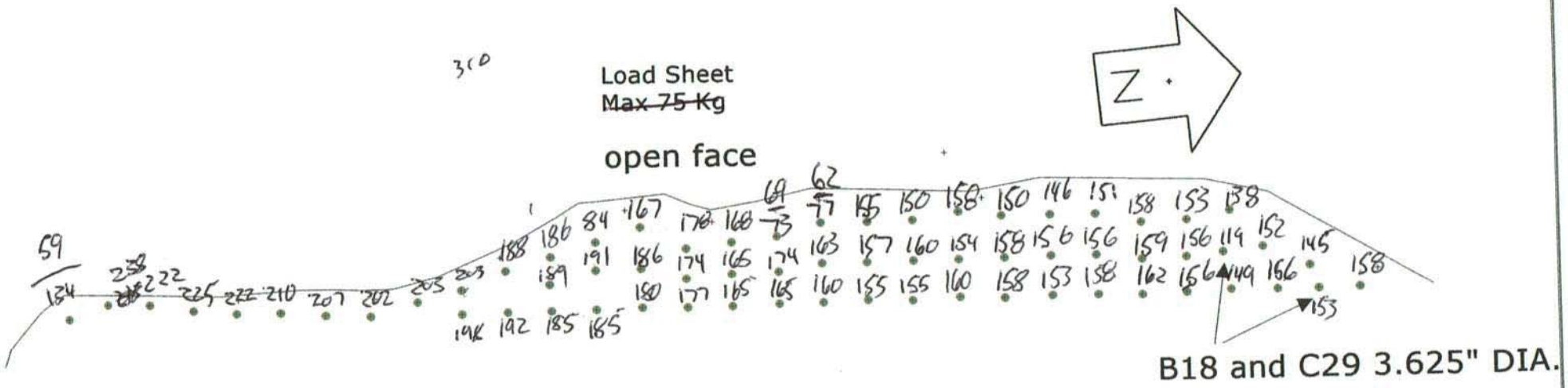
ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 66	Hole angle: 0.0°
Total drilled: 3918.7ft			

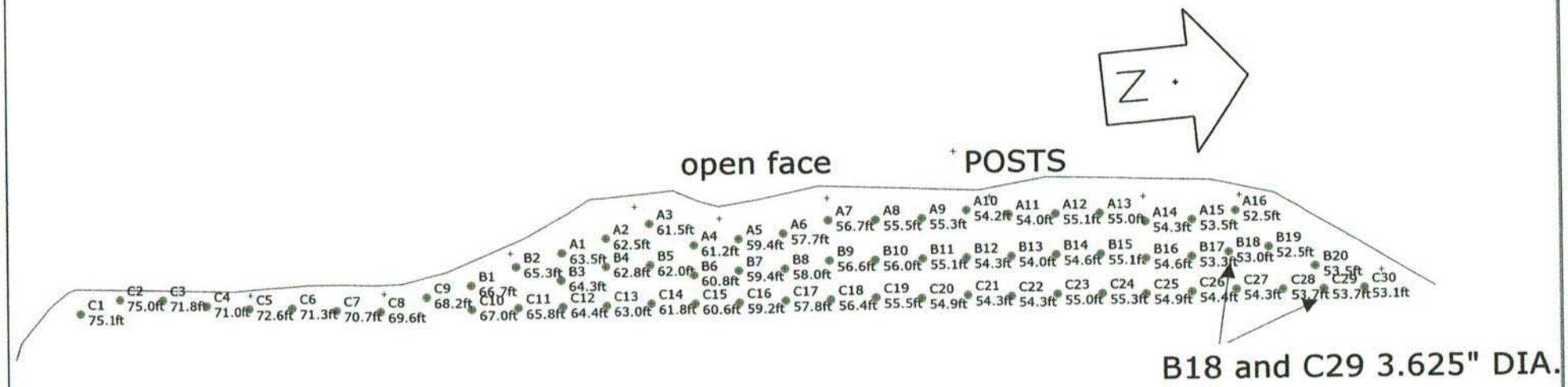


Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 66	Hole angle: 0.0°
Total drilled: 3918.7ft			



ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 66	Hole angle: 0.0°
Total drilled: 3918.7ft			

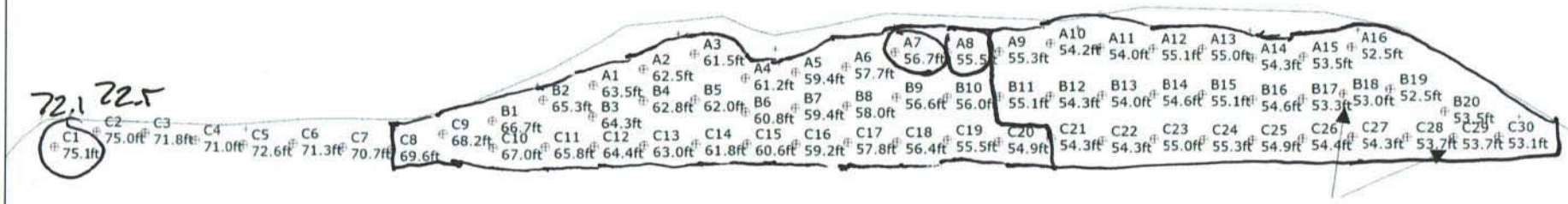
- 5.5'
3913.2'

12165 KGS

N

open face

POSTS



B18 and C29 3.625" DIA.

9MID014 Design Partial - 3.625 and 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV
DRILLER NAME: Michael Keller

Start July 29/19

Finish July 31/19

ORICA

0 = void see log

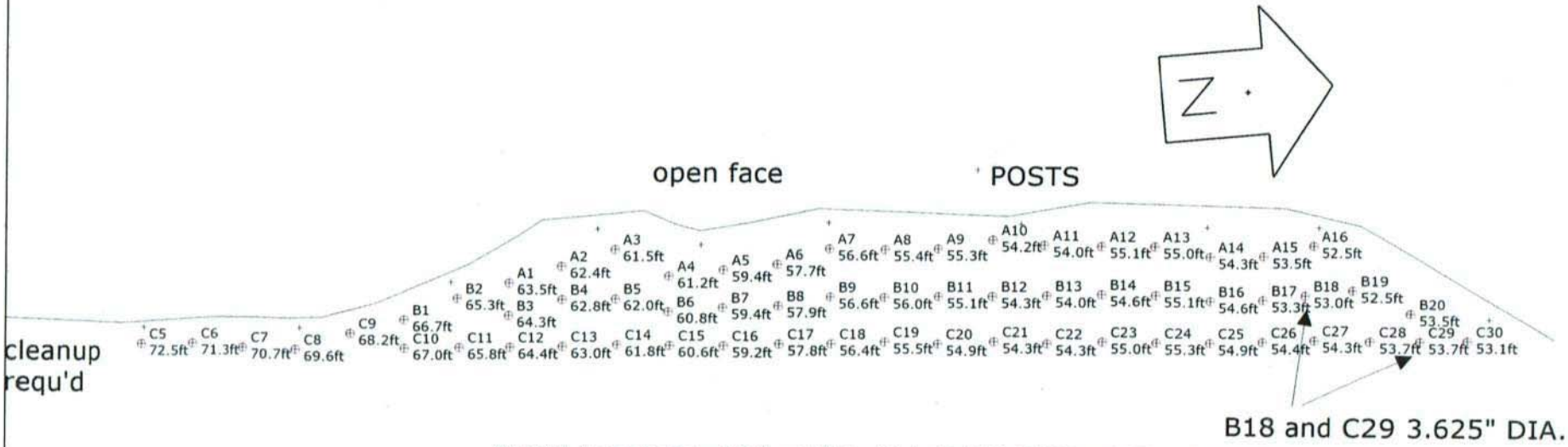
Scale 1:400

SHOTPlus™ Professional 5.7.4.4		7/29/2019
Mine	Burlington	
Location	MID BETWEEN NECRNR AND UPMD	
Title/author	9MID014 Partial Design Fnl	
Filename	9MID014 Partial Design Fnl.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 62	Hole angle: 0.0°
Total drilled: 3624.7ft			



9MID014 Design Partial - 3.625 and 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

Scale 1:375

SHOTPlus™ Professional 5.7.4.4		7/29/2019
Mine	Burlington	
Location	MID BETWEEN NECRNR AND UPMD	
Title/author	9MID014 Partial Design Fnl	
Filename		

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-016
P.O. #:		Orica Order #:	2521575
Blast Date:	2019-08-22	Blast Time:	12:04 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40434 °N Latitude (Centre of Blast) 79.88168 °W Longitude (Centre of Blast)

Wind from the: NW at 15 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 9,144 ft

Tonnes Blasted:	30,187 te	11,610 m3
Total tonnes per day:	30,187 te	TBD Rate Code
Total Holes Loaded:	70 holes	
… including:	0 Dead Holes	
… and:	2 Helper Holes	
Helper Hole Collar:	35.0 ft avg	
# Rows Blasted:	2 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	34 front row	
- Pattern (Back Row) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	36 back row	
Bench Height:	57.7 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	59.7 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Back Row:	4.0 ft avg	
# Decks:	68 per blast	
- Collar Stemming -		
Front Row:	8.0 ft avg	
Back Row:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	47.7 ft avg	
Back Row:	48.7 ft avg	
- Charge Weight -		
Front Row:	139.0 kg/hole	
Back Row:	141.9 kg/hole	
Max. per delay:	130.0 kg/delay	
SD () Equation:	5.0 kg/delay	
Total kg Loaded:	11,030 kg	
Rock Density:	2.60 g/cc = te/m^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

1.601 lb/yd^3	Yield PF:	0.365 kg/te (actual)
1.196 lb/yd^3	Front row:	0.273 kg/te (theoretical)
1.628 lb/yd^3	Main Body:	0.371 kg/te (theoretical)
1.412 lb/yd^3	"KPI" PF:	0.322 kg/te (theoretical)

- Drilling Information -

				Angle from Vertical		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	# Holes:	66	=	3,937.6 ft (4 " diam)
Secondary Bit diam:	114.3	mm	# Holes:	4	=	238.6 ft (4 1/2 " diam)
Tertiary Bit diam:		mm	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,930	22,980	10,950

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	1	25

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	68	23.1
PENTEX DUO (OR EQUIVALENT)	0.45	70	31.8

total explosives weight in Blast (kg): 11,030

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 9M			23
UNITRONIC 600 15M			45
UNITRONIC 600 20M			18
UNITRONIC 600 25M			52
EXEL MS 18m		25 ms	25
EXEL MS 25m		25 ms	45

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	1
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

Package was used to bring up collars

Rate code to be determined by sale rep.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-016
P.O. #:		Orica Order #:	2521575
Blast Date:	2019-08-22	Blast Time:	12:04 PM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40439**	**79.88167**	0.757549	1.394198
Front Row Corner	43.40387	79.88176	0.757540	1.394200
Back Row Corner	43.40478	79.88161	0.757556	1.394197
Average (Centre of Blast)	43.40434	79.88168	0.757549	1.394198

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**355.8**	m		
Post Blast Data: ppV:	**7.2**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**12.5**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**116.7**	dB	Trigger set at: **115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	**1348.6**	m		
Post Blast Data: ppV:	**1.5**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**41.0**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**111.3**	dB	Trigger set at: **115**	dB

South West Corner of property

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	**67.1**	m		
Post Blast Data: ppV:	48.64 xxx**1.5**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	30 xx**41.0**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	128.3 xxxx**3**	dB	Trigger set at: **115**	dB

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(67.1)^2}{30^2} \text{ kg}$$

$$= \frac{4{,}502}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 5 kg

jim bray

Orica
Blaster-in-charge: Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

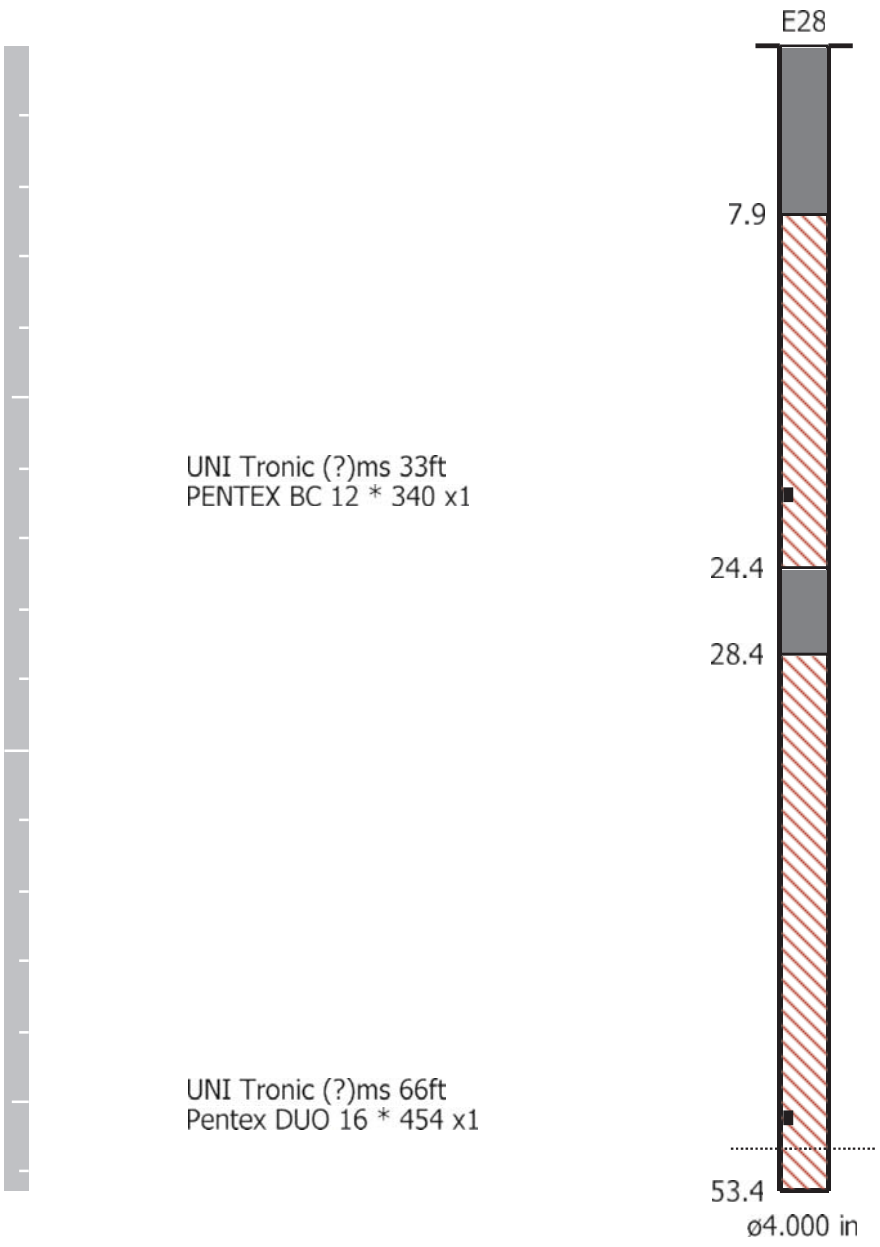
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-016
P.O. #:		Orica Order #:	2521575
Blast Date:			

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 12:05:01 August 22, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.25 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 2nd Line
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

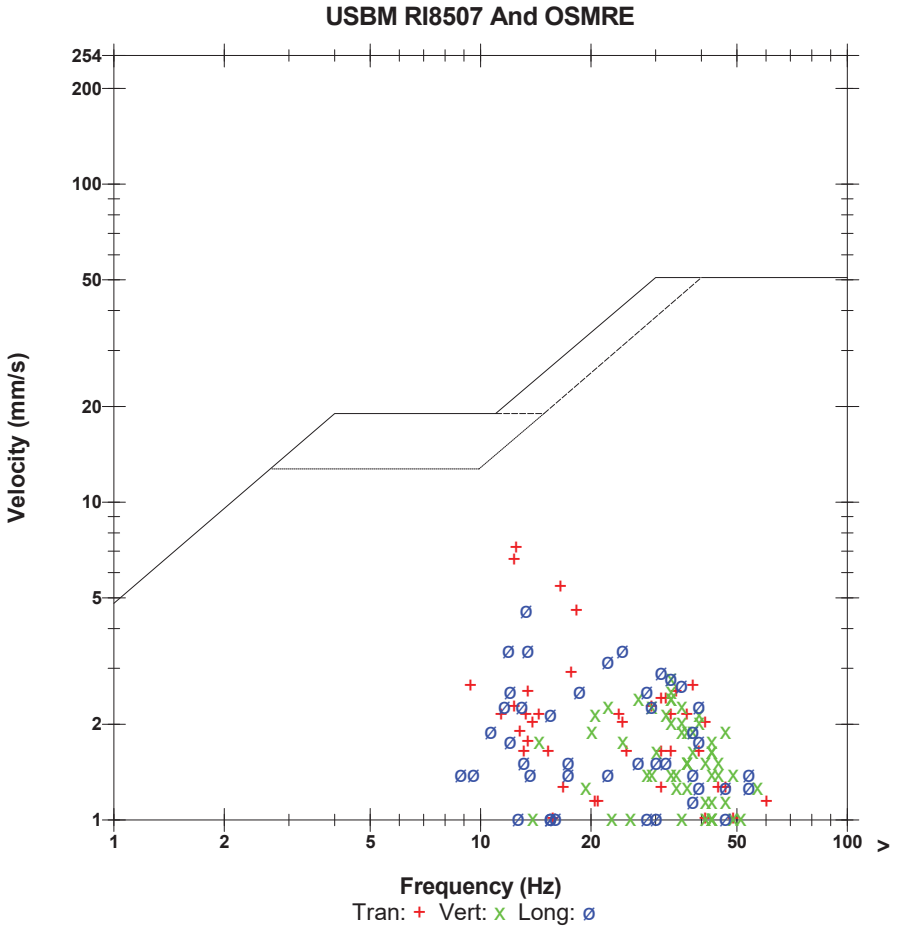
Extended Notes

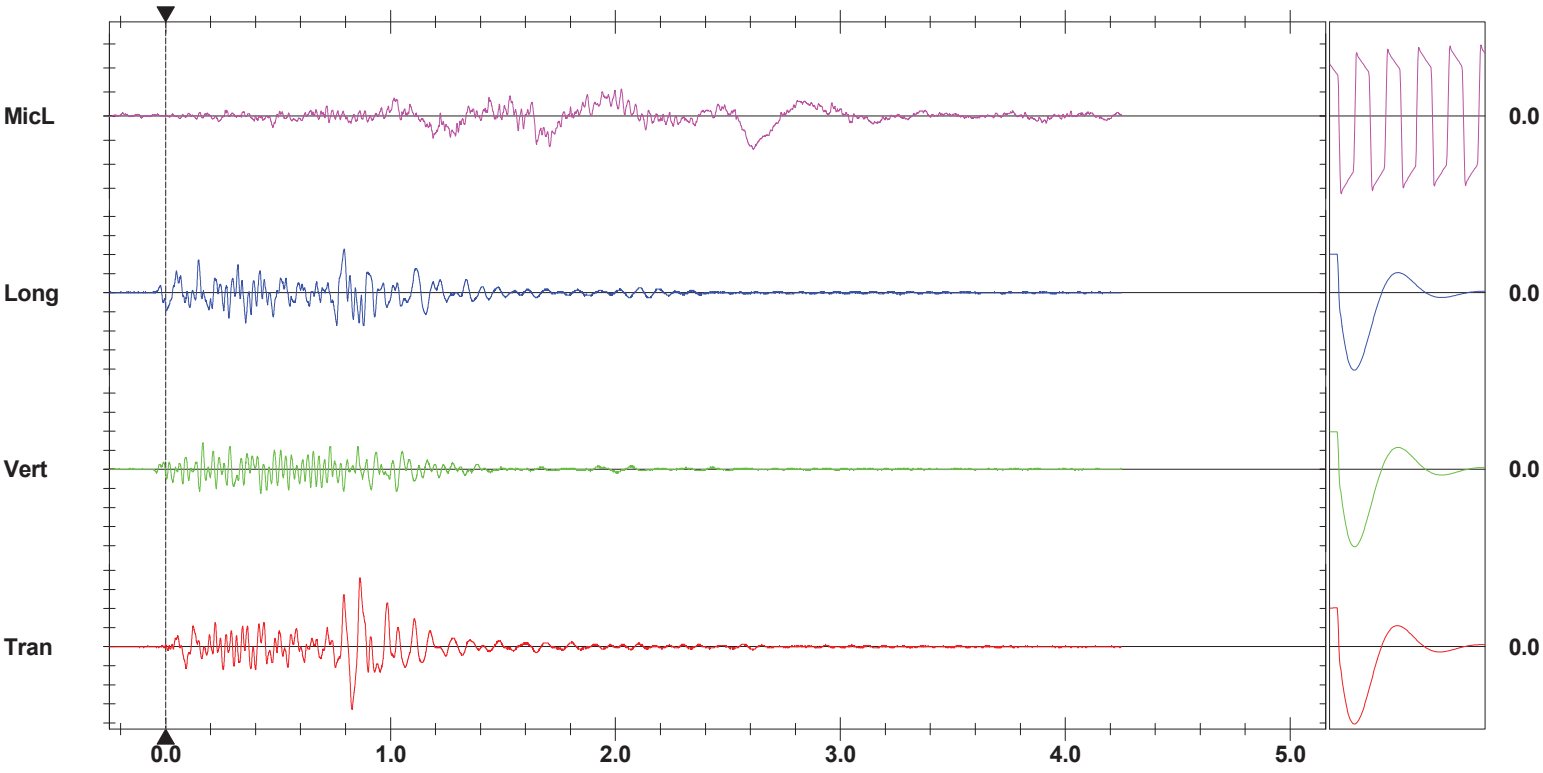
Sand Bagged
N43.40245,W-79.87814

Microphone	Linear Weighting
PSPL	116.7 dB(L) at 2.612 sec
ZC Freq	2.6 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 530 mv)

	Tran	Vert	Long	
PPV	7.239	2.794	4.572	mm/s
ZC Freq	12.5	33	13.3	Hz
Time (Rel. to Trig)	0.864	0.165	0.793	sec
Peak Acceleration	0.106	0.080	0.080	g
Peak Displacement	0.079	0.019	0.050	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.6	3.9	

Peak Vector Sum 7.523 mm/s at 0.864 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	Long at 12:04:56 August 22, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 121.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.0 sec (Auto=4Sec) at 2048 sps
Operator/Setup:	Mike der Kinderen/Burlington SW.MMB

Serial Number	UM6859 V 10-89 Micromate ISEE
Battery Level	3.7 Volts
Unit Calibration	December 24, 2018 by Instantel
File Name	UM6859_20190822120456.IDFW

Notes

Location:	SouthWest Corner of Quarry
Client:	Nelsons Burlington
User Name:	Orica Canada Inc.
General:	Monitoring Vibration and Airblast

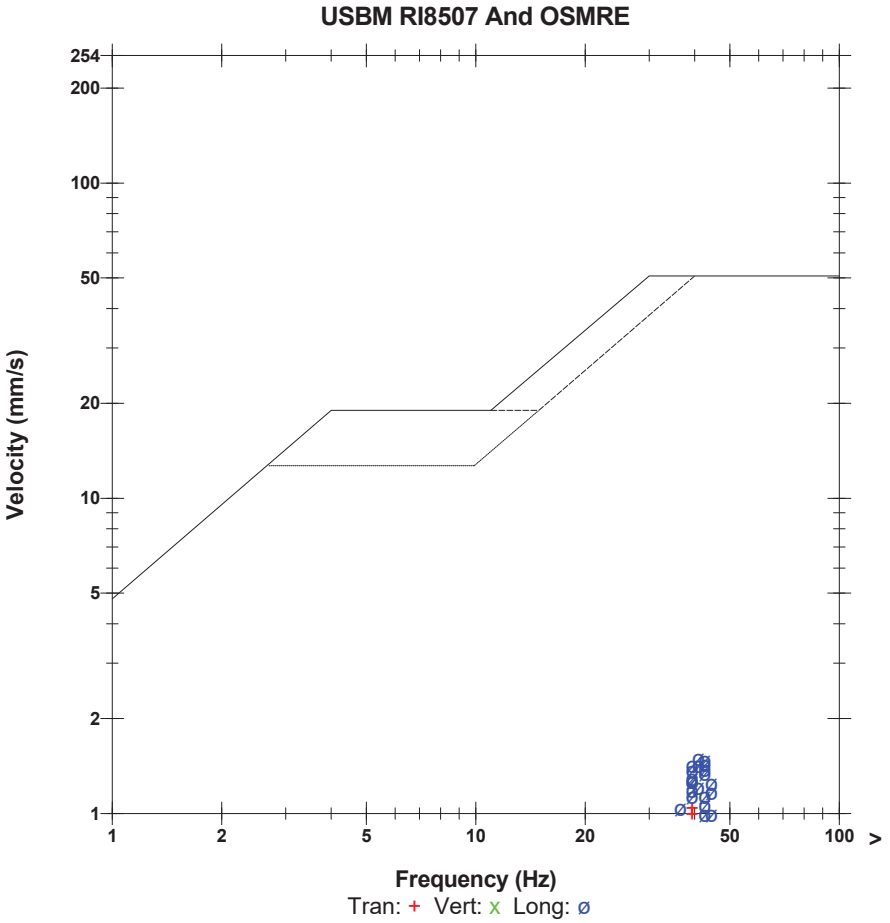
Extended Notes

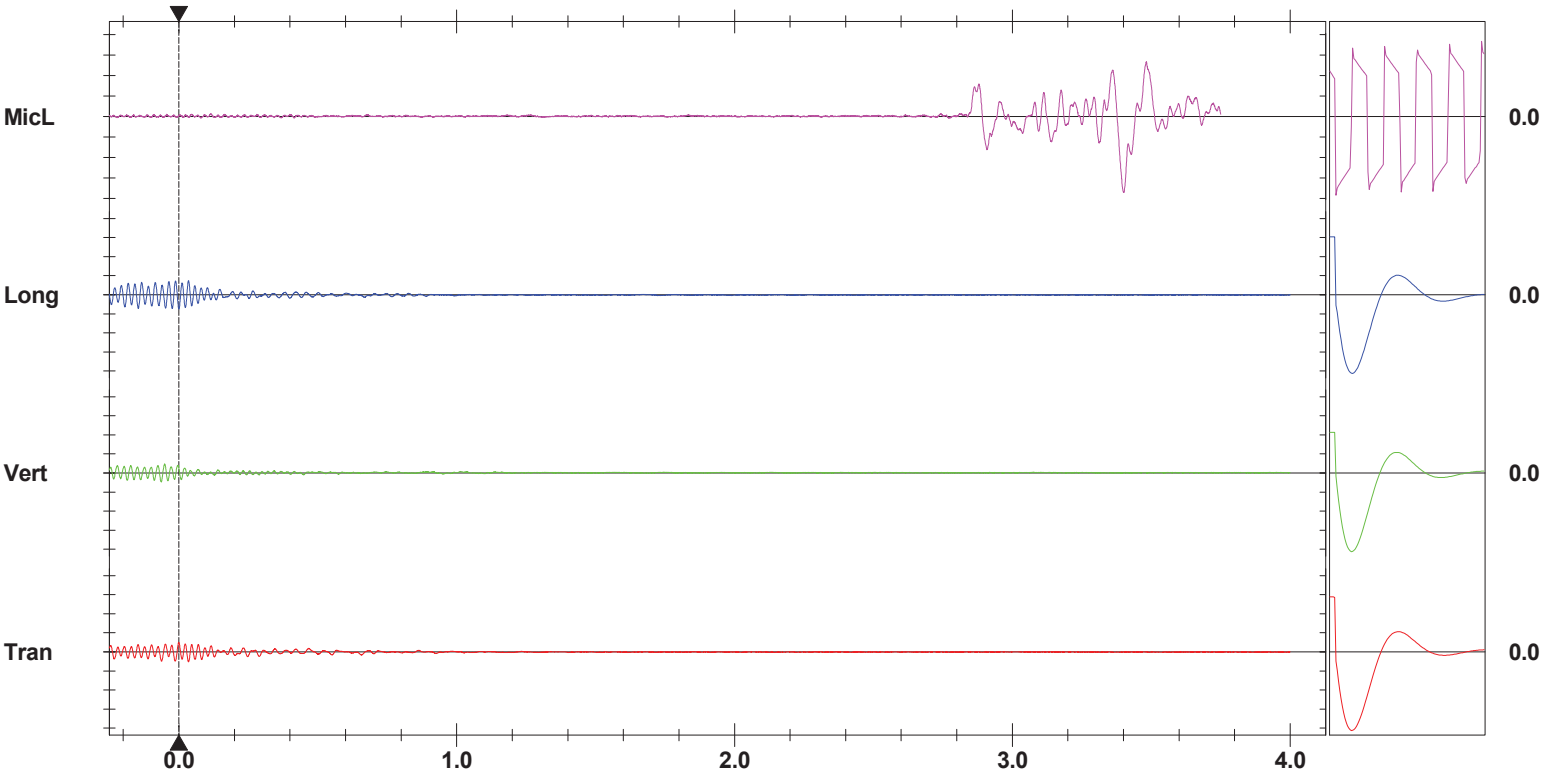
N 43.39339
W 79.88880

Microphone	Linear Weighting
PSPL	111.3 dB(L) at 3.400 sec
ZC Freq	7.7 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 1355 mv)

	Tran	Vert	Long	
PPV	1.040	0.938	1.498	mm/s
ZC Freq	39	43	41	Hz
Time (Rel. to Trig)	0.035	-0.063	0.000	sec
Peak Acceleration	0.028	0.033	0.064	g
Peak Displacement	0.004	0.004	0.006	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.1	Hz
Overswing Ratio	3.9	3.8	4.0	

Peak Vector Sum 1.884 mm/s at 0.000 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 2.000 pa.(L)/div

Sensor Check

Trigger = ▶----------◀

Event Report

Date/Time	Vert at 12:05:00 August 22, 2019
Trigger Source	Geo: 2.000 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.25 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.3 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

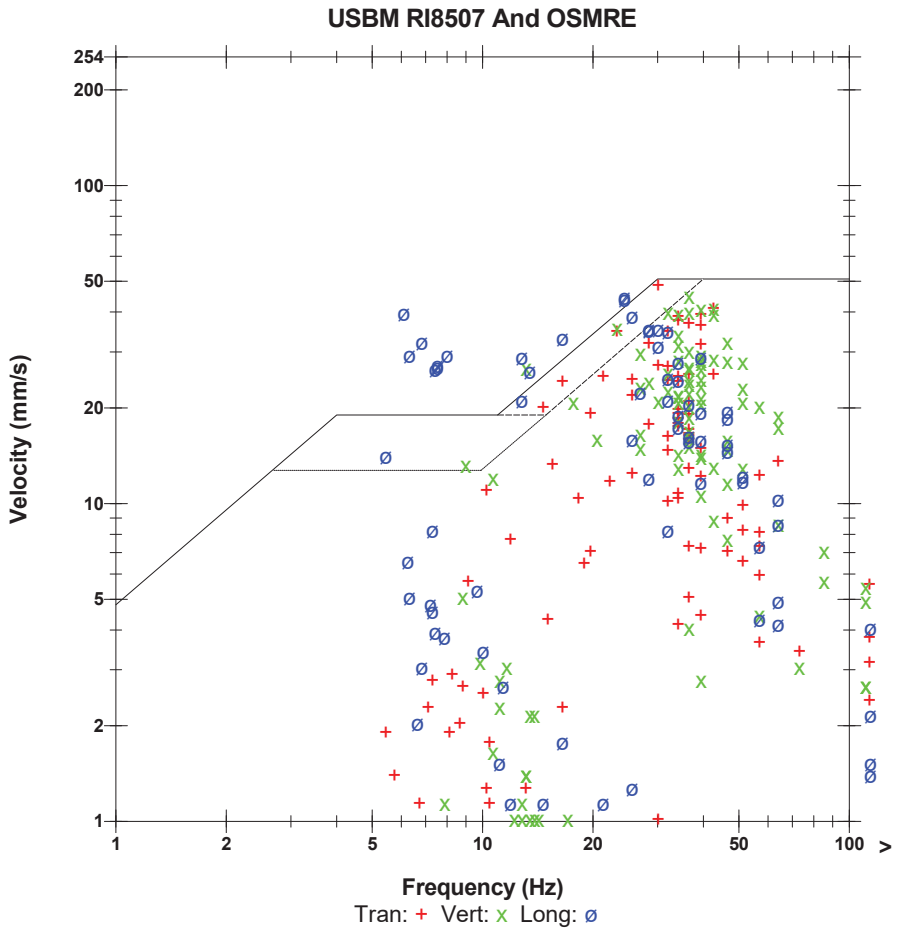
Notes
Location: Gas Line 52 Meters Behind Blast
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

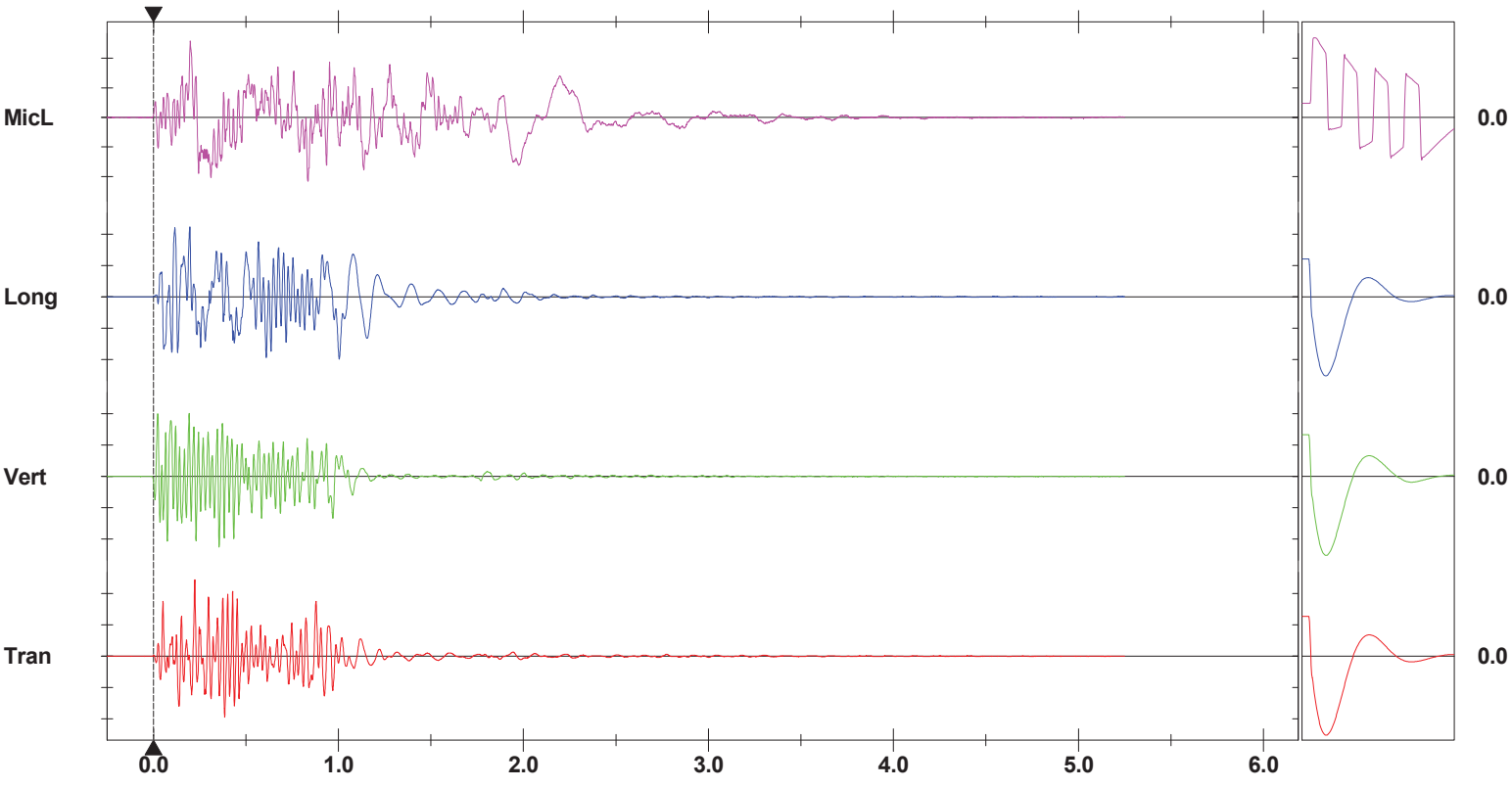
Extended Notes
Sand Bagged at gas line

Microphone	Linear Weighting
PSPL	128.3 dB(L) at 0.199 sec
ZC Freq	10 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 683 mv)

	Tran	Vert	Long	
PPV	48.64	45.08	44.58	mm/s
ZC Freq	30	37	24	Hz
Time (Rel. to Trig)	0.224	0.355	0.196	sec
Peak Acceleration	1.644	1.591	1.259	g
Peak Displacement	0.227	0.301	0.675	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.4	Hz
Overswing Ratio	3.7	3.9	4.1	

Peak Vector Sum 56.13 mm/s at 0.194 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 20.00 mm/s/div Mic: 20.00 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Blind line & Colling rd
Nelson Aggregate
Burlington 2019-08-22 Blast 19-016Middle

Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6857
Aug 22 /19 11:20:47		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Aug 22 /19 11:20:47	Aug 22 /19 12:41:21	No events recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic:

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 70	Hole angle: 0.0°
Total drilled: 4176.3ft			

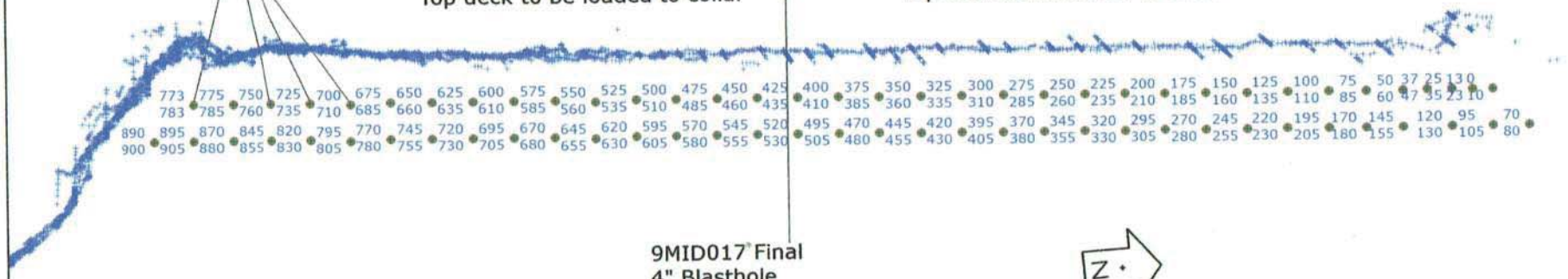
130 Kg Bottom
103Kg Top

D1, D3, D4, D5
4.5" Painted Green

Open Face

110 Kg Bottom
82 Kg Top
Top deck to be loaded to collar

80 Kg Bottom
54 Kg Top
Top deck to be loaded to collar



9MID017 Final
4" Blasthole
12' X 10' Front Row
9' X 10' Body
250.0 + 0.6m Subdrill

Holes D1, D3, D4, D5 are 4.5" Painted Green

Z +

ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 70	Hole angle: 0.0°
Total drilled: 4176.3ft			

Load Sheet

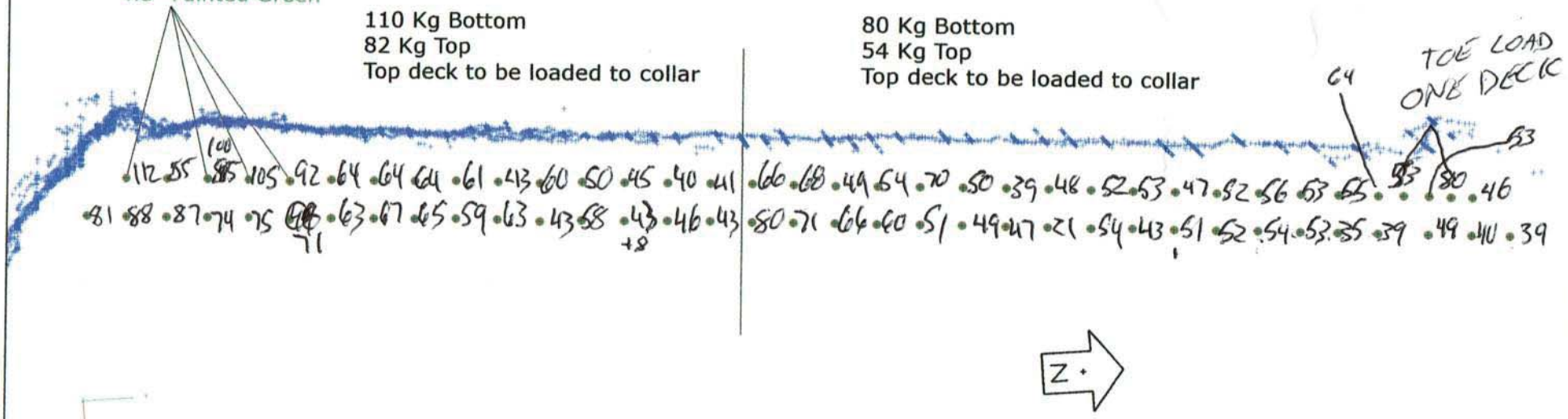
Open Face

130 Kg Bottom
103Kg Top

D1, D3, D4, D5
4.5" Painted Green

110 Kg Bottom
82 Kg Top
Top deck to be loaded to collar

80 Kg Bottom
54 Kg Top
Top deck to be loaded to collar



ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 70	Hole angle: 0.0°
Total drilled: 4176.3ft			

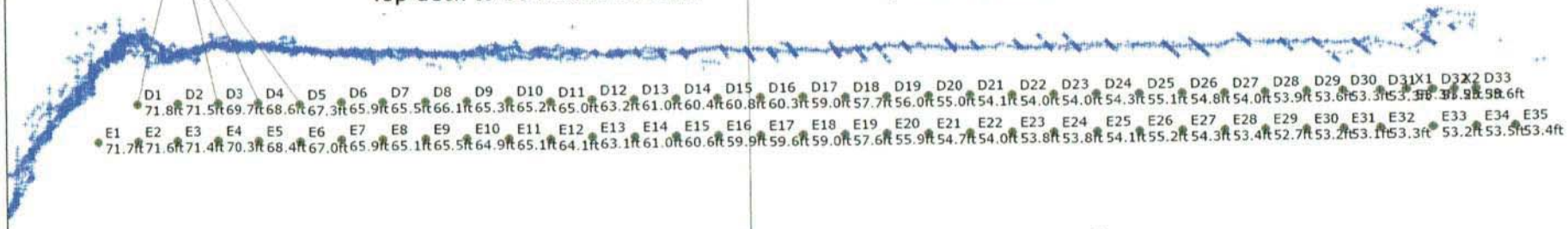
130 Kg Bottom
103Kg Top

D1, D3, D4, D5
4.5" Painted Green

Open Face

110 Kg Bottom
82 Kg Top
Top deck to be loaded to collar

80 Kg Bottom
54 Kg Top
Top deck to be loaded to collar



9MID017 Final
4" Blasthole
12' X 10' Front Row
9' X 10' Body
250.0 + 0.6m Subdrill

Holes D1, D3, D4, D5 are 4.5" Painted Green

Z

ORICA

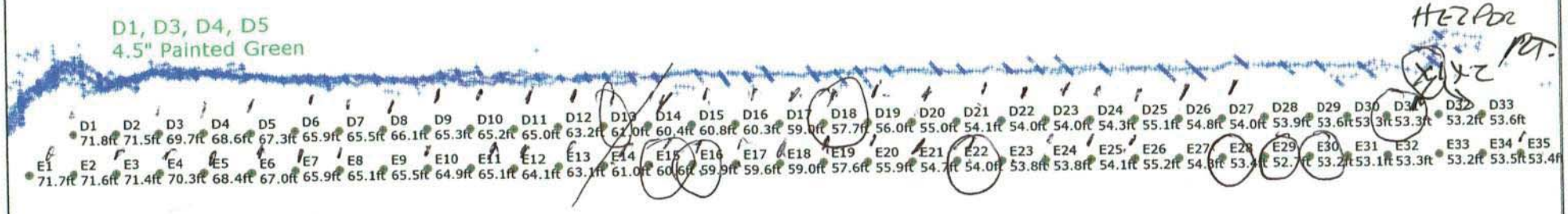
Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 68	Hole angle: 0.0°
Total drilled: 4069.7ft			

Open Face



9MID017 Final
4" Blasthole
12' X 10' Front Row
9' X 10' Body
250.0 + 0.6m Subdrill

Holes D1, D3, D4, D5 are 4.5" Painted Green

Not to scale

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-017
P.O. #:		Orica Order #:	2523993
Blast Date:	2019-08-28	Blast Time:	10:59 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40346 °N Latitude (Centre of Blast) 79.88160 °W Longitude (Centre of Blast)

Wind from the: W at 5 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	15,727 te	6,049 m3
Total tonnes per day:	15,727 te	NB60-08 Rate Code
Total Holes Loaded:	36 holes	
… including:	3 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	2 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	13 front row	
- Pattern (Back Row) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	23 back row	
Bench Height:	64.2 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	66.2 ft avg	
- Stone Decking -		
Front Row:	0.0 ft avg	
Back Row:	0.0 ft avg	
# Decks:	0 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Back Row:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	59.2 ft avg	
Back Row:	59.2 ft avg	
- Charge Weight -		
Front Row:	172.6 kg/hole	
Back Row:	172.6 kg/hole	
Max. per delay:	237.0 kg/delay	
SD () Equation:	22.5 kg/delay	
Total kg Loaded:	7,190 kg	
Rock Density:	2.60 g/cc = te/m^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Drilling Information -

			Angle from Vertical		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes: 36	= 2,383.1 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:	= 0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:	= 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,180	27,010	7,170

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	35	7.9
PENTEX 12 (OR EQUIVALENT)	0.34	36	12.2

total explosives weight in Blast (kg): 7,190

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			35
UNITRONIC 600 25M			36

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	5.5
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

2.004	lb/yd^3	Yield PF: 0.457 kg/te (actual)
1.334	lb/yd^3	Front row: 0.304 kg/te (theoretical)
1.778	lb/yd^3	Main Body: 0.406 kg/te (theoretical)
1.556	lb/yd^3	"KPI" PF: 0.355 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

J-9 Only received a bottom primer due to hole bridging while retracting the hose

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-017
P.O. #:		Orica Order #:	2523993
Blast Date:	2019-08-28	Blast Time:	10:59 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40346	79.88160	0.757533	1.394197
Front Row Corner	43.40333	79.88167	0.757531	1.394198
Back Row Corner	43.40360	79.88153	0.757536	1.394196
Average (Centre of Blast)	43.40346	79.88160	0.757533	1.394197

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	301.5	m			
Post Blast Data: ppV:	7.2	mm/s	Trigger set at:	2.0	mm/s
frequency:	12.3	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)
air overpressure:	119.1	dB	Trigger set at:	115	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	1263.8	m			
Post Blast Data: ppV:	0.1	mm/s	Trigger set at:	2.0	mm/s
frequency:	10.1	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)
air overpressure:	117.4	dB	Trigger set at:	115	dB

Blind Line and Colling Road (Bruce Trail Entrance)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	142.4	m			
Post Blast Data: ppV:	34.4	mm/s	Trigger set at:	2.0	mm/s
frequency:	30.0	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)
air overpressure:	131.6	dB	Trigger set at:	115	dB

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(142.4)^2}{30^2} \text{ kg}$$

$$= \frac{20{,}278}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 23 kg

jim bray

Orica
Blaster-in-charge: Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

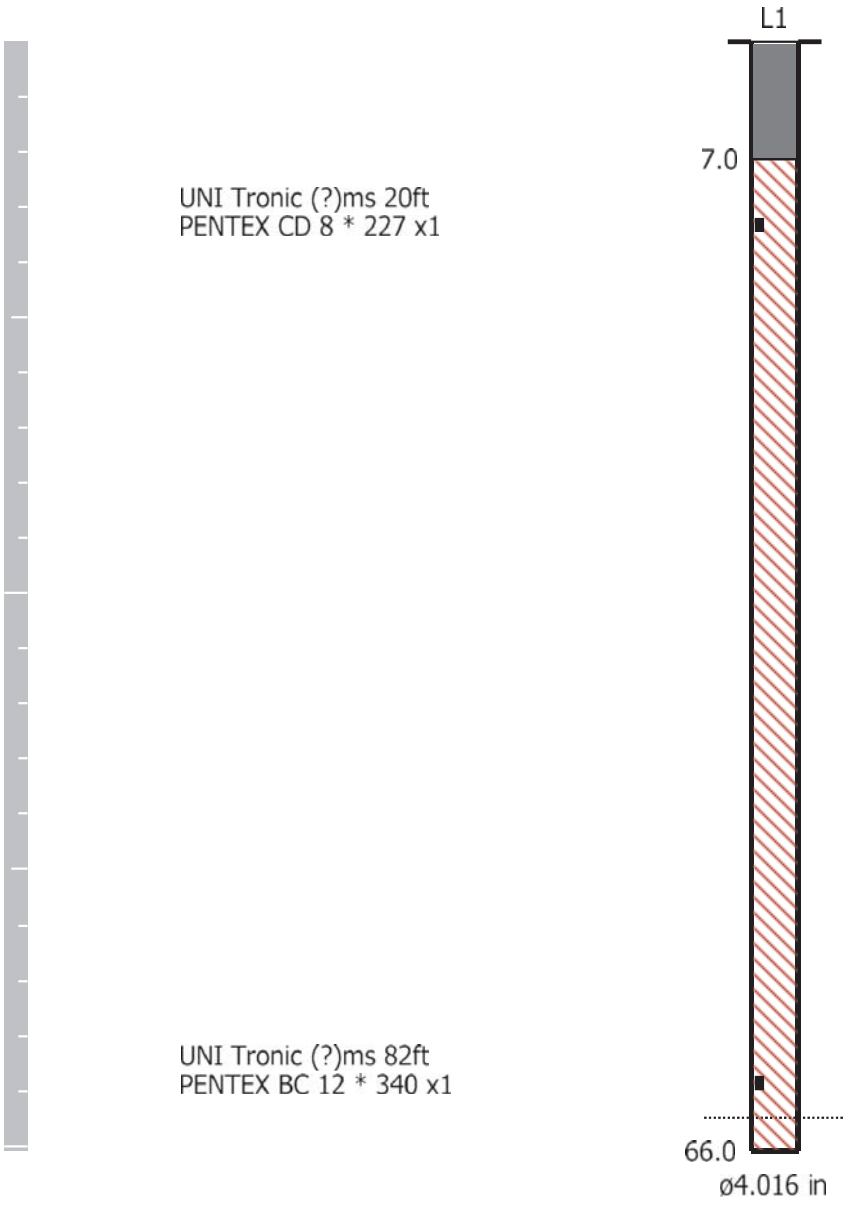
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-017
P.O. #:		Orica Order #:	2523993
Blast Date:	8/28/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Vert at 10:59:42 August 28, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.2 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

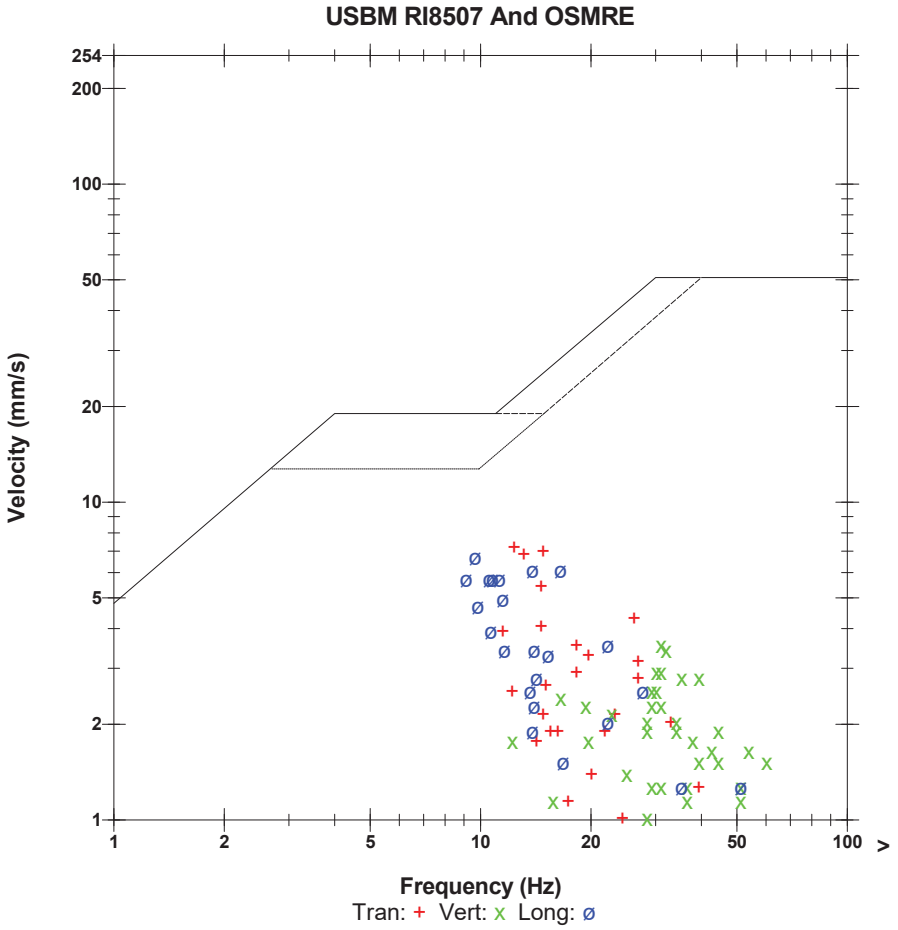
Notes
Location: 2450 2nd Line
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

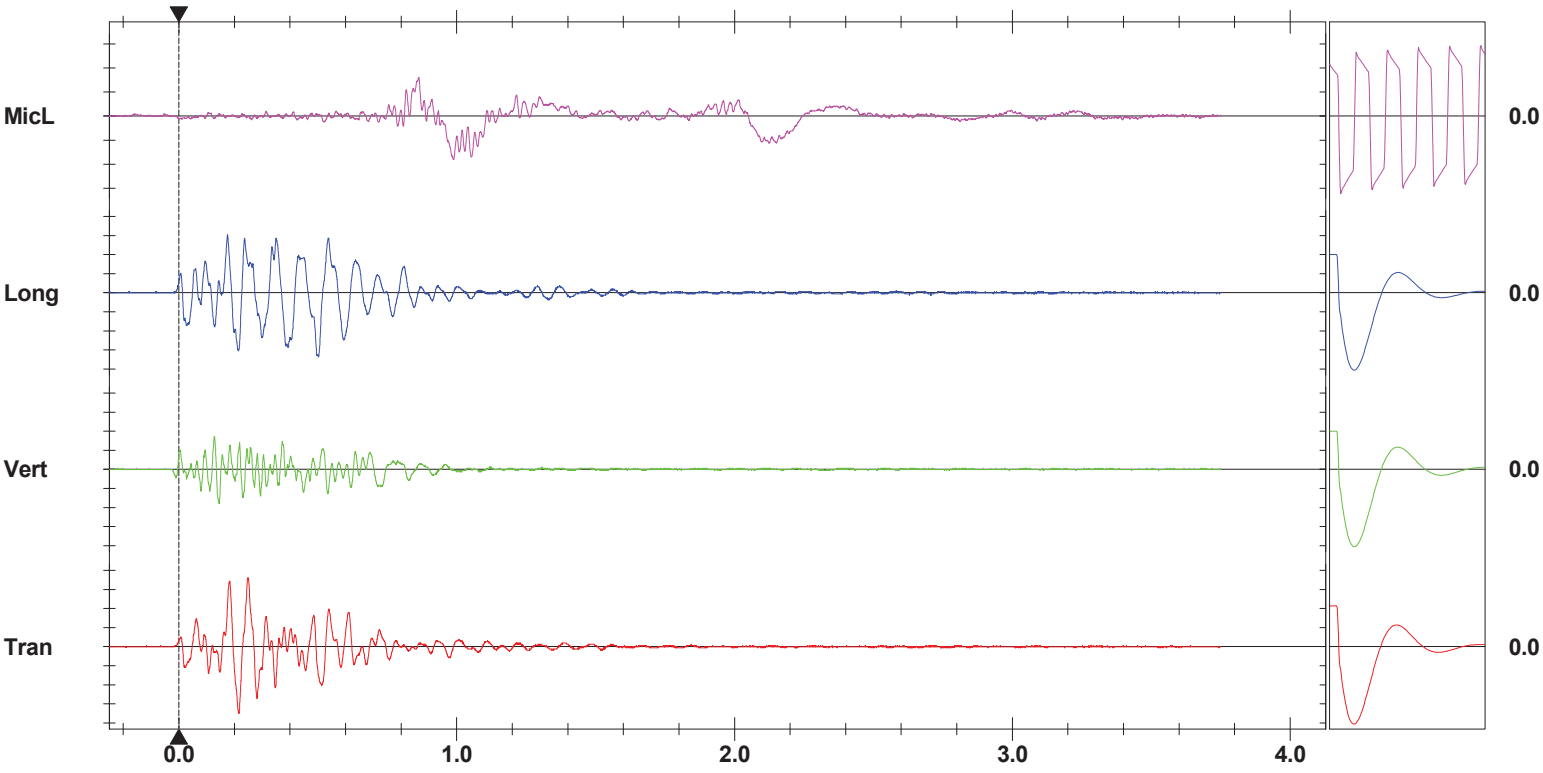
Extended Notes
Sand Bagged
N43.40245,W-79.87814

Microphone	Linear Weighting
PSPL	119.1 dB(L) at 0.987 sec
ZC Freq	3.0 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 520 mv)

	Tran	Vert	Long	
PPV	7.239	3.556	6.731	mm/s
ZC Freq	12.3	31	9.7	Hz
Time (Rel. to Trig)	0.248	0.144	0.502	sec
Peak Acceleration	0.106	0.106	0.106	g
Peak Displacement	0.073	0.027	0.094	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.3	Hz
Overswing Ratio	3.6	3.5	3.9	

Peak Vector Sum 9.410 mm/s at 0.216 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	MicL at 10:59:42 August 28, 2019
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.088 sec (Auto=5Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.5 Volts
Unit Calibration	January 15, 2019 by Instantel
File Name	UM6857_20190828105942.IDFW

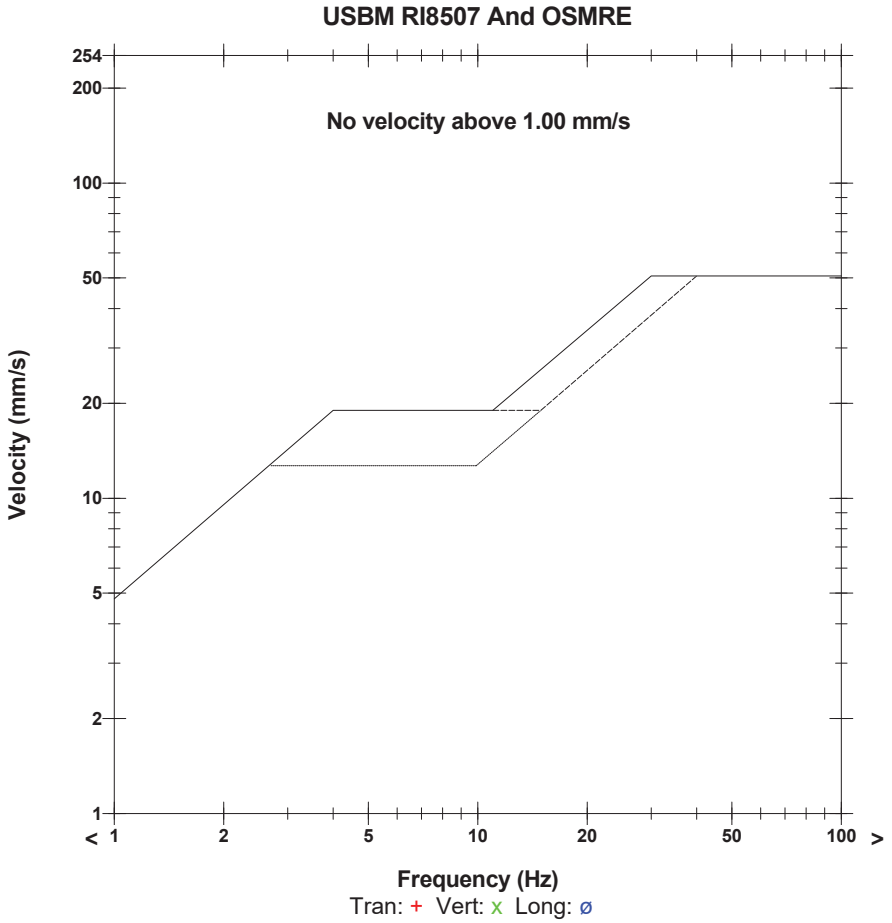
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

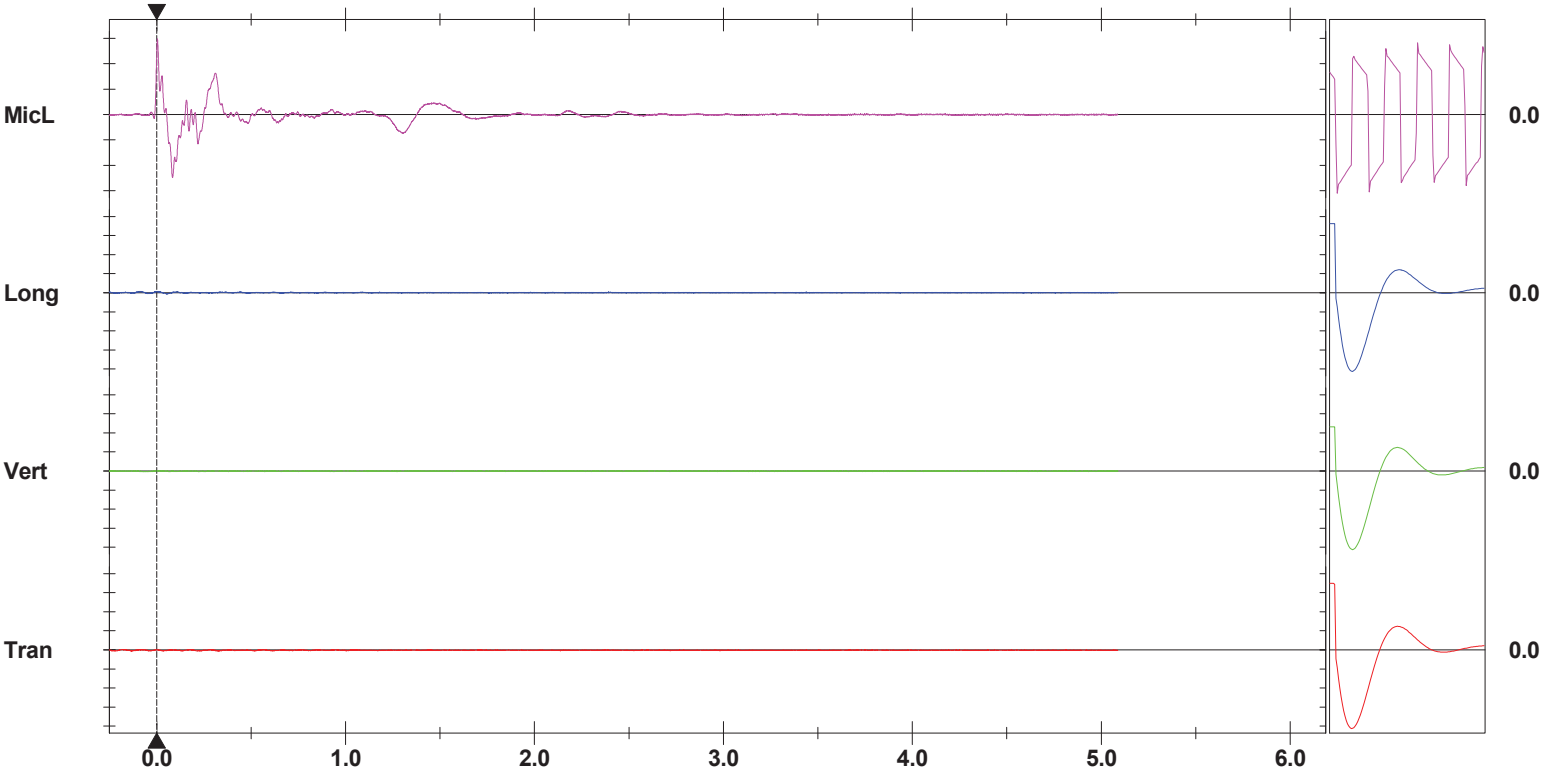
Extended Notes
N 43.31617
W 80.02664

Microphone	Linear Weighting
PSPL	117.4 dB(L) at 0.004 sec
ZC Freq	8.0 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1338 mv)

	Tran	Vert	Long	
PPV	0.126	0.079	0.134	mm/s
ZC Freq	9.5	6.6	10.1	Hz
Time (Rel. to Trig)	-0.219	-0.071	-0.093	sec
Peak Acceleration	0.008	0.010	0.010	g
Peak Displacement	0.017	0.002	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.3	3.3	3.4	

Peak Vector Sum 0.146 mm/s at -0.088 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Event Report

Date/Time	Vert at 10:59:42 August 28, 2019
Trigger Source	Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.4 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

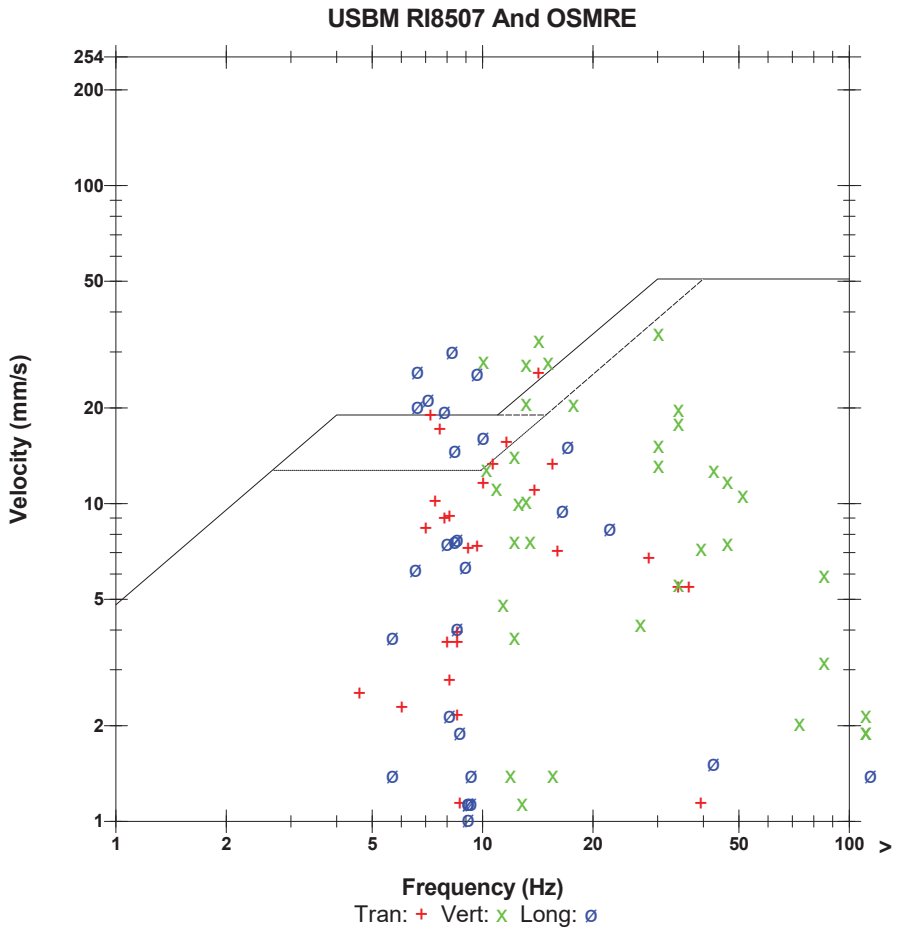
Notes
Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

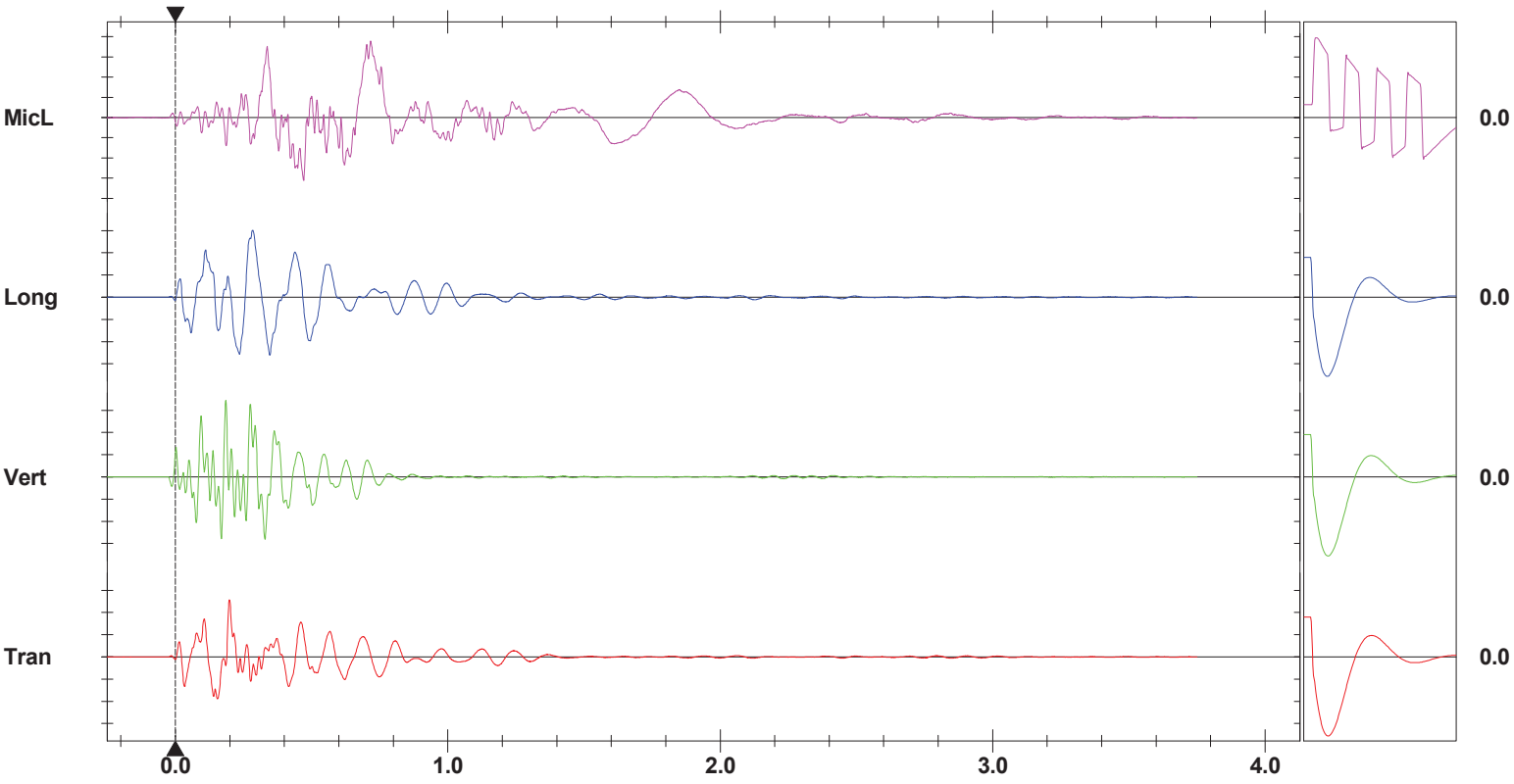
Extended Notes
Sand Bagged at gas line

Microphone	Linear Weighting
PSPL	131.6 dB(L) at 0.717 sec
ZC Freq	4.1 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 695 mv)

	Tran	Vert	Long	
PPV	25.65	34.42	30.10	mm/s
ZC Freq	14	30	8.3	Hz
Time (Rel. to Trig)	0.198	0.186	0.282	sec
Peak Acceleration	0.424	0.663	0.278	g
Peak Displacement	0.333	0.340	0.556	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.2	7.3	7.5	Hz
Overswing Ratio	3.7	3.7	4.0	

Peak Vector Sum 43.35 mm/s at 0.275 sec





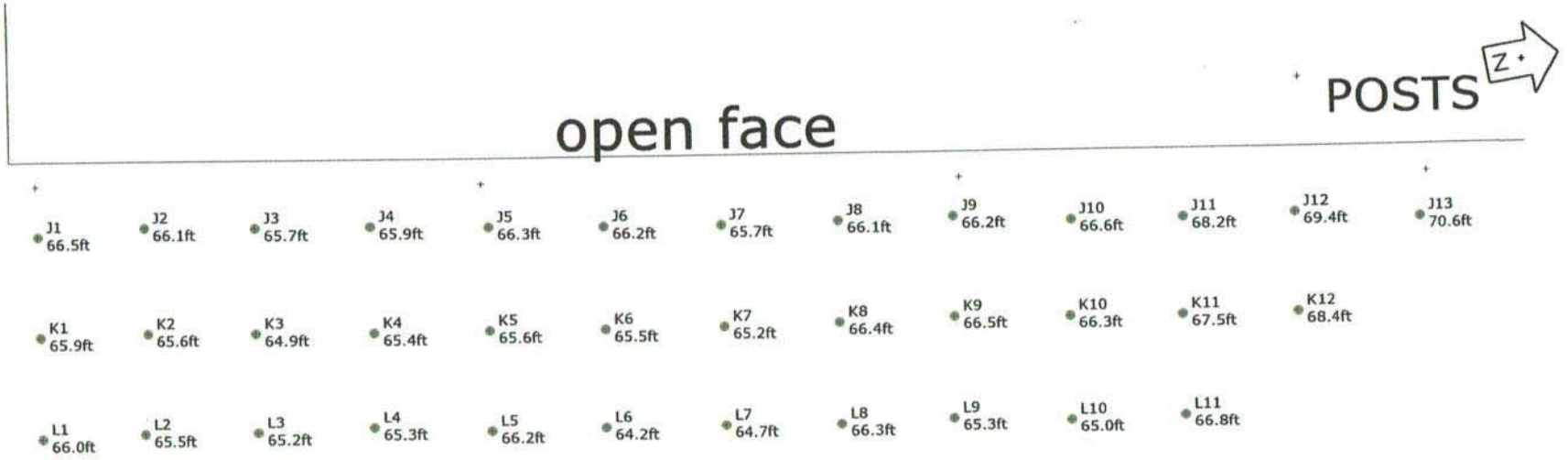
Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 10.000 mm/s/div Mic: 20.00 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 2383.1ft			



9UPMD016 Design Fnl - 4" Blast Hole 12x10 9x10 271 and 250 + .

DRILLER NAME:_____

ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 2383.1ft			

9UPMD016 Design Fnl - 4" Blast Hole 12x10 9x10 271 and 250 + .

DRILLER NAME:_____

ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 2383.1ft			

Load Sheet
Max 225 Kg

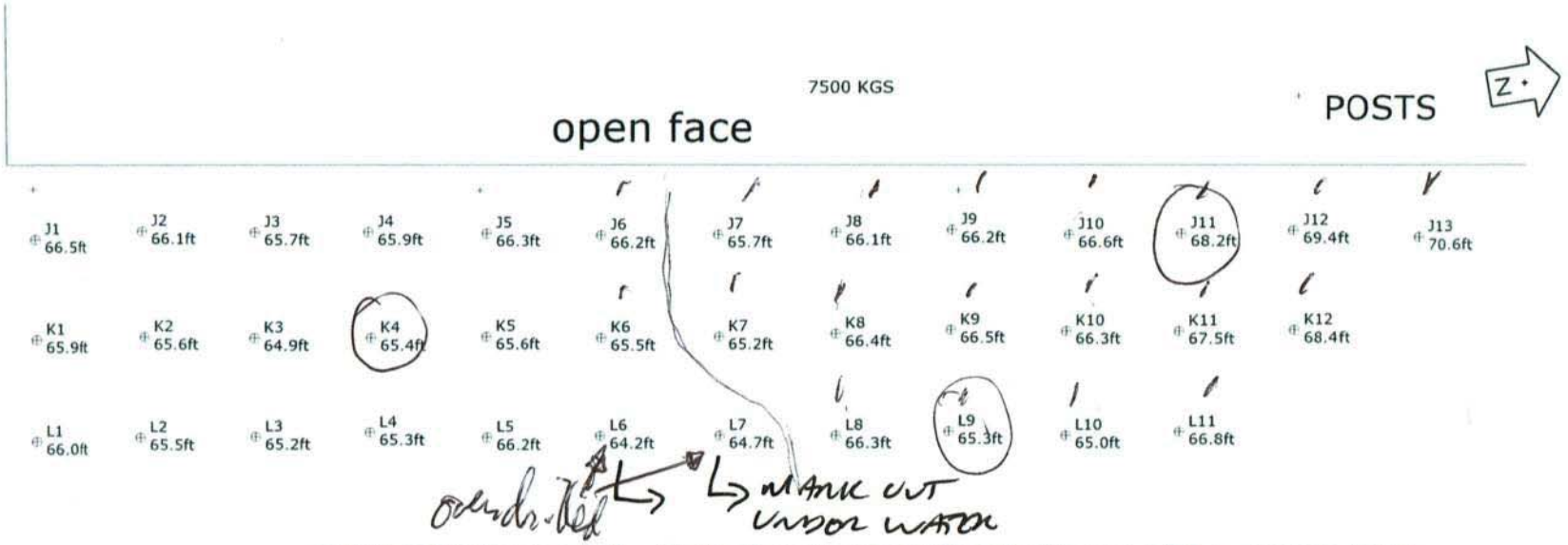
open face

ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 2383.1ft			



9UPMD016 Design Fnl - 4" Blast Hole 12x10 9x10 271 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

Scale 1:200

SHOTPlus™ Professional 5.7.4.4	8/19/2019
Mine	Burlington
Location	UPPER MIDDLE SLOT NEXT TO OLD WHLWAS
Title/author	9UPMD016 Design Fnl
Filename	

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-018
P.O. #:		Orica Order #:	2528633
Blast Date:	2019-09-09	Blast Time:	12:37 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40434 °N Latitude (Centre of Blast) 79.88160 °W Longitude (Centre of Blast)

Wind from the: NE at 15 kph Temperature: 16 to 20 °C

Clear:		Rain:		Overcast:	
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 2,400 ft

Tonnes Blasted:	35,108 te	13,503 m3
Total tonnes per day:	35,108 te	NB60-16 Rate Code
Total Holes Loaded:	78 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	2 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	40 front row	
- Pattern (Back Row) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	38 back row	
Bench Height:	58.0 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	60.0 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Back Row:	4.0 ft avg	
# Decks:	97 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Back Row:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	49.0 ft avg	
Back Row:	49.0 ft avg	
- Charge Weight -		
Front Row:	142.9 kg/hole	
Back Row:	142.9 kg/hole	
Max. per delay:	110.0 kg/delay	
SD () Equation:	4.2 kg/delay	
Total kg Loaded:	11,596 kg	
Rock Density:	2.60 g/cc = te/m^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Powder Factor -

1.447 lb/yd^3	Yield PF:	0.330 kg/te (actual)
1.222 lb/yd^3	Front row:	0.279 kg/te (theoretical)
1.629 lb/yd^3	Main Body:	0.372 kg/te (theoretical)
1.426 lb/yd^3	"KPI" PF:	0.325 kg/te (theoretical)

- Drilling Information -

		Angle from Vertical				Nominal Bit Diameter:	
Primary Bit diam:	101.6 mm	0 °	# Holes:	78	=	4,680.9 ft (4	" diam)
Secondary Bit diam:	mm	°	# Holes:		=	0.0 ft (	" diam)
Tertiary Bit diam:	mm	°	# Holes:		=	0.0 ft (	" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,710	22,210	11,500

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	1	25

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	79	26.9
PENTEX DUO (OR EQUIVALENT)	0.45	97	44.0

total explosives weight in Blast (kg): 11,596

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 9M			20
UNITRONIC 600 15M			78
UNITRONIC 600 20M			39
UNITRONIC 600 25M			54
EXEL MS 15m			19
EXEL MS 18m			39

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	4
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	12.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

The first 19 Holes at the north end of the blast received 3 emulsion decks, the rest of the blast received 2 emulsion decks to control vibrations at the gas line and the near by shop.

Rate Code NB60-16 (19 decks in addtion to the 78 built into the rate code)

Excel MS 25M 25ms---24 Used

15 additional 25M Unitronics were used instead of 25M ms because of limited stock

No additional charge should be added

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-018
P.O. #:		Orica Order #:	2528633
Blast Date:	2019-09-09	Blast Time:	12:37 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40436**	**79.88159**	0.757549	1.394197
Front Row Corner	43.40381	79.88168	0.757539	1.394198
Back Row Corner	43.40486	79.88152	0.757558	1.394196
Average (Centre of Blast)	43.40434	79.88160	0.757549	1.394197

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**349.9**	m			
Post Blast Data: ppV:	**4.1**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**10.9**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**117.4**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	**1351.1**	m			
Post Blast Data: ppV:	**0.1**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**14.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**116.4**	dB	Trigger set at:	**115**	dB

Blind Line and Colling Road (Bruce Trail Entrance)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	**61.5**	m			
Post Blast Data: ppV:	**29.3**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**20.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**128.2**	dB	Trigger set at:	**115**	dB

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(61.5)^2}{30^2} \text{ kg}$$

$$= \frac{3{,}782}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 4 kg

jim bray

Orica
Blaster-in-charge: *Mike derkinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

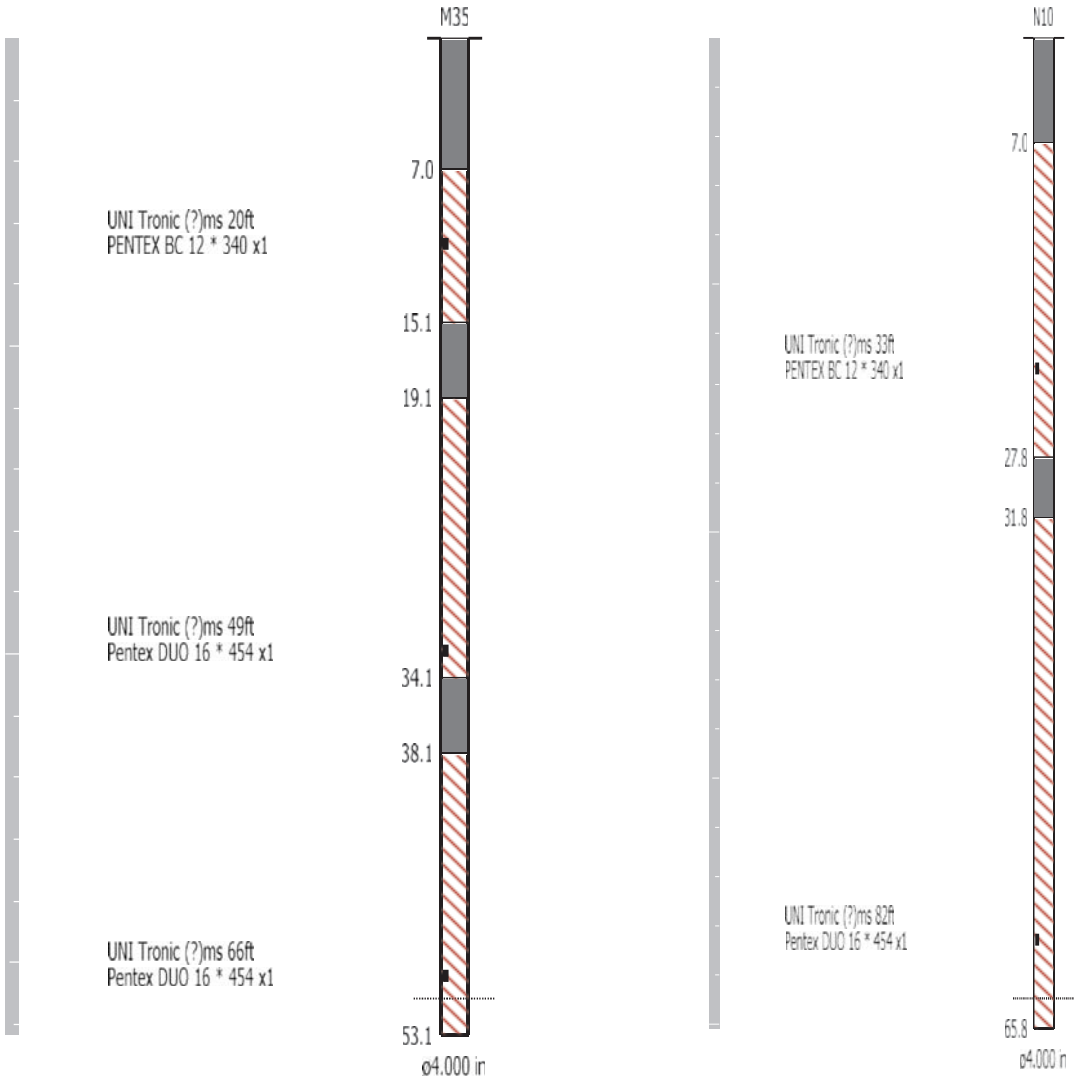
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-018
P.O. #:		Orica Order #:	2528633
Blast Date:	9/9/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 12:37:13 September 9, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.0 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.2 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

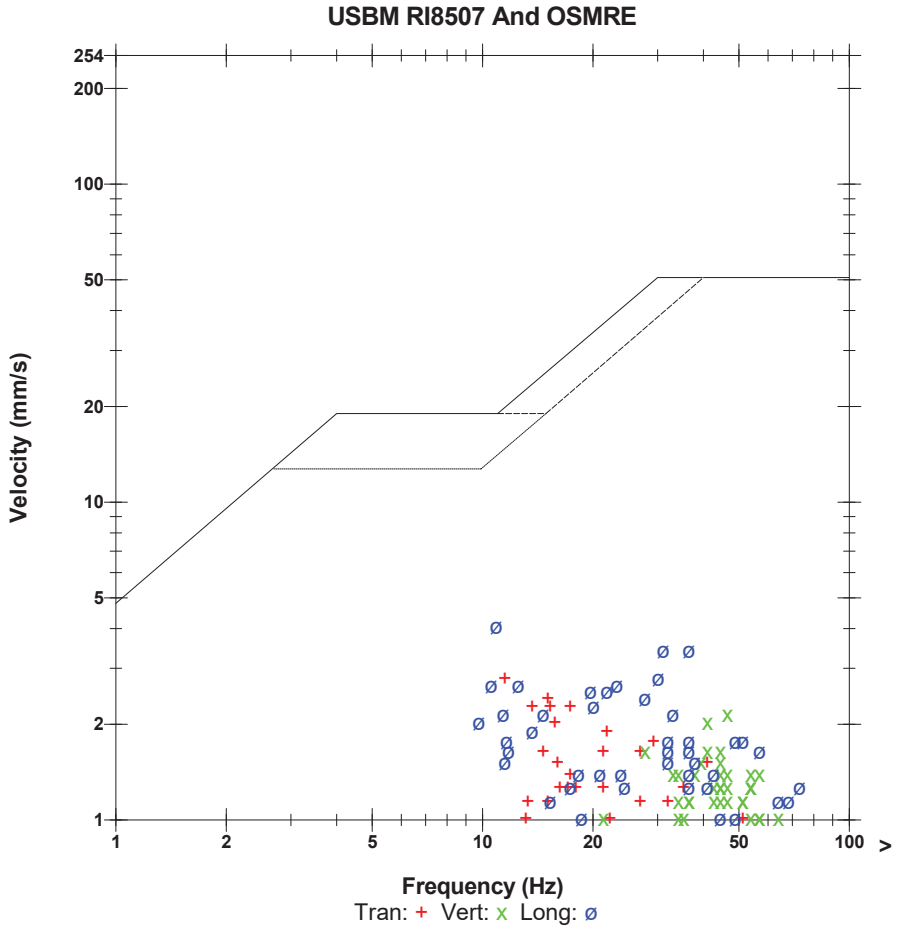
Location:	2450 #2 Road Burlington
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

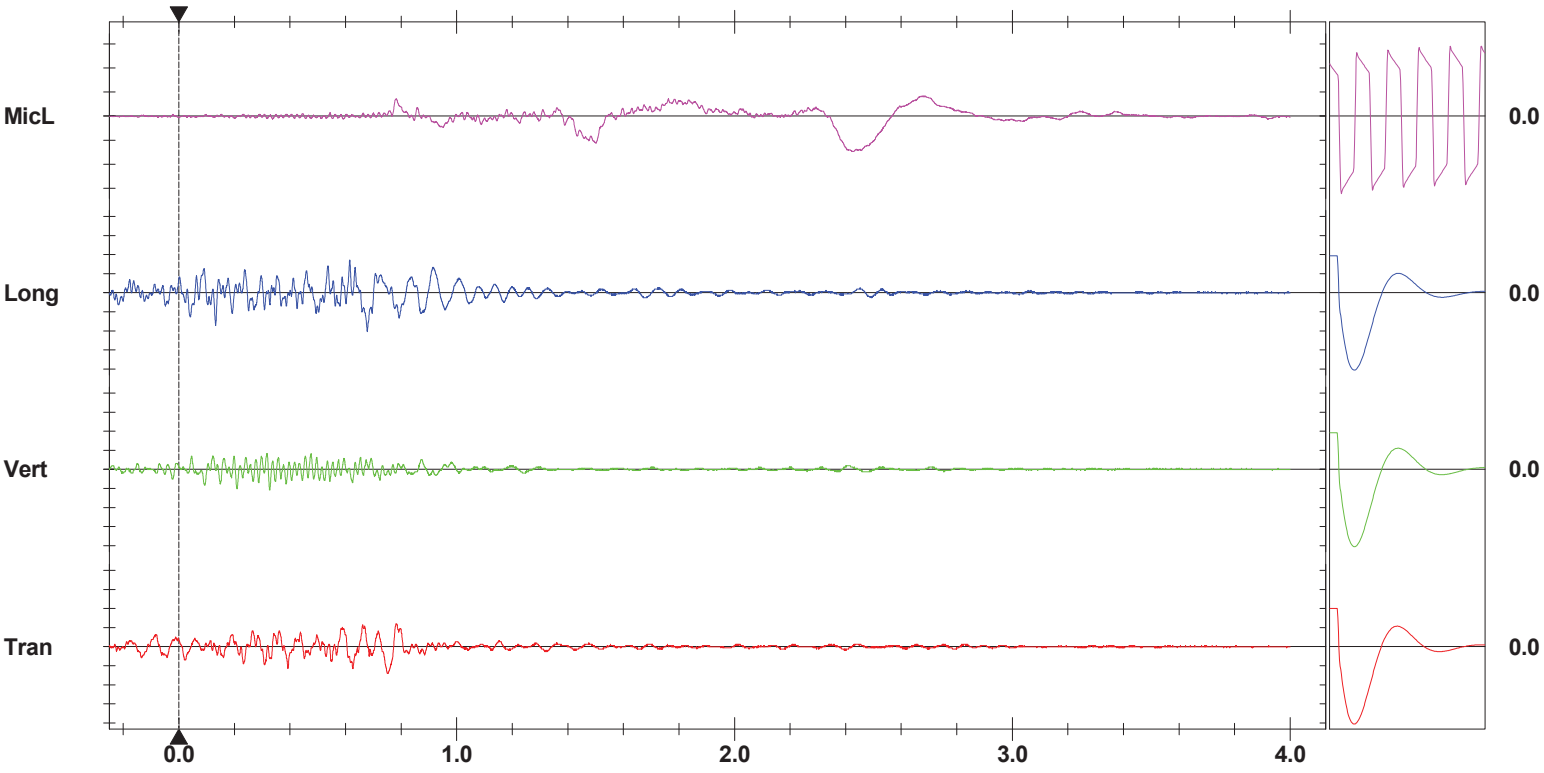
Extended Notes
Sand Bagged

Microphone	Linear Weighting
PSPL	117.4 dB(L) at 2.425 sec
ZC Freq	2.3 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 599 mv)

	Tran	Vert	Long	
PPV	2.794	2.159	4.064	mm/s
ZC Freq	11.5	47	10.9	Hz
Time (Rel. to Trig)	0.750	0.326	0.678	sec
Peak Acceleration	0.053	0.080	0.106	g
Peak Displacement	0.036	0.010	0.048	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.3	7.2	Hz
Overswing Ratio	3.8	3.7	4.1	

Peak Vector Sum 4.098 mm/s at 0.678 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	MicL at 12:37:15 September 9, 2019	**Serial Number**	UM6857 V 10-89 Micromate ISEE
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)	**Battery Level**	3.7 Volts
Range	Geo: 254.0 mm/s	**Unit Calibration**	January 15, 2019 by Instantel
Record Time	5.012 sec (Auto=5Sec) at 2048 sps	**File Name**	UM6857_20190909123715.IDFW
Operator/Setup:	MIKE DERKNDEREN/Burlington Bruce TRL.MMB		

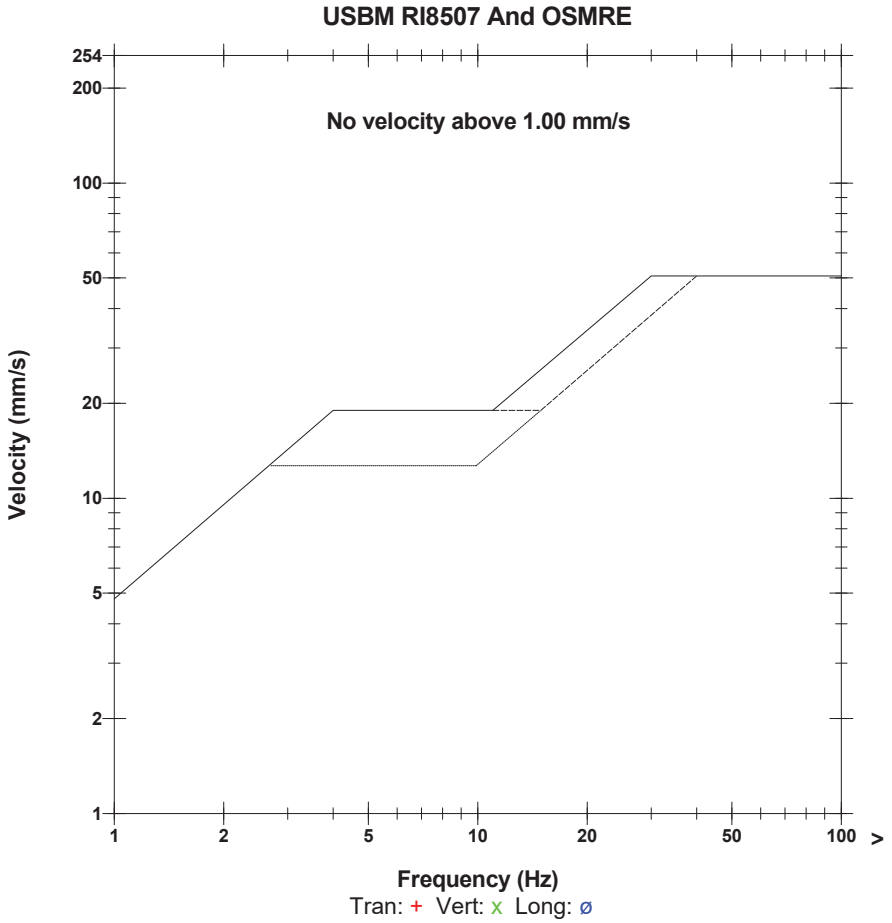
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

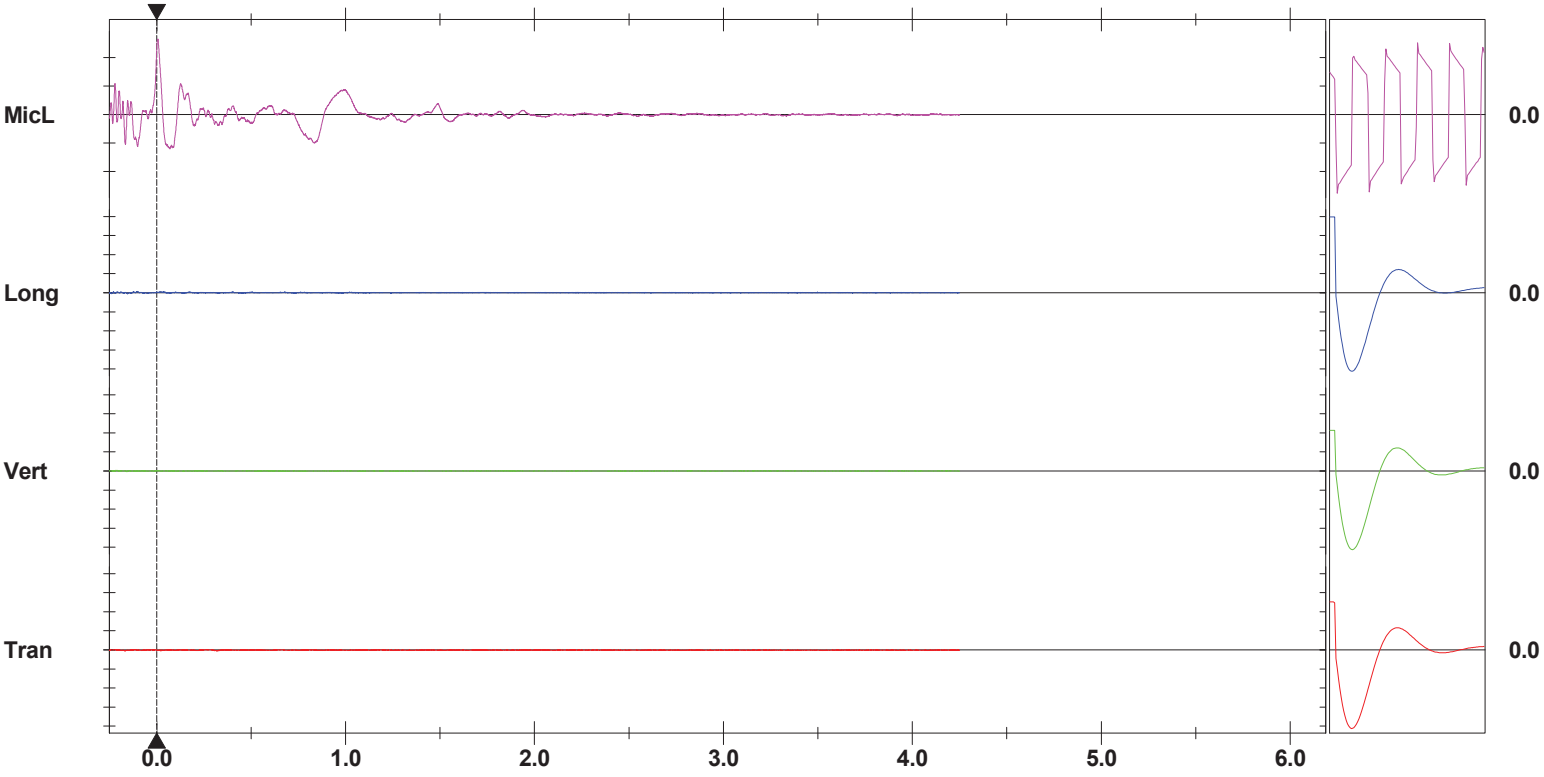
Extended Notes
N 43.31617
W 80.02664

Microphone Linear Weighting
PSPL 116.4 dB(L) at 0.007 sec
ZC Freq 7.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1392 mv)

	Tran	Vert	Long	
PPV	0.102	0.071	0.142	mm/s
ZC Freq	9.1	20	14.0	Hz
Time (Rel. to Trig)	-0.167	-0.214	-0.104	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.003	0.000	0.001	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.6	3.4	3.4	

Peak Vector Sum 0.151 mm/s at -0.104 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	Vert at 12:35:20 September 9, 2019
Trigger Source	Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.25 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.4 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

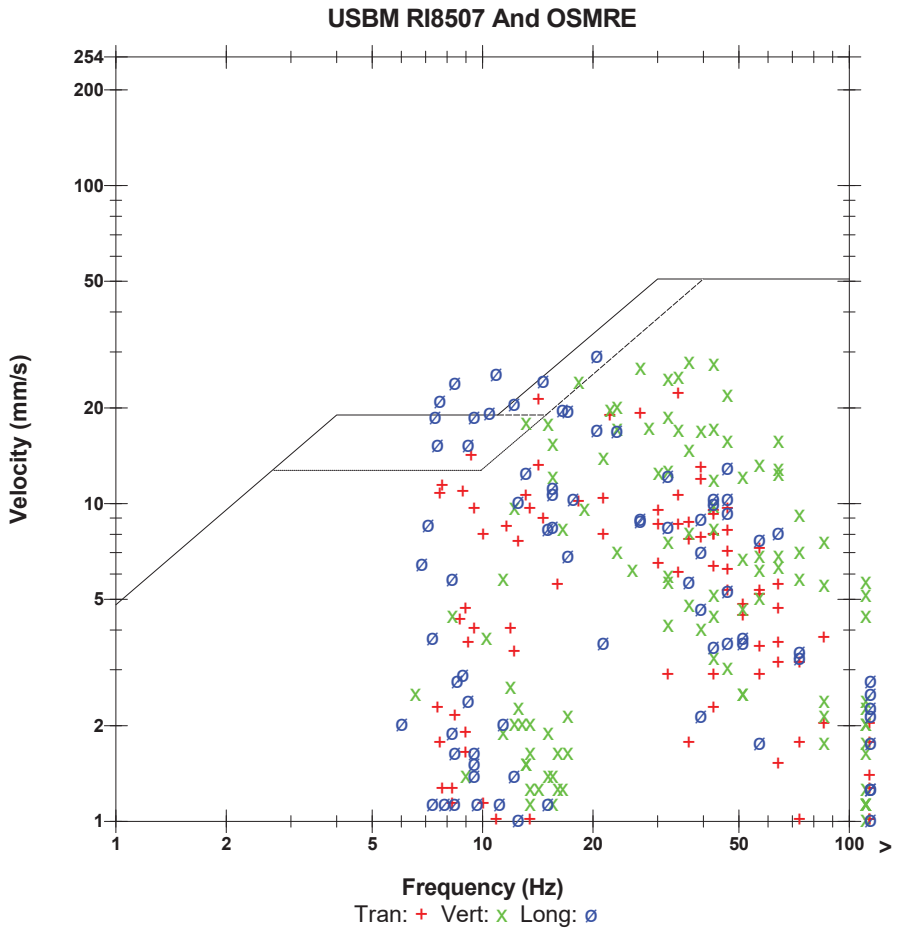
Notes
Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

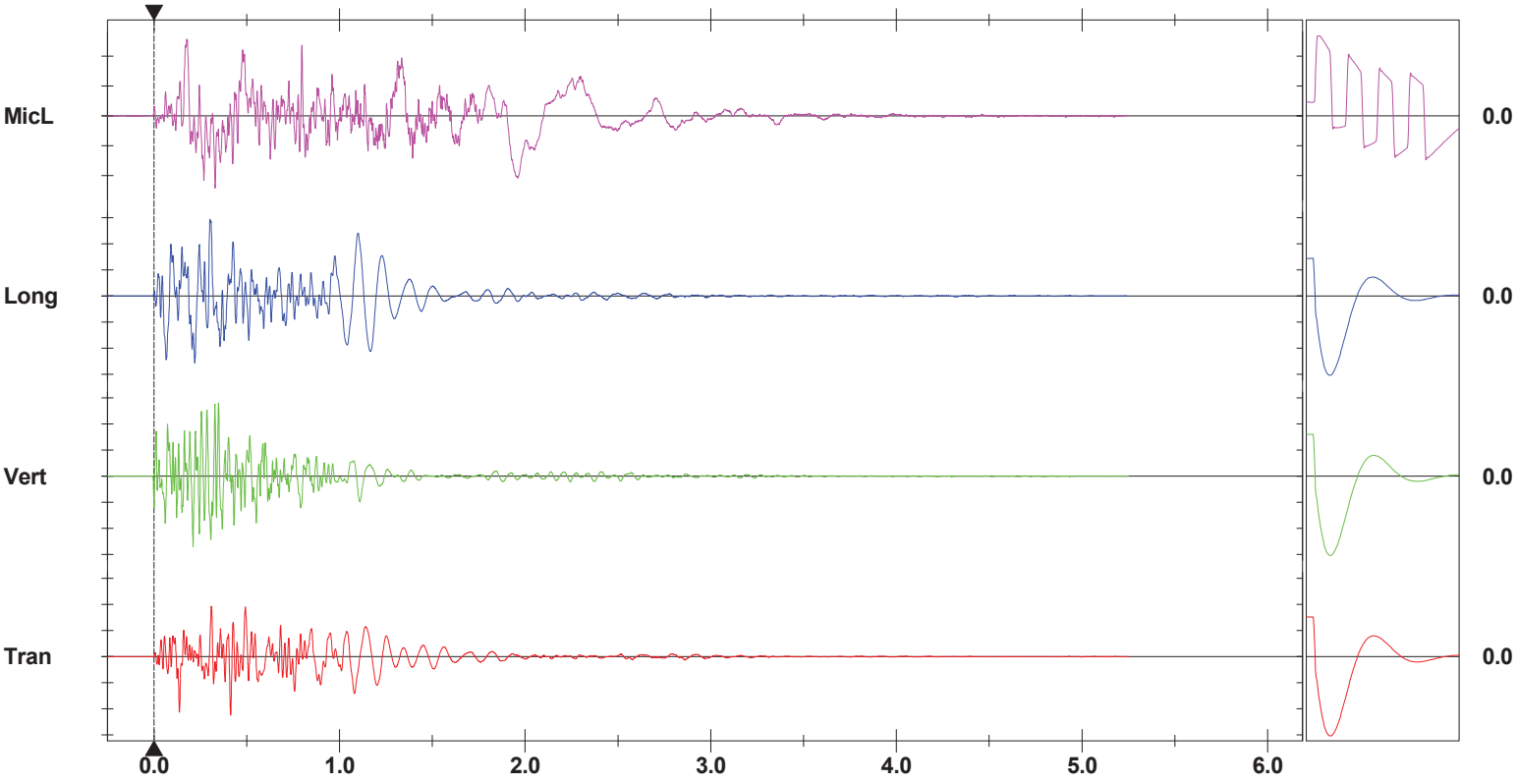
Extended Notes
Sand Bagged at gas line

Microphone	Linear Weighting
PSPL	128.2 dB(L) at 0.177 sec
ZC Freq	16 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 624 mv)

	Tran	Vert	Long	
PPV	22.35	28.07	29.34	mm/s
ZC Freq	34	37	20	Hz
Time (Rel. to Trig)	0.414	0.349	0.303	sec
Peak Acceleration	0.464	0.862	0.583	g
Peak Displacement	0.224	0.195	0.444	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.4	Hz
Overswing Ratio	3.9	3.9	4.2	

Peak Vector Sum 41.10 mm/s at 0.308 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 10.000 mm/s/div Mic: 20.00 pa.(L)/div Sensor Check
Trigger = ▶----------◀

SHOTPlus Plan

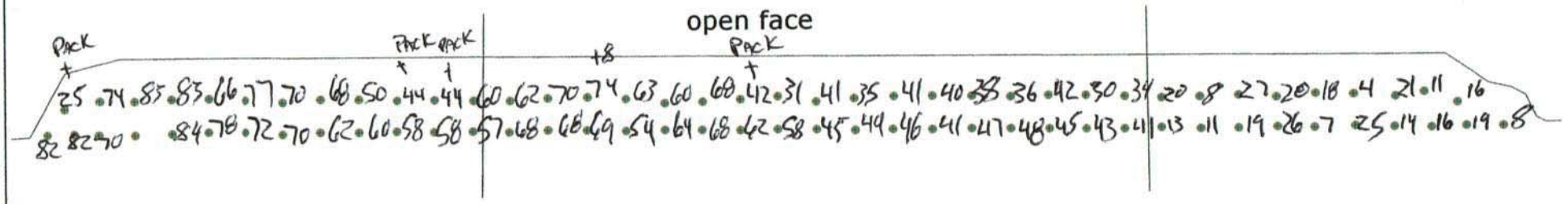
Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 78	Hole angle: 0.0°
Total drilled: 4681.0ft			

2 decks
78Kg
110kg

2 decks
68Kg
85kg

3 decks
32Kg
48Kg
48Kg



9MID018 Design Fnl -
4" Blast Hole
12x10 9x10 271.25 and 250 + .6 SUB ELEV
DRILLER NAME:_____

ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

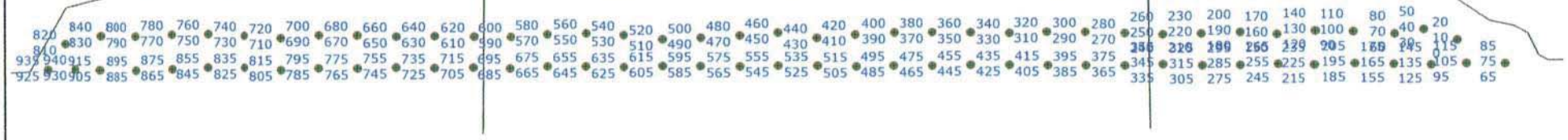
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 78	Hole angle: 0.0°
Total drilled: 4681.0ft			

2 decks
78Kg
110kg

2 decks
68Kg
85kg

3 decks
32Kg
48Kg
48Kg

open face



9MID018 Design Fnl -
4" Blast Hole
12x10 9x10 271.25 and 250 + .6 SUB ELEV
DRILLER NAME:_____

ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

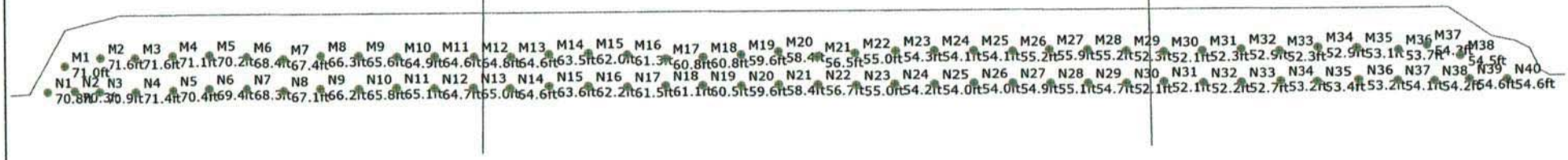
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 78	Hole angle: 0.0°
Total drilled: 4681.0ft			

2 decks
78Kg
110kg

2 decks
68Kg
85kg

3 decks
32Kg
48Kg
48Kg

open face



9MID018 Design Fnl -
4" Blast Hole
12x10 9x10 271.25 and 250 + .6 SUB ELEV
DRILLER NAME:_____

ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 78	Hole angle: 0.0°
Total drilled: 4681.0ft			

9MID018 Design Fnl - 4" Blast Hole 12x10 9x10 271.25 and 250 + .6 SUB ELEV
DRILLER NAME:_____

ORICA

Scale 1:525

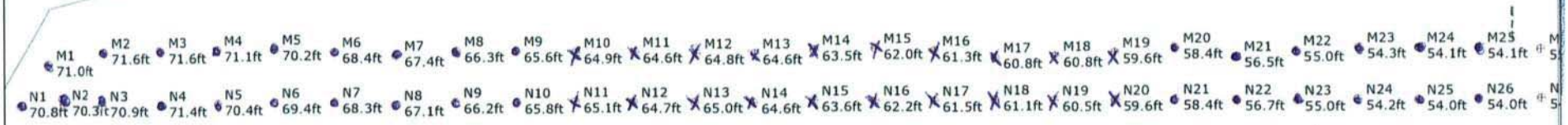
SHOTPlus™ Professional 5.7.4.4		8/29/2019
Mine	Burlington	
Location	2 ROW MID WALL	
Title/author	9MID018 Design Fnl	
Filename		

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 78	Hole angle: 0.0°
Total drilled: 4681.0ft			

open face



9MID018 Design Fnl - 4" Blast Hole 12x10 9x10 271.25 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

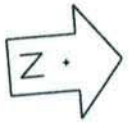
Scale 1:325

SHOTPlus™ Professional 5.7.4.4		8/29/2019
Mine	Burlington	
Location	2 ROW MID WALL	
Title/author	9MID018 Design Fnl	
Filename		

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 78	Hole angle: 0.0°
Total drilled: 4681.0ft			



pen face

ble 12x10 9x10 271.25 and 250 + .6 SUB ELEV

ORICA

Scale 1:325

SHOTPlus™ Professional 5.7.4.4		8/29/2019
Mine	Burlington	
Location	2 ROW MID WALL	
Title/author	9MID018 Design Fnl	
Filename		

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-019
P.O. #:		Orica Order #:	2534945
Blast Date:	2019-09-24	Blast Time:	12:05 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40405 °N Latitude (Centre of Blast) 79.88154 °W Longitude (Centre of Blast)

Wind from the: W at 10 kph Temperature: 21 to 25 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	32,416 te	12,468 m3
Total tonnes per day:	32,416 te	NB60-16 Rate Code
Total Holes Loaded:	72 holes	
… including:	3 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	72	=	4,700.4 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	36,500	23,730	12,770

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	1	25

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	74	25.2
PENTEX DUO (OR EQUIVALENT)	0.45	72	32.7

total explosives weight in Blast (kg): 12,853

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			2
UNITRONIC 600 15M			72
UNITRONIC 600 20M			54
UNITRONIC 600 25M			90

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	13.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Theoretical PF (Based on a single hole)

- Pattern (Front Row)-

Burden:	12.0	ft avg
Spacing:	10.0	ft avg
# Holes:	26	front row

- Pattern (Main Body) -

Burden:	9.0	ft avg
Spacing:	10.0	ft avg
# Holes:	46	main body
Bench Height:	63.3	ft avg
Sub-drill:	2.0	ft avg
Hole Depth:	65.3	ft avg

- Stone Decking -

Front Row:	4.0	ft avg
Main Body:	4.0	ft avg
# Decks:	72	per blast

- Collar Stemming -

Front Row:	7.0	ft avg
Main Body:	7.0	ft avg
Material used:	3/4" Clear	

- Charge Length -

Front Row:	54.3	ft avg
Main Body:	54.3	ft avg

- Charge Weight -

Front Row:	158.3	kg/hole
Main Body:	158.3	kg/hole
Max. per delay:	110.0	kg/delay
SD () Equation:	7.5	kg/delay
Total kg Loaded:	12,853	kg
Rock Density:	2.60	g/cc = te/m^3

- Powder Factor -

1.738 lb/yd^3	Yield PF:	0.396	kg/te (actual)
1.241 lb/yd^3	Front row:	0.283	kg/te (theoretical)
1.654 lb/yd^3	Main Body:	0.377	kg/te (theoretical)
1.516 lb/yd^3	"KPI" PF:	0.346	kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blastec

NOTES (ANY VARIATION FROM STANDARD):

We had to use 2 unitronics per dou booster due to shortage of 25M Excel ms 25ms

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-019
P.O. #:		Orica Order #:	2534945
Blast Date:	2019-09-24	Blast Time:	12:05 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40407	79.88154	0.757544	1.394196
Front Row Corner	43.40376	79.88161	0.757538	1.394197
Back Row Corner	43.40432	79.88148	0.757548	1.394195
Average (Centre of Blast)	43.40405	79.88154	0.757544	1.394196

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	327.9	m			
Post Blast Data: ppV:	6.7	mm/s	Trigger set at:	2.0	mm/s
frequency:	16.5	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)
air overpressure:	116.7	dB	Trigger set at:	115	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	1324.1	m			
Post Blast Data: ppV:	Did	mm/s	Trigger set at:	2.0	mm/s
frequency:	Not	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)
air overpressure:	Trigger	dB	Trigger set at:	115	dB

Blind Line and Colling Road (Bruce Trail Entrance)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	81.9	m			
Post Blast Data: ppV:	37.3	mm/s	Trigger set at:	2.0	mm/s
frequency:	30.0	Hz	V / T / L :	?	(Vertical, Transverse or Longitudinal)
air overpressure:	131.9	dB	Trigger set at:	115	dB

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(81.9)^2}{30^2} \text{ kg}$$

$$= \frac{6{,}708}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 7 kg

jim bray

Orica
Blaster-in-charge: Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

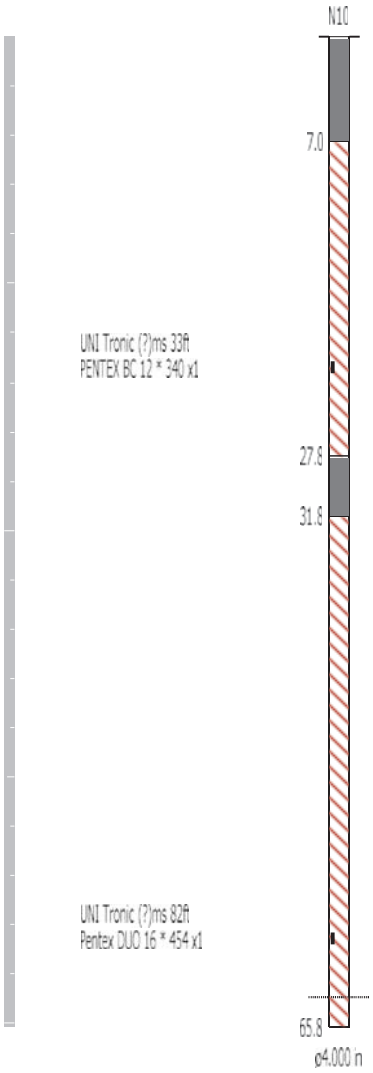
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-019
P.O. #:		Orica Order #:	2534945
Blast Date:	9/9/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

Quarry Manager: Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 12:06:02 September 24, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.0 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 #2 road, Burlington
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

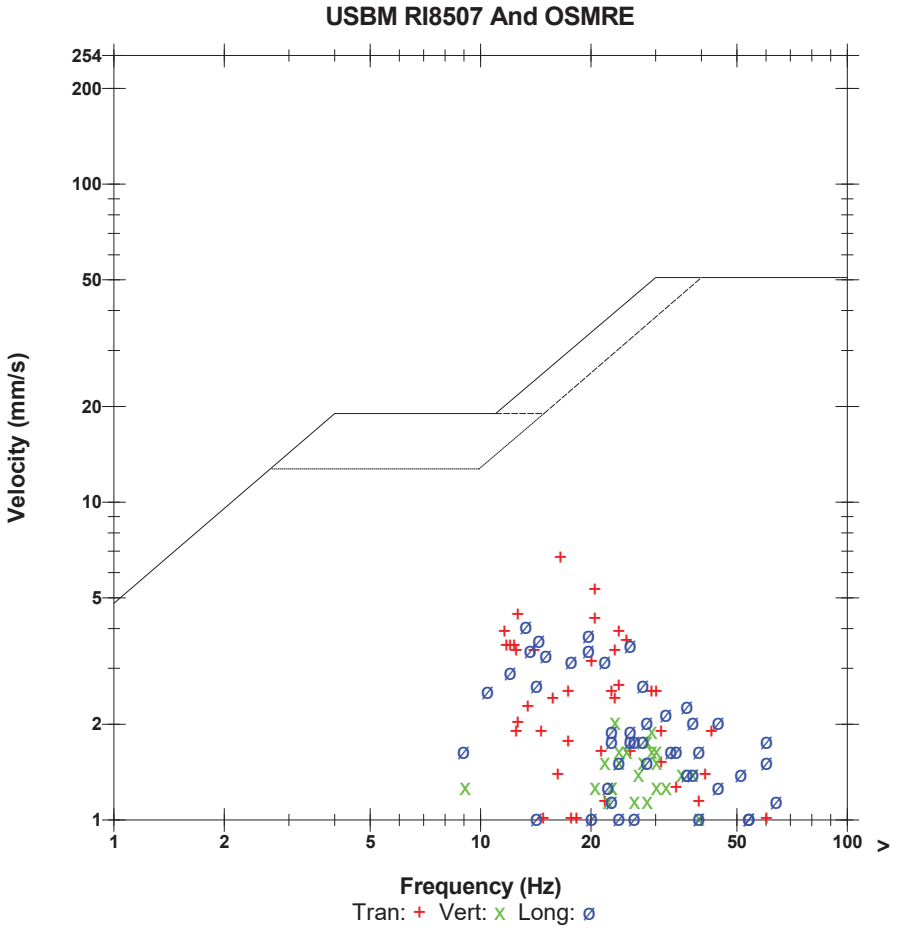
Extended Notes

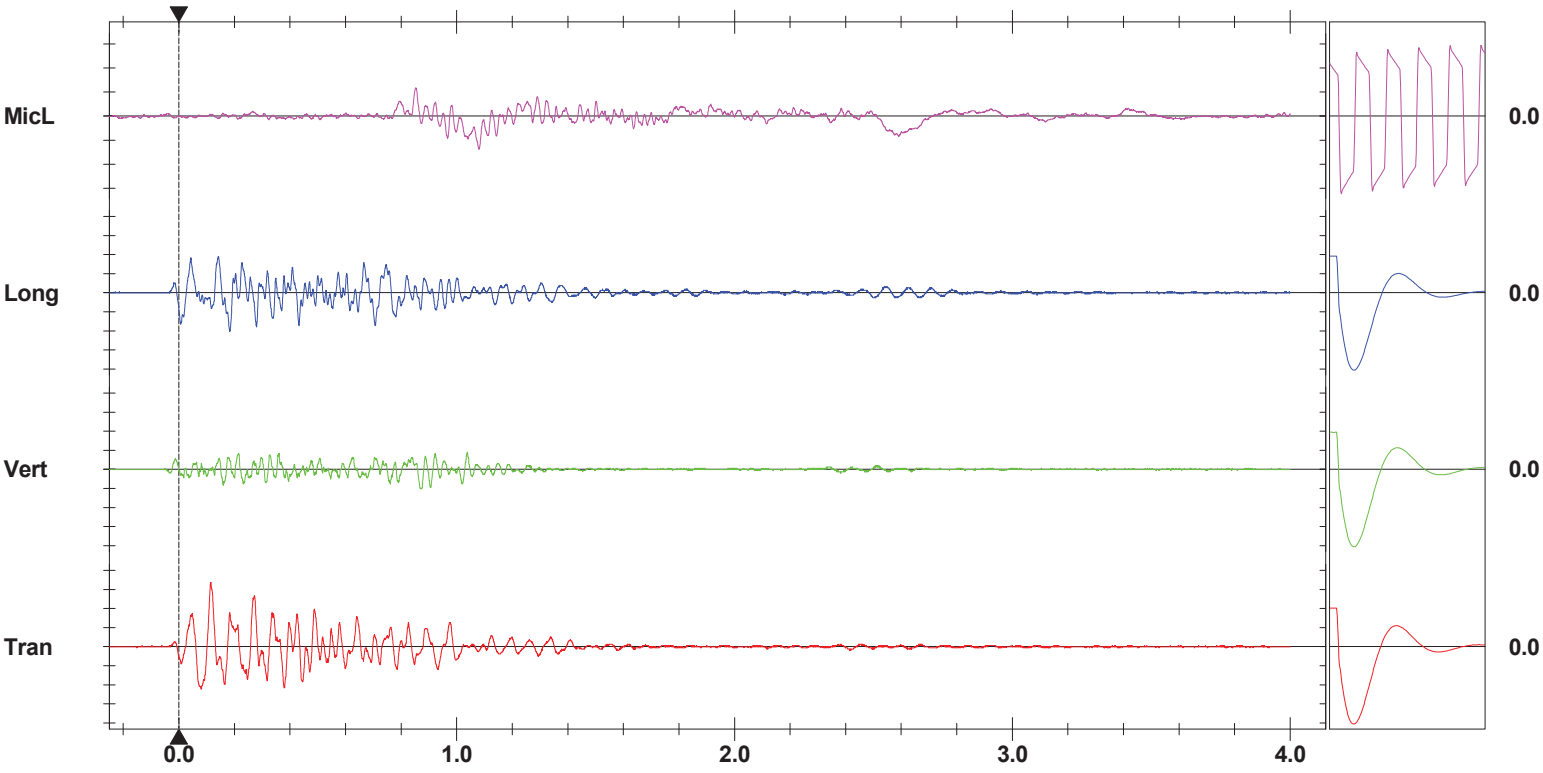
Sand Bagged
N43.40245 W-79.87814

Microphone	Linear Weighting
PSPL	116.7 dB(L) at 1.080 sec
ZC Freq	3.8 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 570 mv)

	Tran	Vert	Long	
PPV	6.731	2.032	4.064	mm/s
ZC Freq	16.5	23	13.3	Hz
Time (Rel. to Trig)	0.114	0.869	0.184	sec
Peak Acceleration	0.106	0.080	0.106	g
Peak Displacement	0.063	0.018	0.039	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.2	Hz
Overswing Ratio	3.8	3.7	4.1	

Peak Vector Sum 6.901 mm/s at 0.116 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Blind Line & Colling rd
Nelson Aggregate
Burlington 2019-09-24 Blast 19-019 Middle

Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6857
Sep 24 /19 06:03:57		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Sep 24 /19 06:03:57	Sep 24 /19 13:17:31	No events recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic:

Event Report

Date/Time	Long at 12:06:01 September 24, 2019
Trigger Source	Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.25 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.3 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

Notes
Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

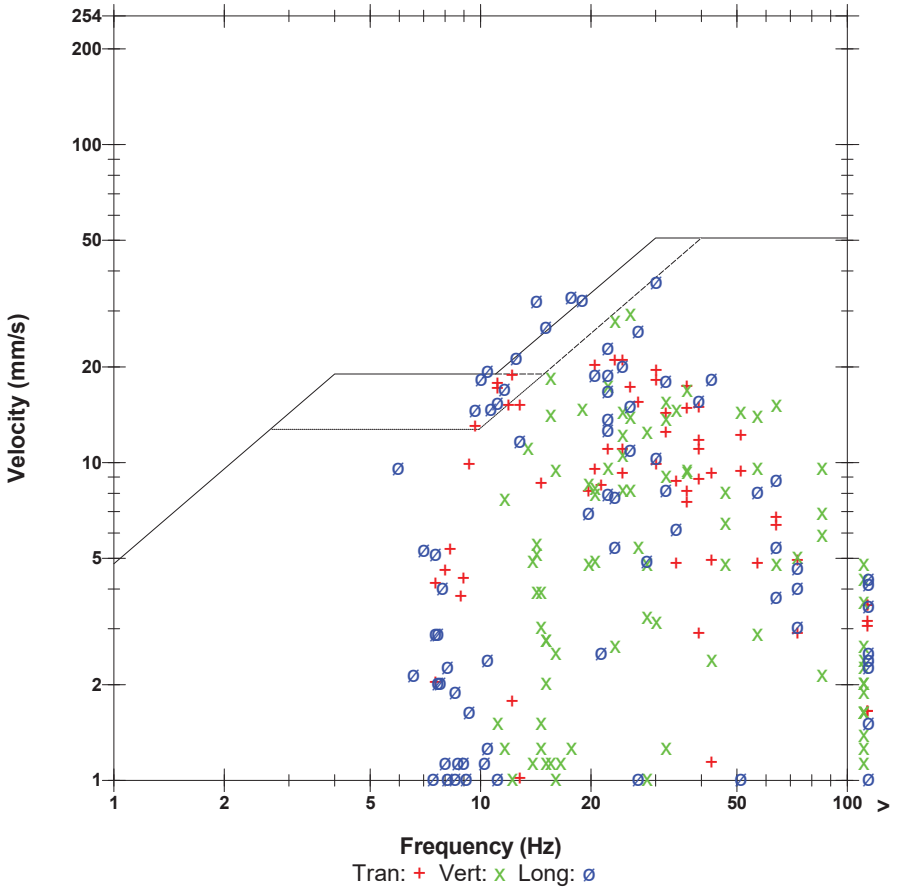
Extended Notes
Sand Bagged at gas line

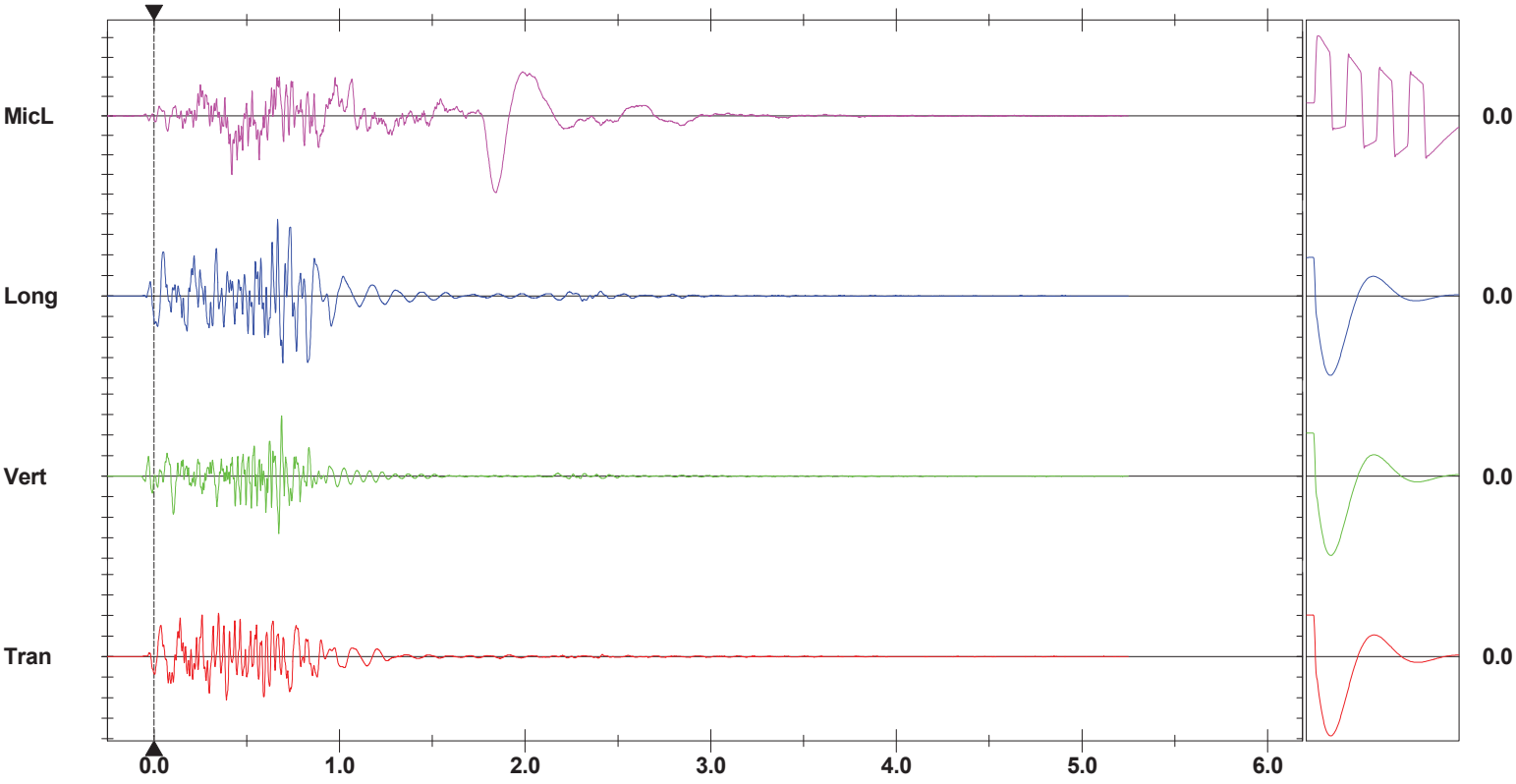
Microphone	Linear Weighting
PSPL	131.9 dB(L) at 1.840 sec
ZC Freq	3.5 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 611 mv)

	Tran	Vert	Long	
PPV	21.08	29.46	37.34	mm/s
ZC Freq	24	26	30	Hz
Time (Rel. to Trig)	0.349	0.688	0.667	sec
Peak Acceleration	0.490	0.742	0.623	g
Peak Displacement	0.235	0.167	0.378	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.7	3.7	4.1	

Peak Vector Sum 42.02 mm/s at 0.667 sec

USBM RI8507 And OSMRE





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 10.000 mm/s/div Mic: 20.00 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 72	Hole angle: 0.0°
Total drilled: 4700.5ft			

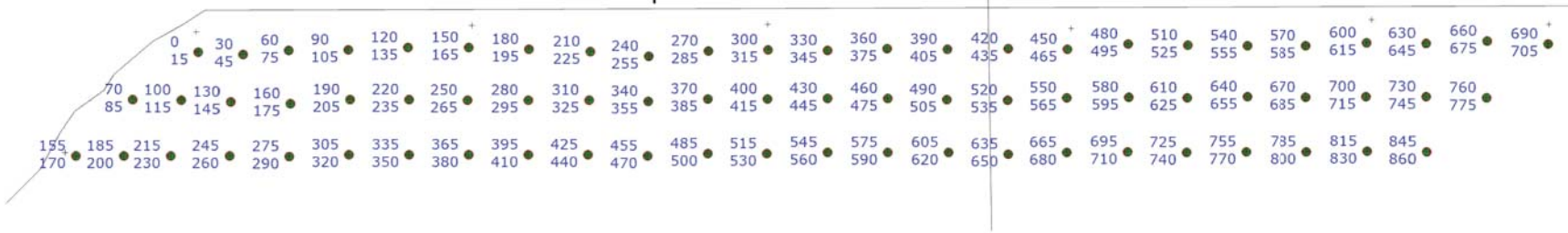
82Kg/delay
110Kg/delay

25M/25M
15M/15M,ms

85Kg/Delay
85Kg/Delay

20M/18M,ms
15M/15M,ms

open face



9MID019 Design Fnl - 4" Blast Hole 12x10 9x10 271 266 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

Not to scale

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 72	Hole angle: 0.0°
Total drilled: 4700.5ft			

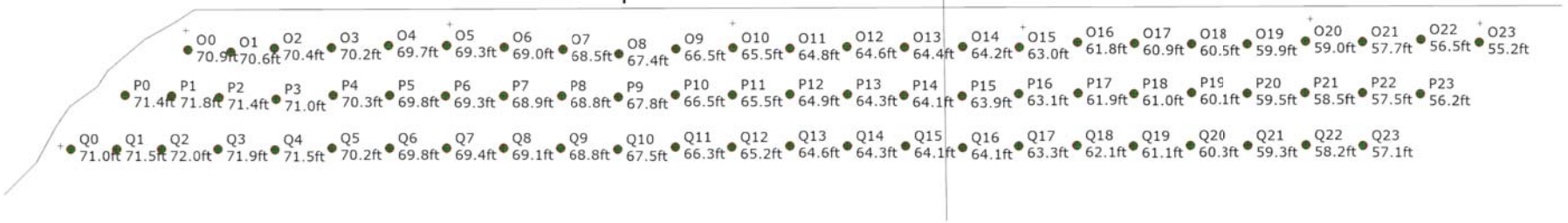
82Kg/delay
110Kg/delay

25M/25M
15M/15M,ms

85Kg/Delay
85Kg/Delay

20M/18M,ms
15M/15M,ms

open face



9MID019 Design Fnl - 4" Blast Hole 12x10 9x10 271 266 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

Not to scale

SHOTPlus Plan

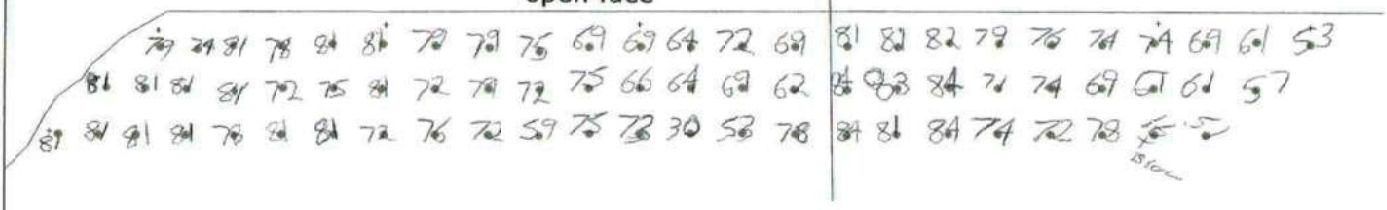
Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 72	Hole angle: 0.0°
Total drilled: 4700.5ft			

82Kg/delay
110Kg/delay

85Kg/Delay
85Kg/Delay

open face



ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 72	Hole angle: 0.0°
Total drilled: 4700.5ft			

N

POSTS

open face

O0 70.9ft	O1 70.6ft	O2 70.4ft	O3 70.2ft	O4 69.7ft	O5 69.3ft	O6 69.0ft	O7 68.5ft	O8 67.4ft	O9 66.5ft	O10 65.5ft	O11 64.8ft	O12 64.6ft	O13 64.4ft	O14 64.2ft	O15 63.0ft	O16 61.8ft	O17 60.9ft	O18 60.5ft	O19 59.9ft	O20 59.0ft	O21 57.7ft	O22 56.5ft	O23 55.2ft	
P0 71.4ft	P1 71.8ft	P2 71.4ft	P3 71.0ft	P4 70.3ft	P5 69.8ft	P6 69.3ft	P7 68.9ft	P8 68.8ft	P9 67.8ft	P10 66.5ft	P11 65.5ft	P12 64.9ft	P13 64.3ft	P14 64.1ft	P15 63.9ft	P16 63.1ft	P17 61.9ft	P18 61.0ft	P19 60.1ft	P20 59.5ft	P21 58.5ft	P22 57.5ft	P23 56.2ft	
Q0 71.0ft	Q1 71.5ft	Q2 72.0ft	Q3 71.9ft	Q4 71.5ft	Q5 70.2ft	Q6 69.8ft	Q7 69.4ft	Q8 69.1ft	Q9 68.8ft	Q10 67.5ft	Q11 66.3ft	Q12 65.2ft	Q13 64.6ft	Q14 64.3ft	Q15 64.1ft	Q16 64.1ft	Q17 63.3ft	Q18 62.1ft	Q19 61.1ft	Q20 60.3ft	Q21 59.3ft	Q22 58.2ft	Q23 57.1ft	

3 3 4 4 4 4 4 4 5 5 5 5 5

9MID019 Design Fnl - 4" Blast Hole 12x10 9x10 271 266 and 250 + .6 SUB ELEV

DRILLER NAME:_____

11-785'
28-1904'
16-1014.3'
17-997.4'

ORICA

Scale 1:350

SHOTPlus™ Professional 5.7.4.4		9/11/2019
Mine	Burlington	
Location	SOUTH OPEN END	
Title/author	9MID019 Design Fnl	
Filename		

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-020
P.O. #:		Orica Order #:	2537318
Blast Date:	2019-09-30	Blast Time:	11:56 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40469 °N Latitude (Centre of Blast) 79.88146 °W Longitude (Centre of Blast)

Wind from the: NE at 15 kph Temperature: 16 to 20 °C

Clear:		Rain:		Overcast:			
Partly Cloudy:	x	Snow:		Inversion:		Ceiling	30,000 ft

Tonnes Blasted:	24,167 te	9,295 m3
Total tonnes per day:	24,167 te	NB60-17 Rate Code
Total Holes Loaded:	64 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	24 front row	
- Pattern (Main Body) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	40 main body	
Bench Height:	50.7 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	52.7 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Main Body:	4.0 ft avg	
# Decks:	128 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	41.7 ft avg	
Main Body:	41.7 ft avg	
- Charge Weight -		
Front Row:	121.5 kg/hole	
Main Body:	121.5 kg/hole	
Max. per delay:	40.0 kg/delay	
SD () Equation:	1.7 kg/delay	
Total kg Loaded:	7,391 kg	
Rock Density:	2.60 g/cc = te/m^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	64	=	3,370.0 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,320	20,030	7,290

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	0	50

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	65	22.1
PENTEX DUO (OR EQUIVALENT)	0.45	64	29.1

total explosives weight in Blast (kg): 7,391

Pkgd Prod (50 kg) % of Total kg: 0.7%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
UNITRONIC 600 9M			64
UNITRONIC 600 15M			64
UNITRONIC 600 20M			64
EXEL MS 15m			64
EXEL MS 18m			64

Cord & Accessories:

	U of M	# used
	units	
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	12.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

- Powder Factor -

1.340 lb/yd^3	Yield PF:	0.306 kg/te (actual)
1.189 lb/yd^3	Front row:	0.271 kg/te (theoretical)
1.586 lb/yd^3	Main Body:	0.362 kg/te (theoretical)
1.454 lb/yd^3	"KPI" PF:	0.332 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

64 Addition decks on top of rate code

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-020
P.O. #:		Orica Order #:	2537318
Blast Date:	2019-09-30	Blast Time:	11:56 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40469**	**79.88146**	0.757555	1.394195
Front Row Corner	43.40444	79.88153	0.757550	1.394196
Back Row Corner	43.40493	79.88140	0.757559	1.394193
Average (Centre of Blast)	43.40469	79.88146	0.757555	1.394195

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**366.2**	m			
Post Blast Data: ppV:	**2.8**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**26.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**111.8**	dB	Trigger set at:	**115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	**1390.6**	m			
Post Blast Data: ppV:	**Did**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**Not**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**Trigger**	dB	Trigger set at:	**115**	dB

Blind Line and Colling Road (Bruce Trail Entrance)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	**39.3**	m			
Post Blast Data: ppV:	**30.4**	mm/s	Trigger set at:	**2.0**	mm/s
frequency:	**20.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**129.9**	dB	Trigger set at:	**115**	dB

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(39.3)^2}{30^2} \text{ kg}$$

$$= \frac{1{,}544}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 2 kg

jim bray

Orica
Blaster-in-charge: Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

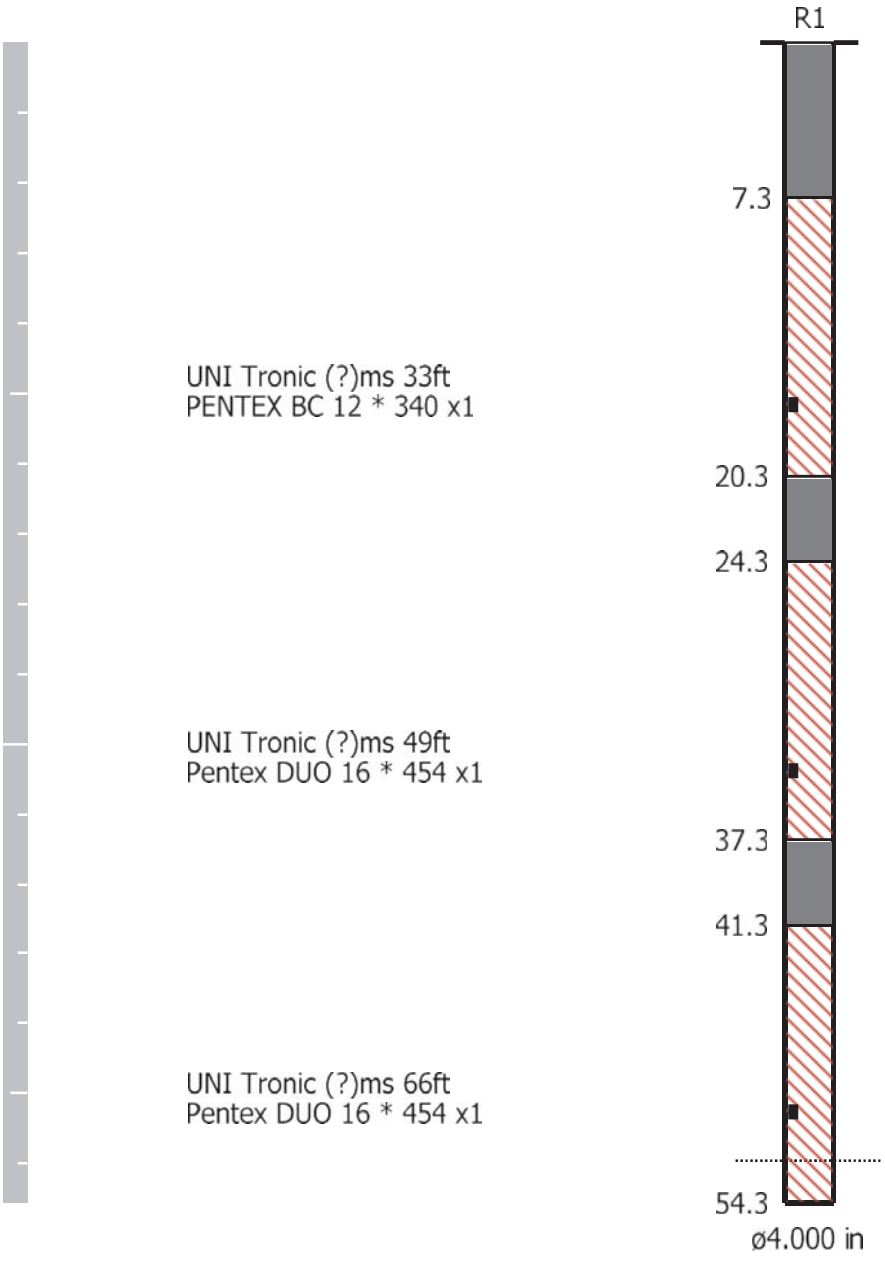
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-020
P.O. #:		Orica Order #:	2537318
Blast Date:	9/30/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica Blaster-in-charge:	Mike der Kinderen
Quarry Manager:	Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Vert at 11:56:54 September 30, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.0 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.2 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 #2 road, Burlington
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington

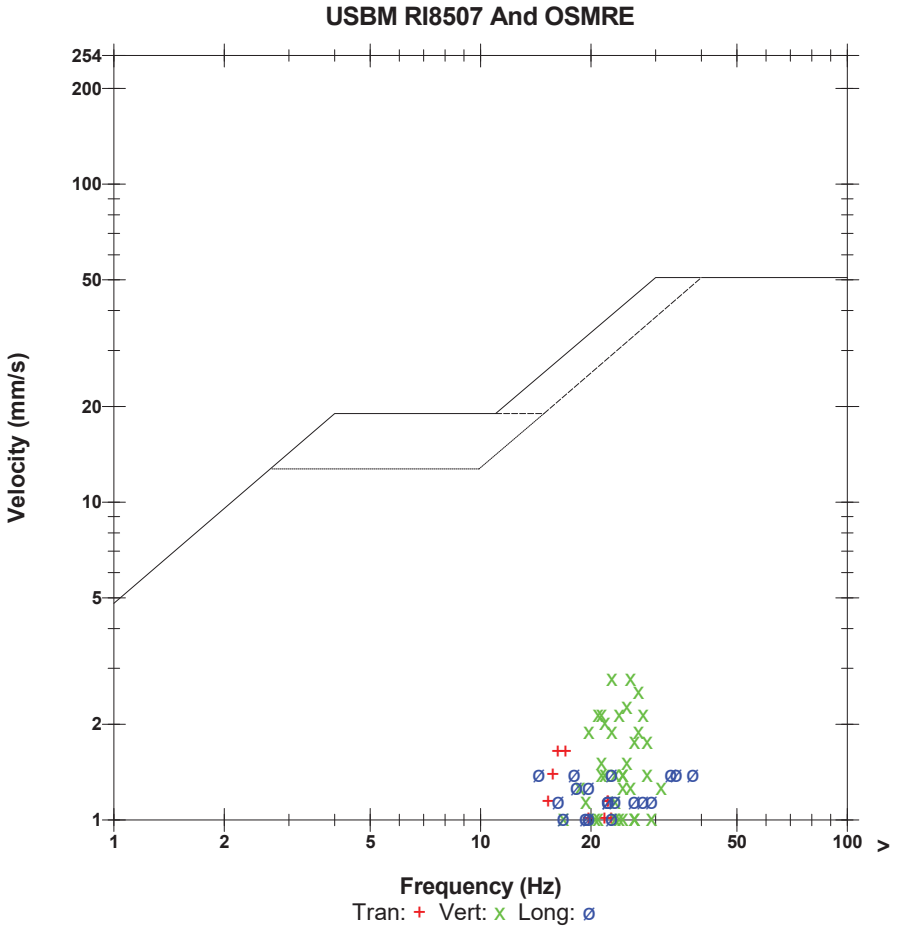
Extended Notes

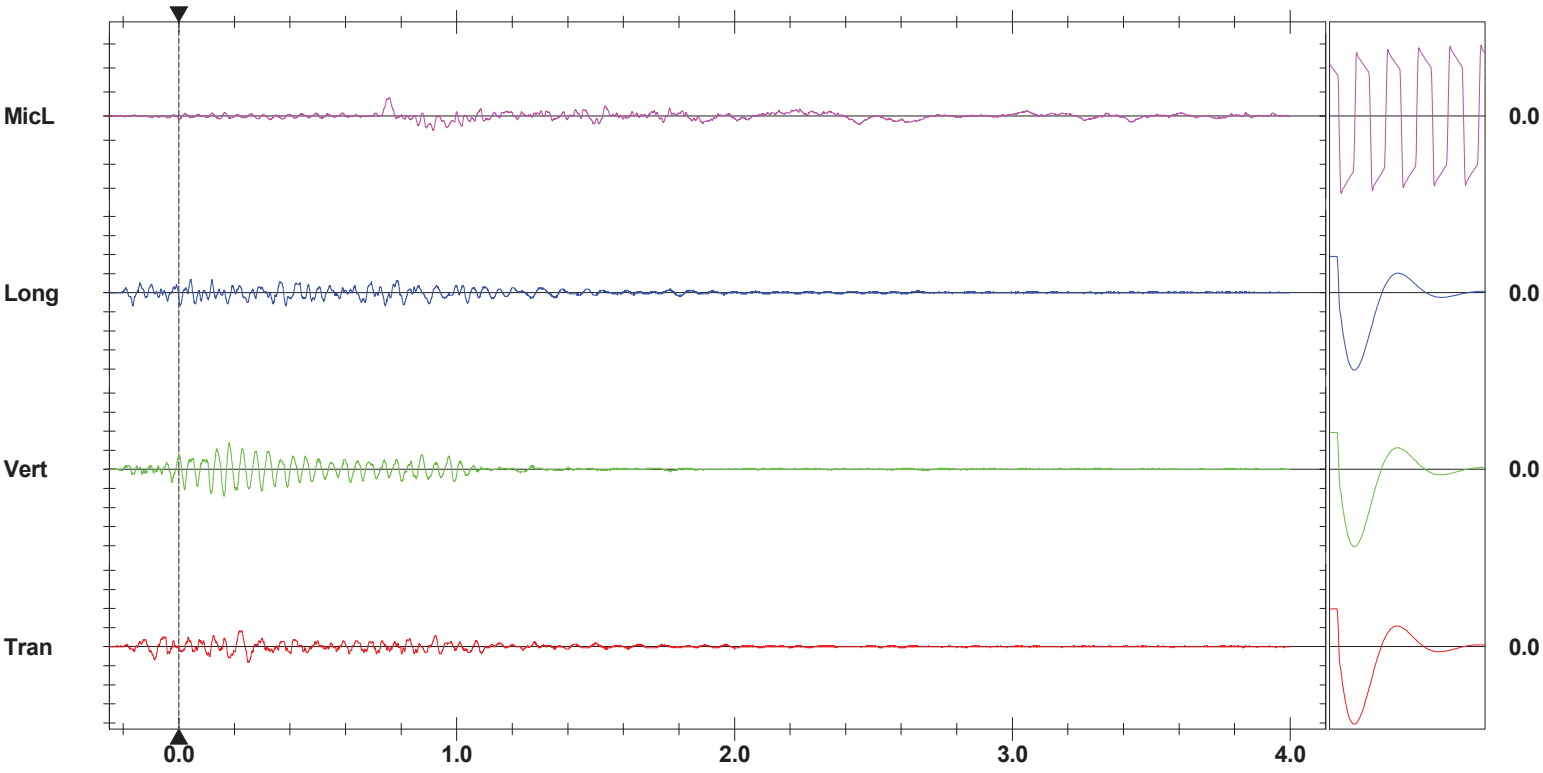
Sand Bagged
N43.40245 W-79.87814

Microphone	Linear Weighting
PSPL	111.8 dB(L) at 0.757 sec
ZC Freq	10.8 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 574 mv)

	Tran	Vert	Long	
PPV	1.651	2.794	1.397	mm/s
ZC Freq	16.3	26	18.0	Hz
Time (Rel. to Trig)	0.216	0.161	-0.167	sec
Peak Acceleration	0.053	0.080	0.053	g
Peak Displacement	0.018	0.019	0.012	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.7	4.0	

Peak Vector Sum 3.113 mm/s at 0.181 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Blind Line & Colling road
Burlington
Burlington 2019-09-30 Blast 19-020 Middle

Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
----------	----------	SERIAL NUMBER: UM6857
Sep 30 /19 06:17:01		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Sep 30 /19 10:16:29	Sep 30 /19 10:16:34	Event recorded. Trigger Level MicL: 115.0 dB
Sep 30 /19 10:16:34	Sep 30 /19 12:25:24	Event recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic: 115.

Event Report

Date/Time	Vert at 11:56:52 September 30, 2019
Trigger Source	Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.25 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.3 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

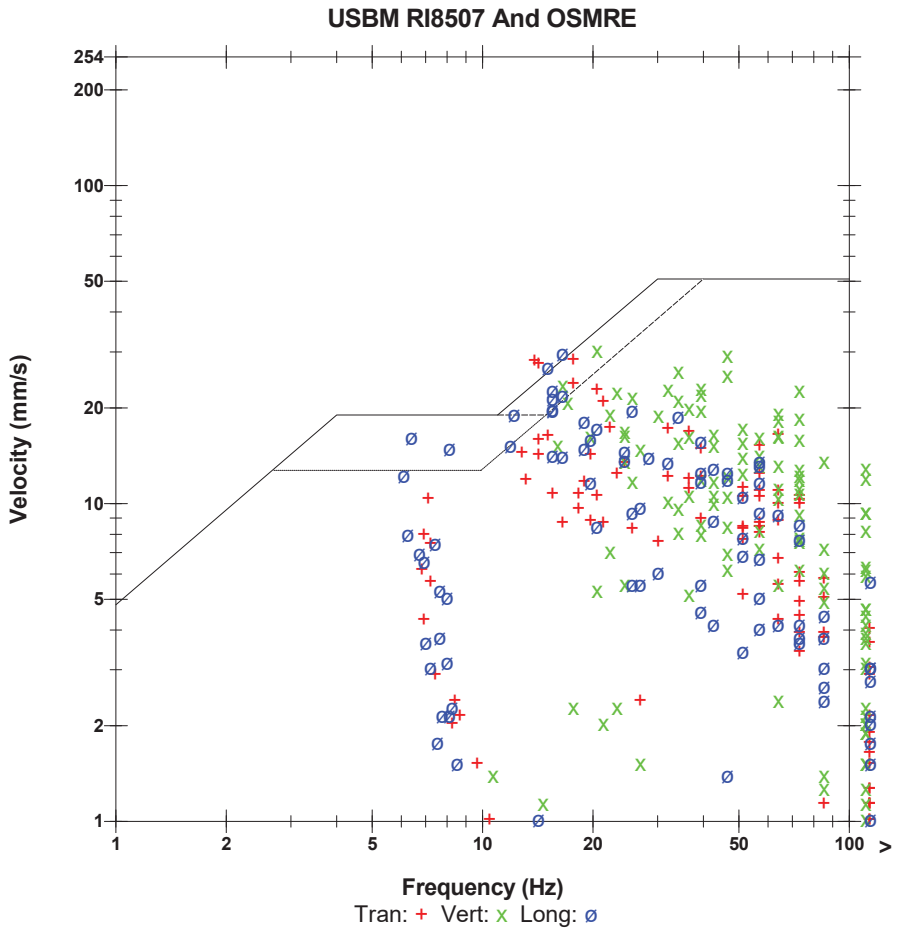
Notes
Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

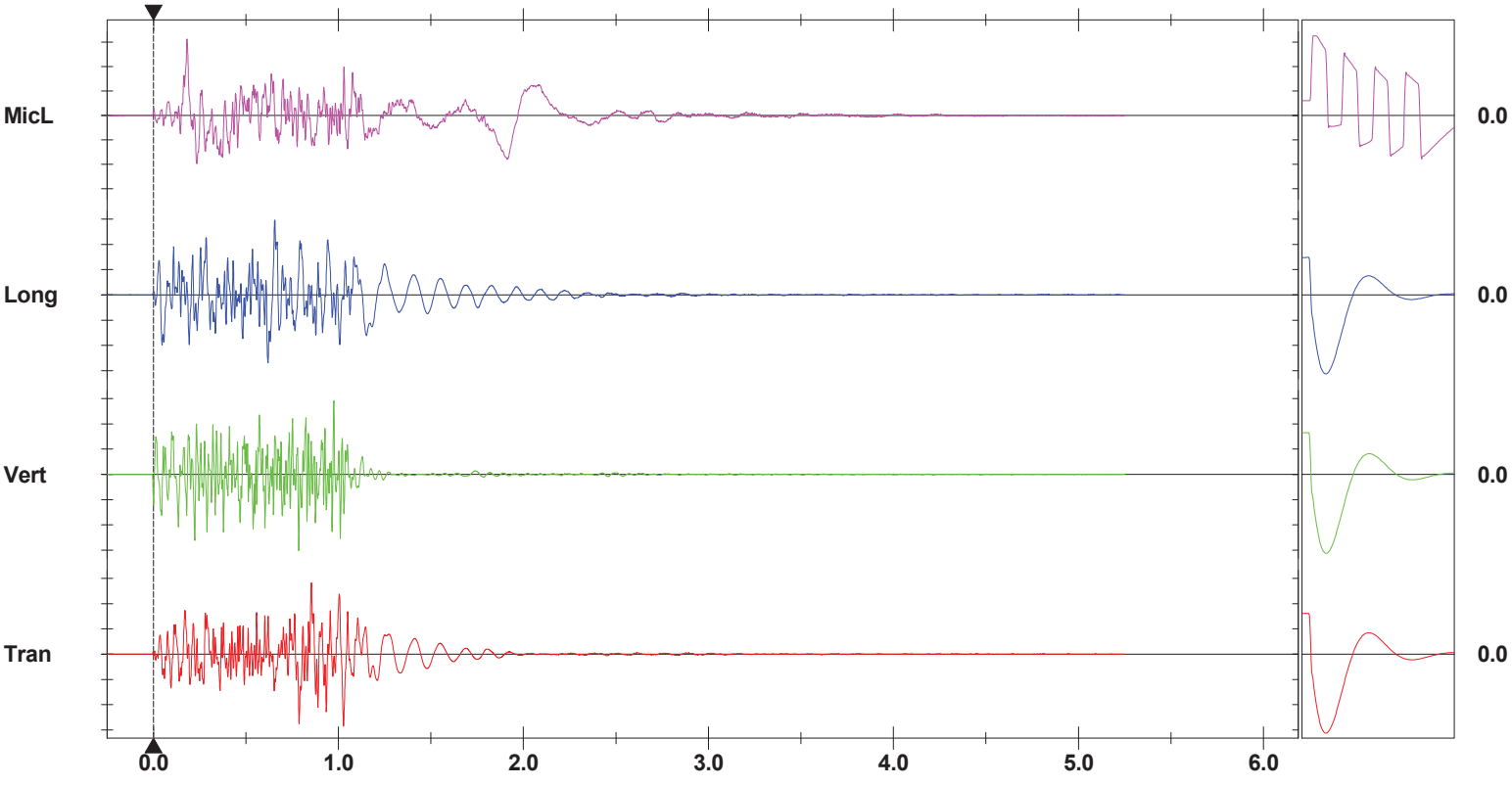
Extended Notes
Sand Bagged at gas line

Microphone	Linear Weighting
PSPL	129.9 dB(L) at 0.182 sec
ZC Freq	10 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 644 mv)

	Tran	Vert	Long	
PPV	28.57	30.35	29.72	mm/s
ZC Freq	18	20	17	Hz
Time (Rel. to Trig)	1.027	0.785	0.656	sec
Peak Acceleration	0.610	1.418	0.663	g
Peak Displacement	0.246	0.144	0.403	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.3	7.3	Hz
Overswing Ratio	3.7	3.9	4.2	

Peak Vector Sum 40.18 mm/s at 0.787 sec

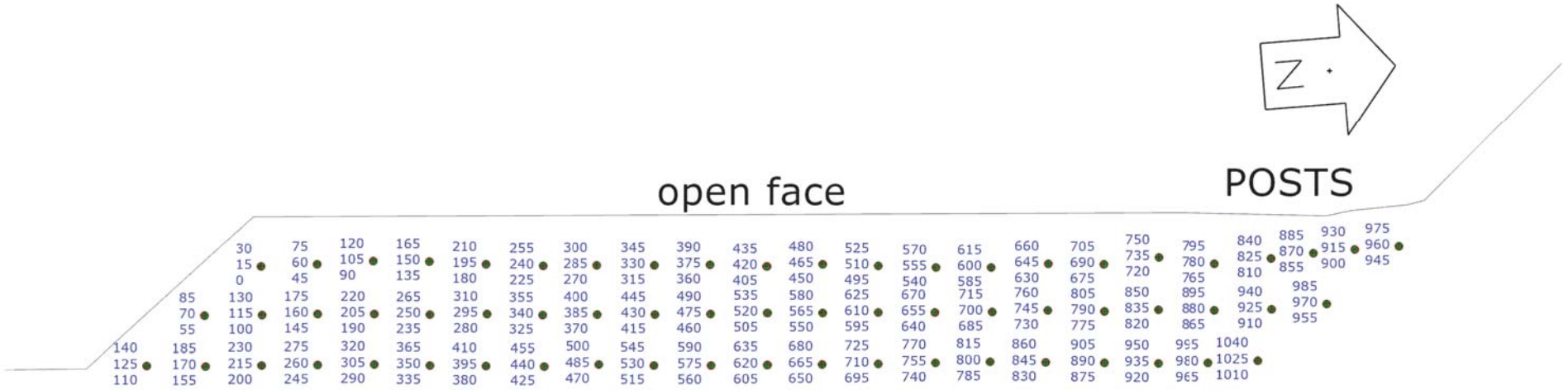




Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 10.000 mm/s/div Mic: 20.00 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 73	Hole angle: 0.0°
Total drilled: 4105.8ft			

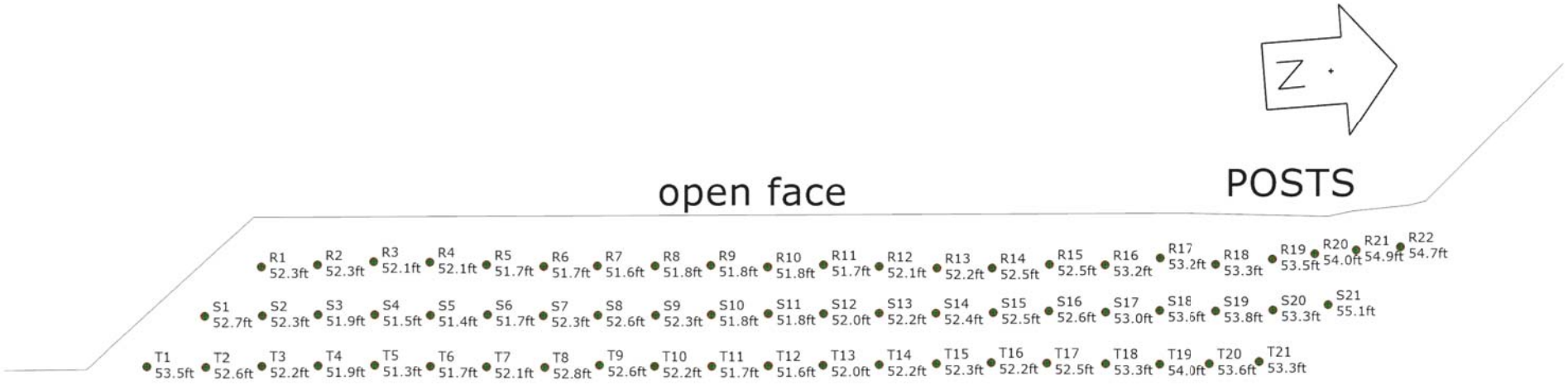


9MID020 Design Fnl - 4" Blast Hole 12x10 9x10 266 and 250 + .6 SUB ELEV

DRILLER NAME:_____

Not to scale

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 73	Hole angle: 0.0°
Total drilled: 4105.8ft			



9MID020 Design Fnl - 4" Blast Hole 12x10 9x10 266 and 250 + .6 SUB ELEV

DRILLER NAME:_____

ORICA

Not to scale

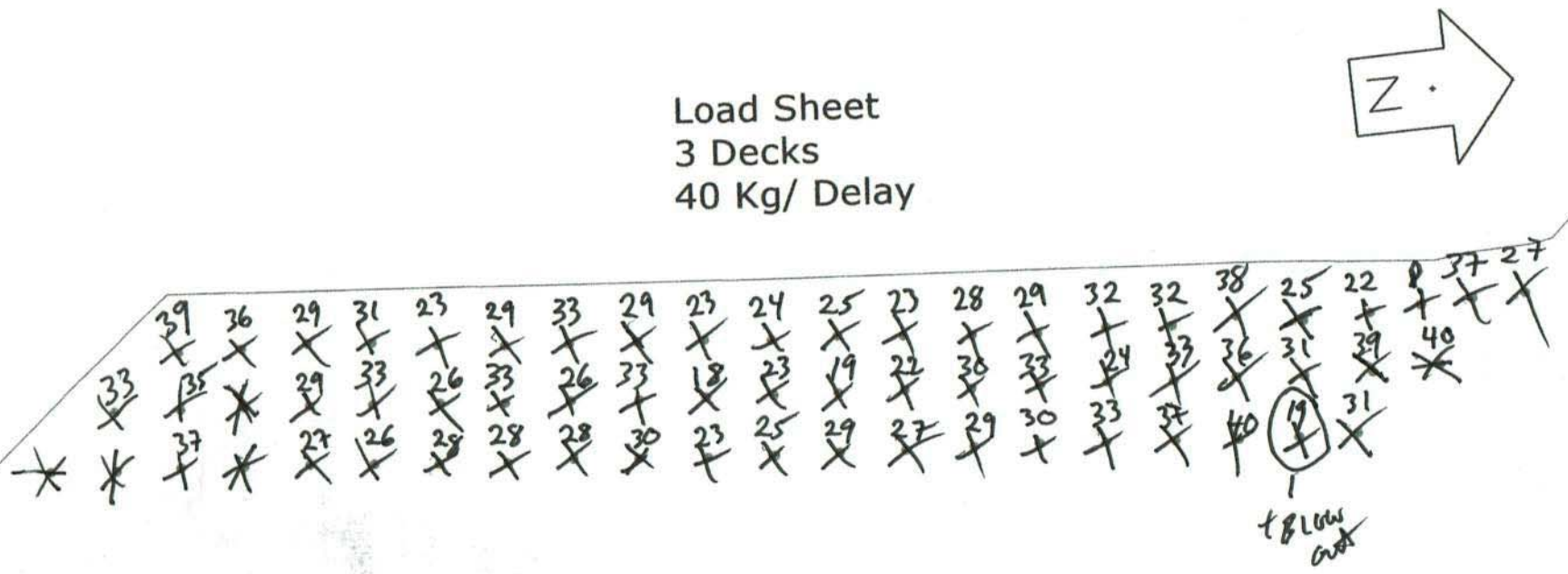
SHOTPlus Plan

25

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 73	Hole angle: 0.0°
Total drilled: 4105.8ft			

Load Sheet
3 Decks
40 Kg/ Delay



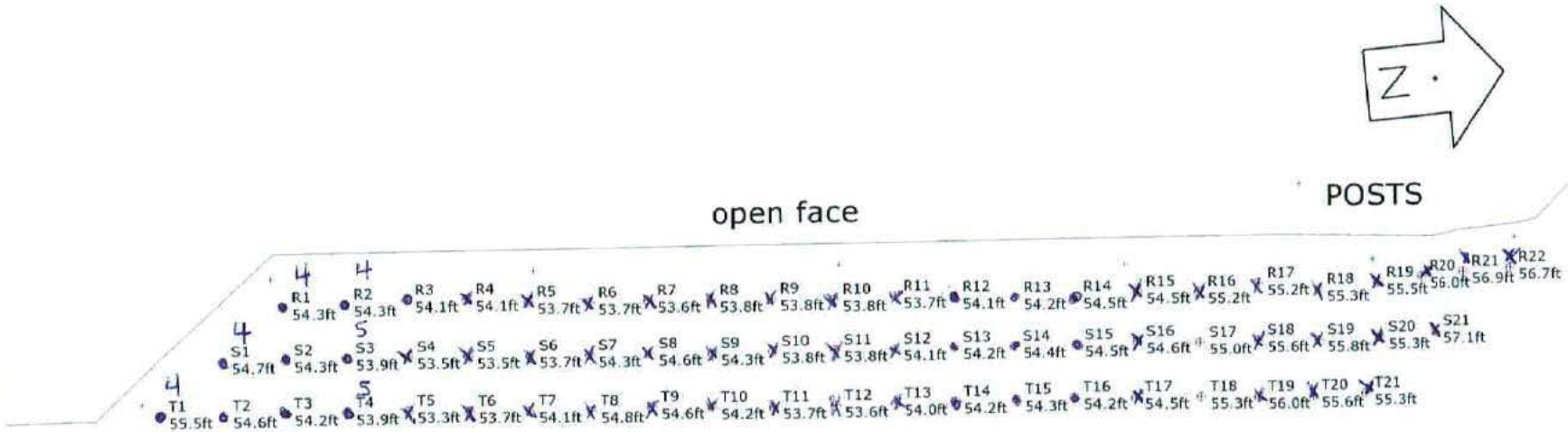
ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 64	Hole angle: 0.0°
Total drilled: 3489.7ft			



9MID020 Design Fnl - 4" Blast Hole 12x10 9x10 266 and 250 + .6 SUB ELEV

DRILLER NAME:_____

10-543.8

ORICA

Scale 1:350

SHOTPlus™ Professional 5.7.4.4		9/11/2019
Mine	Burlington	
Location	NORTH CLOSED END	
Title/author	9MID020 Design Fnl	
Filename		

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-021
P.O. #:		Orica Order #:	2543361
Blast Date:	2019-10-15	Blast Time:	11:55 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40362 °N Latitude (Centre of Blast) 79.88148 °W Longitude (Centre of Blast)

Wind from the: S at 5 kph Temperature: 11 to 15 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	26,561	te	10,216	m3		
Total tonnes per day:	26,561	te	NB60-17	Rate Code		
Total Holes Loaded:	53	holes				
… including:	0	Dead Holes				
… and:	0	Helper Holes				
Helper Hole Collar:	0.0	ft avg				
# Rows Blasted:	3	rows				
- Pattern (Front Row)-						
Burden:	12.0	ft avg				
Spacing:	10.0	ft avg				
# Holes:	22	front row				
- Pattern (Main Body) -						
Burden:	9.0	ft avg				
Spacing:	10.0	ft avg				
# Holes:	31	main body				
Bench Height:	66.4	ft avg				
Sub-drill:	2.0	ft avg				
Hole Depth:	68.4	ft avg				
- Stone Decking -						
Front Row:	8.0	ft avg				
Main Body:	0.0	ft avg				
# Decks:	2	per blast				
- Collar Stemming -						
Front Row:	7.0	ft avg				
Main Body:	7.0	ft avg				
Material used:	3/4" Clear					
- Charge Length -						
Front Row:	53.4	ft avg				
Main Body:	61.4	ft avg				
- Charge Weight -						
Front Row:	155.8	kg/hole				
Main Body:	179.2	kg/hole				
Max. per delay:	107.0	kg/delay				
SD () Equation:	16.7	kg/delay				
Total kg Loaded:	9,669	kg				
Rock Density:	2.60	g/cc	= te/m^3			
- Powder Factor -						
Yield PF:	0.364	kg/te	(actual)	1.595	lb/yd^3	
Front row:	0.265	kg/te	(theoretical)	1.163	lb/yd^3	
Main Body:	0.407	kg/te	(theoretical)	1.783	lb/yd^3	
"KPI" PF:	0.360	kg/te	(theoretical)	1.577	lb/yd^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0	°	56	=	3,832.6 ft (4 " diam)
Secondary Bit diam:	92.1	mm		°	3	=	205.3 ft (3 5/8 " diam)
Tertiary Bit diam:		mm		°		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,740	24,140	9,600

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	1	25

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	56	19.0
PENTEX DUO (OR EQUIVALENT)	0.45	54	24.5

total explosives weight in Blast (kg): 9,669

Pkgd Prod (25 kg) % of Total kg: 0.3%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 15M			54
UNITRONIC 600 25M			54
EXEL MS 25m			54
UNITRONIC 600 6M			2

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.5
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

NOTES (ANY VARIATION FROM STANDARD):

Nick Heap and I decided it was best to cut 6 holes off to the south due to a hole that was 20' short in depth.

Package was use to load through lean burden

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-021
P.O. #:		Orica Order #:	2543361
Blast Date:	2019-10-15	Blast Time:	11:55 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40365**	**79.88148**	0.757537	1.394195
Front Row Corner	43.40332	79.88155	0.757531	1.394196
Back Row Corner	43.40390	79.88141	0.757541	1.394194
Average (Centre of Blast)	43.40362	79.88148	0.757536	1.394195

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**300.1**	m		
Post Blast Data: ppV:	**6.0**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**14.6**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**112.8**	dB	Trigger set at: **115**	dB

2450 2nd Line

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance **(2nd Seis. From Centre of Blast)**	**1283.8**	m		
Post Blast Data: ppV:	**0.2**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**9.1**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**117.0**	dB	Trigger set at: **115**	dB

Blind Line and Colling Road (Bruce Trail Entrance)

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	**122.6**	m		
Post Blast Data: ppV:	**18.8**	mm/s	Trigger set at: **2.0**	mm/s
frequency:	**15.0**	Hz	V / T / L : **?**	(Vertical, Transverse or Longitudinal)
air overpressure:	**129.7**	dB	Trigger set at: **115**	dB

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(122.6)^2}{30^2} \text{ kg}$$

$$= \frac{15{,}031}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 17 kg

jim bray

Orica
Blaster-in-charge: *Mike derkinderen*

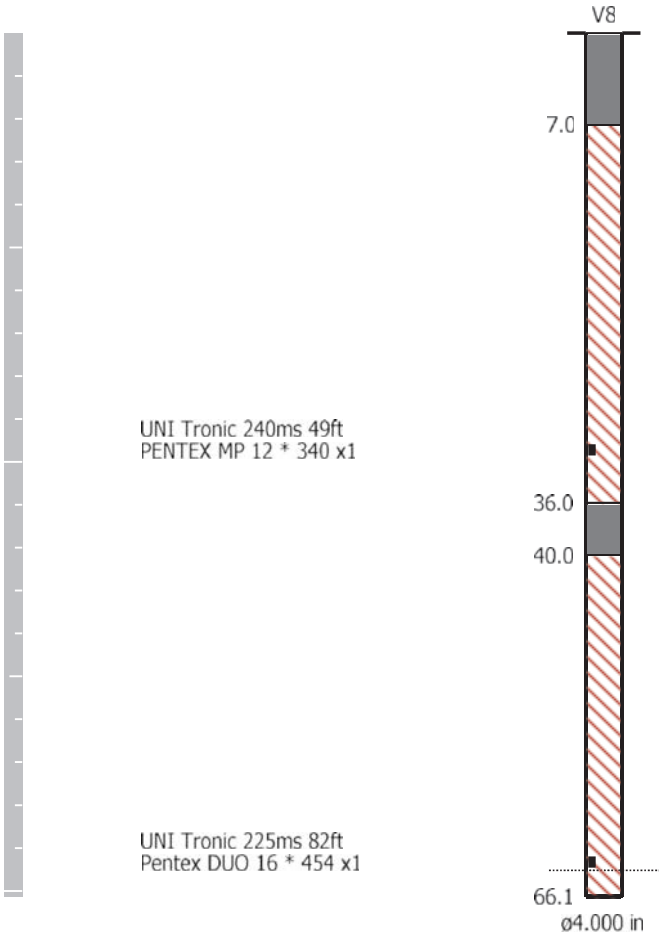
Signature required, indicating that
Blast Report is Complete & Accurate.

Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-021
P.O. #:		Orica Order #:	2543361
Blast Date:	10/15/2019		

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

Quarry Manager: Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Vert at 11:55:04 October 15, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.25 sec (Auto=3Sec) at 2048 sps
Job Number:	1

Serial Number	BE12877 V 10.72-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	December 4, 2018 by Instantel
File Name	__TEMP.EVT

Notes

Location:	2450 #2 road, Burlington
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Burlington, On

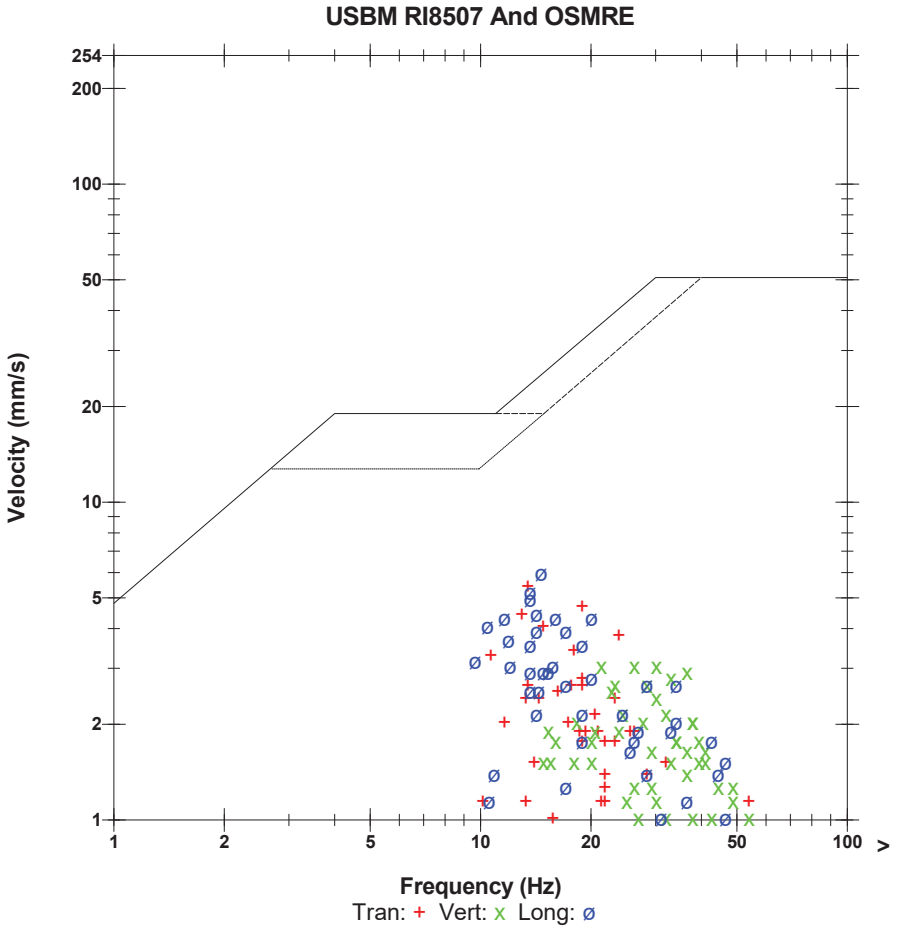
Extended Notes

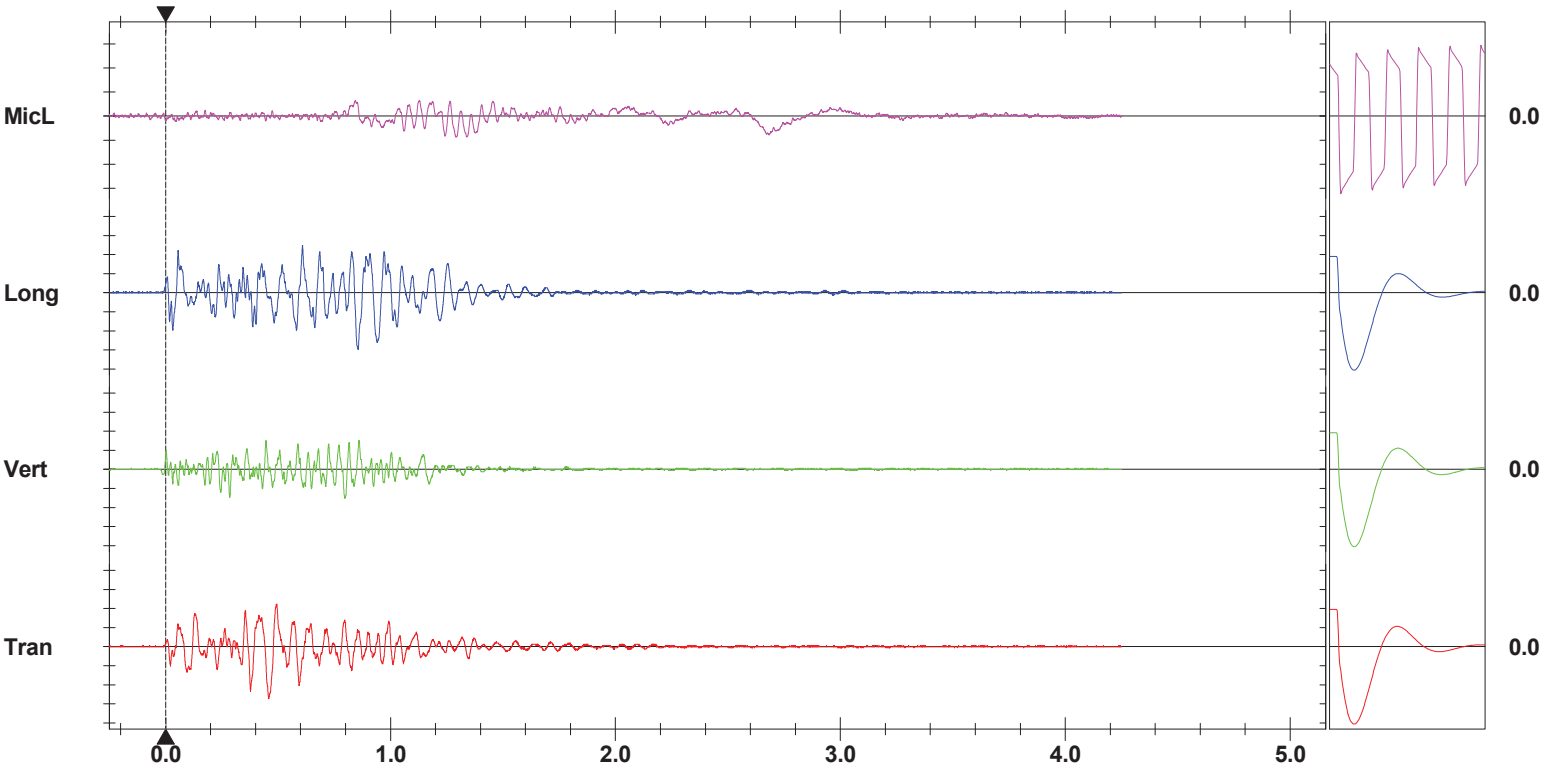
Sand Bagged
43.40245 -79.87814

Microphone	Linear Weighting
PSPL	112.8 dB(L) at 1.290 sec
ZC Freq	15.3 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 627 mv)

	Tran	Vert	Long	
PPV	5.461	3.048	5.969	mm/s
ZC Freq	13.5	30	14.6	Hz
Time (Rel. to Trig)	0.458	0.446	0.855	sec
Peak Acceleration	0.080	0.080	0.106	g
Peak Displacement	0.064	0.019	0.065	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.3	7.2	Hz
Overswing Ratio	3.9	3.7	4.1	

Peak Vector Sum 6.571 mm/s at 0.856 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	MicL at 11:55:03 October 15, 2019
Trigger Source	Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.054 sec (Auto=5Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.6 Volts
Unit Calibration	January 15, 2019 by Instantel
File Name	UM6857_20191015115503.IDFW

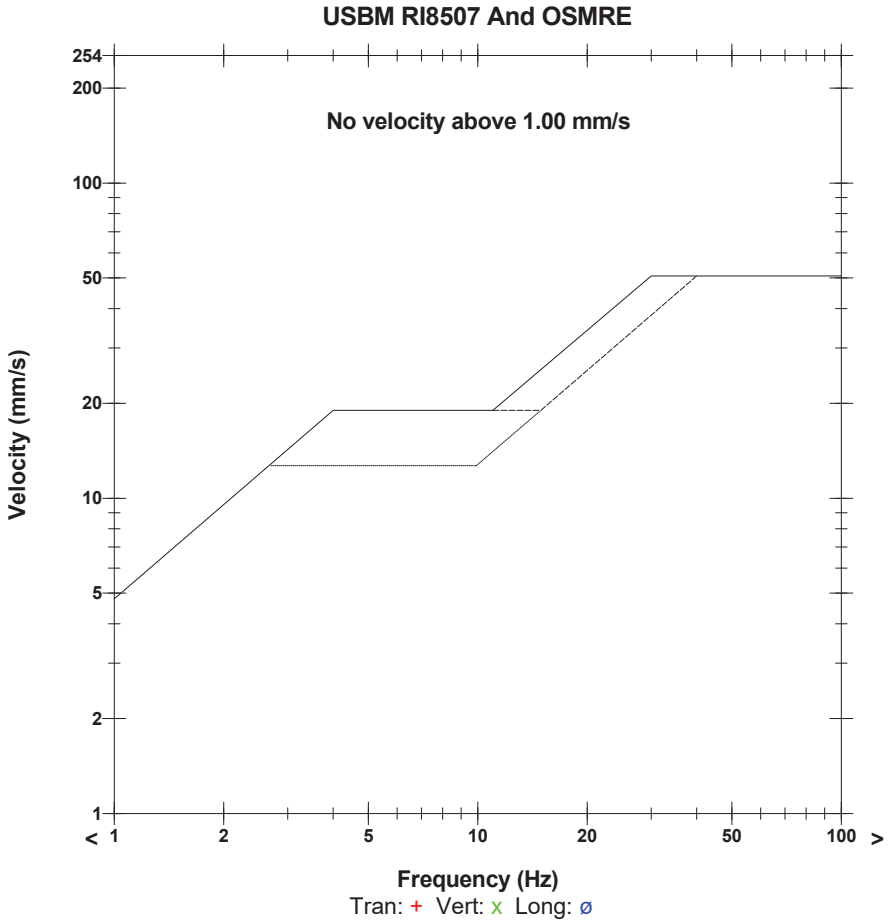
Notes
Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

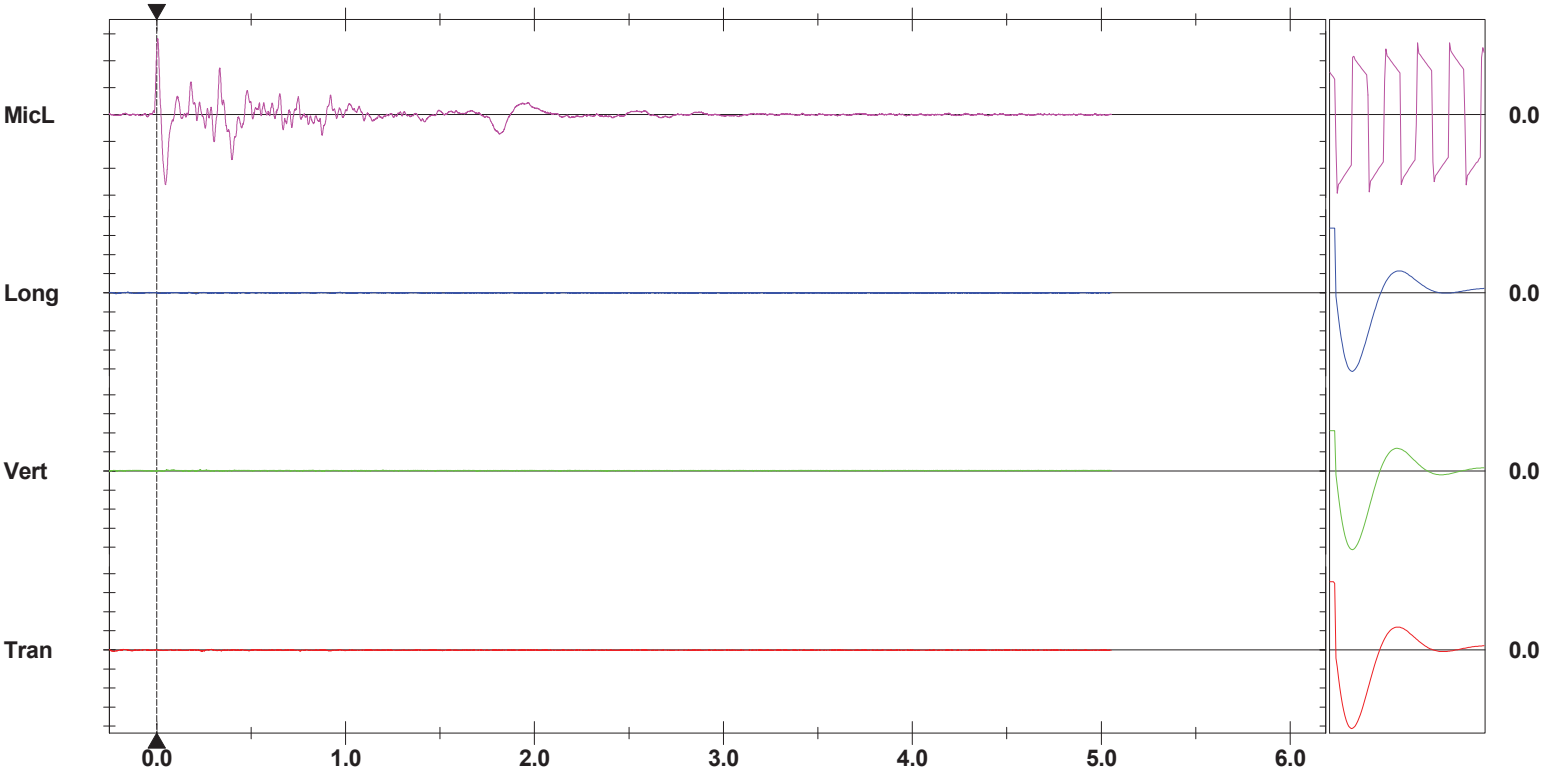
Extended Notes
N 43.31617
W 80.02664

Microphone	Linear Weighting
PSPL	117.0 dB(L) at 0.006 sec
ZC Freq	10.0 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1474 mv)

	Tran	Vert	Long	
PPV	0.166	0.110	0.102	mm/s
ZC Freq	9.1	4.0	13.7	Hz
Time (Rel. to Trig)	-0.229	0.056	0.206	sec
Peak Acceleration	0.008	0.010	0.012	g
Peak Displacement	0.005	0.013	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.4	3.6	

Peak Vector Sum 0.177 mm/s at -0.229 sec





Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Event Report

Date/Time	Tran at 11:52:41 October 15, 2019
Trigger Source	Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	5.25 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.3 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

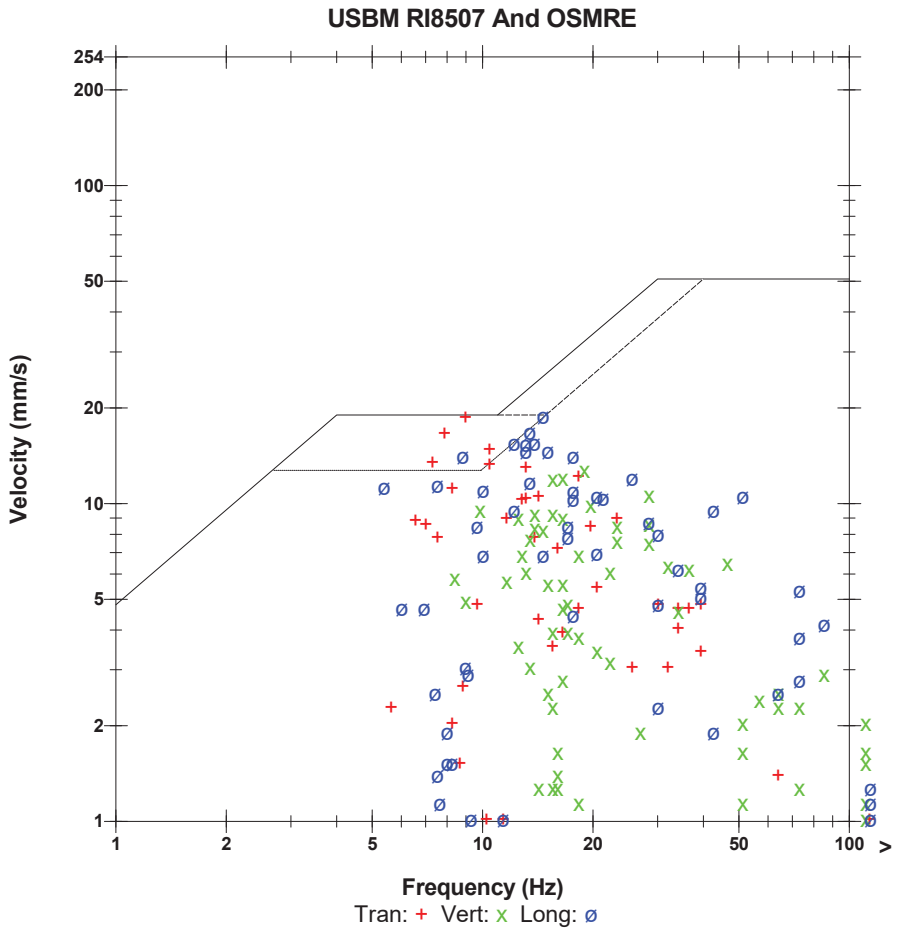
Notes
Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

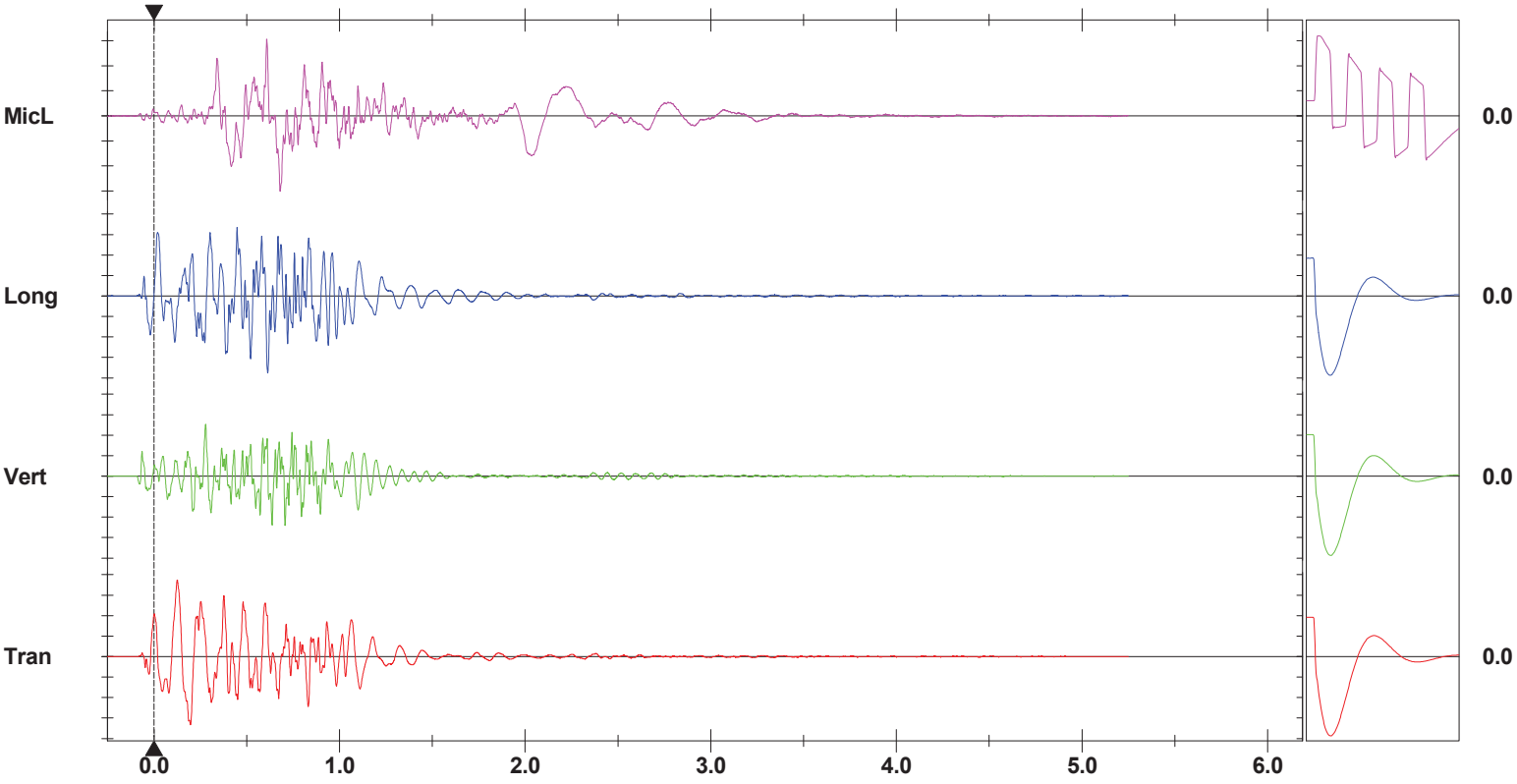
Extended Notes
Sand Bagged at gas line

Microphone	Linear Weighting
PSPL	129.7 dB(L) at 0.607 sec
ZC Freq	16 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 627 mv)

	Tran	Vert	Long	
PPV	18.67	12.70	18.80	mm/s
ZC Freq	9.0	19	15	Hz
Time (Rel. to Trig)	0.125	0.278	0.613	sec
Peak Acceleration	0.199	0.318	0.318	g
Peak Displacement	0.323	0.112	0.234	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.4	Hz
Overswing Ratio	3.8	3.9	4.2	

Peak Vector Sum 22.37 mm/s at 0.610 sec





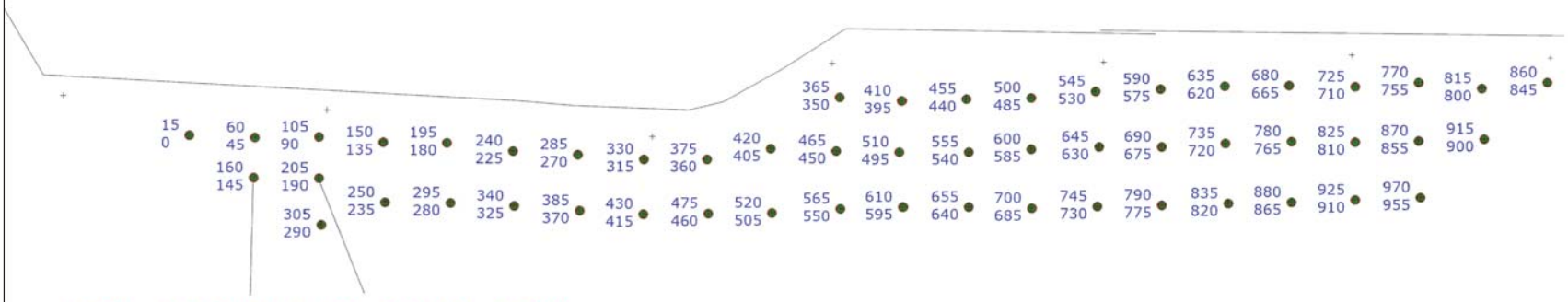
Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 5.000 mm/s/div Mic: 20.00 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 3634.7ft			

open face



W2 W3 W4 3.625" DIA

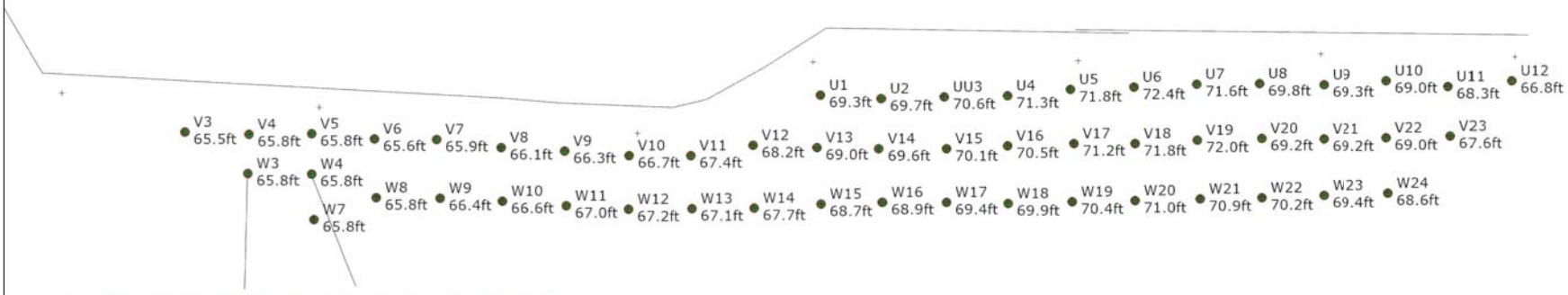
ORICA

Not to scale

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 3634.7ft			

open face

Load Sheet
100 Kg Max
95Kg Bottom Deck



W2 W3 W4 3.625" DIA

ORICA

Not to scale

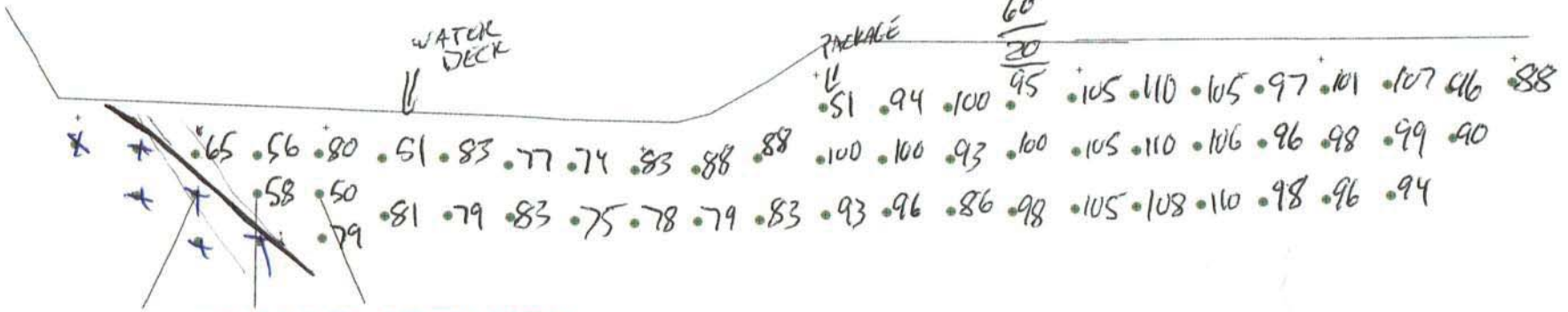
SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 59	Hole angle: 0.0°
Total drilled: 4029.6ft			

open face

Load Sheet
100 Kg Max
95Kg Bottom Deck



W2 W3 W4 3.625" DIA

ORICA

Not to scale

SHOTPlus 5 Plan

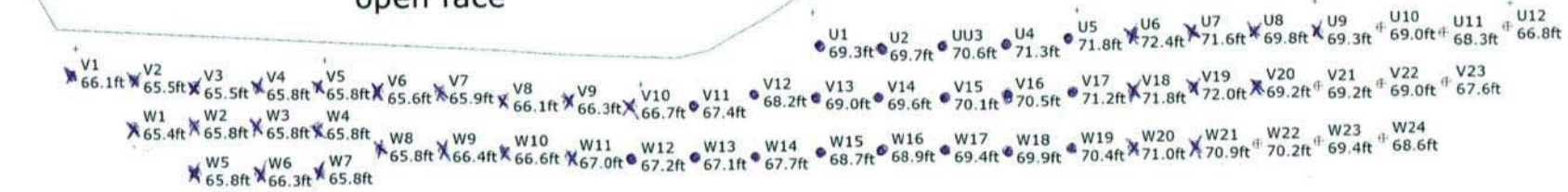
Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 59	Hole angle: 0.0°
Total drilled: 4029.6ft			

APPROX 12300 KGS WITH NO DECKS

POSTS

open face



W2 W3 W4 3.625" DIA

9MID021 Design Fnl - 3.625 and 4" Blast Holes 12x10 9x10 271 and 250 + .6 SUB ELEV

DRILL TO DEPTH OR SHALE + 2 FEET

ORICA

Scale 1:350

SHOTPlus™ Professional 5.7.4.4		9/25/2019
Mine	Burlington	
Location	SOUTH WALL TO MID NEXT TO OLD WHL WS	
Title/author	9MID021 Design Partial Fnl	
Filename	9MID021 Design Partial Fnl.spf	

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-022
P.O. #:		Orica Order #:	2547256
Blast Date:	2019-10-23	Blast Time:	11:59 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40443 °N Latitude (Centre of Blast) 79.88139 °W Longitude (Centre of Blast)

Wind from the: W at 15 kph Temperature: 11 to 15 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:	x	Snow:		Inversion:	

Ceiling: 30,000 ft

Tonnes Blasted:	26,393 te	10,151 m3
Total tonnes per day:	26,393 te	NB60-17 Rate Code
Total Holes Loaded:	64 holes	
… including:	0 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	2 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	33 front row	
- Pattern (Back Row) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	31 back row	
Bench Height:	53.1 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	55.1 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Back Row:	ft avg	
# Decks:	64 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Back Row:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	44.1 ft avg	
Back Row:	48.1 ft avg	
- Charge Weight -		
Front Row:	128.6 kg/hole	
Back Row:	140.3 kg/hole	
Max. per delay:	85.0 kg/delay	
SD () Equation:	2.0 kg/delay	
Total kg Loaded:	9,041 kg	
Rock Density:	2.60 g/cc	= te/m^3

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	64	=	3,527.0 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,760	24,820	8,940

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	0	50

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	66	22.4
PENTEX DUO (OR EQUIVALENT)	0.45	64	29.1

total explosives weight in Blast (kg): 9,041

Pkgd Prod (50 kg) % of Total kg: 0.6%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
UNITRONIC 600 15M			64
UNITRONIC 600 20M			36
UNITRONIC 600 25M			29
EXEL MS 18m		25 ms	36
EXEL MS 25m		25 ms	28

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	12.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Theoretical PF (Based on a single hole)

1.501	lb/yd^3	*- Powder Factor -*
1.201	lb/yd^3	Yield PF: 0.343 kg/te (actual)
1.747	lb/yd^3	Front row: 0.274 kg/te (theoretical)
1.474	lb/yd^3	Main Body: 0.399 kg/te (theoretical)
		"KPI" PF: 0.336 kg/te (theoretical)

Yield Powder Factor (kg Loaded / te Blastec

NOTES (ANY VARIATION FROM STANDARD):

Drilled to dept od shale + 2'

2 Cases of package were used for X1 due to lean burden from 30' to collar

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-022
P.O. #:		Orica Order #:	2547256
Blast Date:	2019-10-23	Blast Time:	11:59 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40443**	**79.88138**	0.757550	1.394193
Front Row Corner	43.40401	79.88147	0.757543	1.394195
Back Row Corner	43.40485	79.88133	0.757557	1.394192
Average (Centre of Blast)	43.40443	79.88139	0.757550	1.394193

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**343.1**	m				
Post Blast Data: ppV:	**Memory**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**was full**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**from high wind**	dB	Trigger set at:	**115**	dB	

2450 #2 Sideroad, Burlington, On

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40614	79.87455	0.757580	1.394074
2nd Reading				
Average	43.40614	79.87455	0.757580	1.394074

Distance **(2nd Seis. From Centre of Blast)**	**585.1**	m				
Post Blast Data: ppV:	**3.3**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**43.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**104.6**	dB	Trigger set at:	**115**	dB	

2582 #2 Sideroad, Burlington, On

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	**42.2**	m				
Post Blast Data: ppV:	**Memory**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**was full**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**from high wind**	dB	Trigger set at:	**115**	dB	

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(42.2)^2}{30^2} \text{ kg}$$

$$= \frac{1{,}781}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 2 kg

jim bray

Orica
Blaster-in-charge: Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

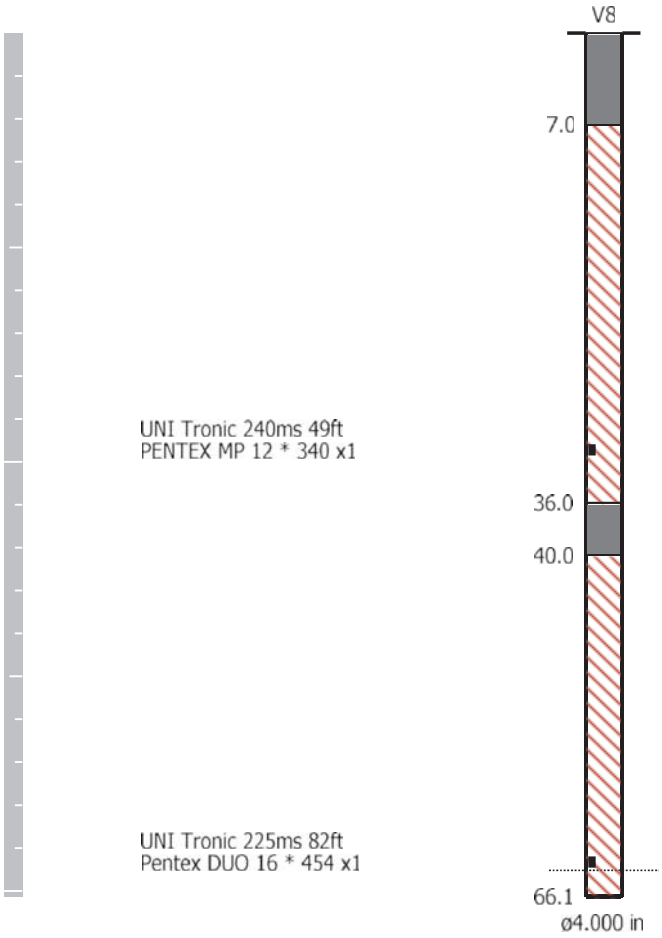
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-022
P.O. #:		Orica Order #:	2547256
Blast Date:	10/23/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

Quarry Manager: Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time	Long at 11:59:19 October 23, 2019
Trigger Source	Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range	Geo: 254.0 mm/s
Record Time	4.875 sec (Auto=4Sec) at 2048 sps
Operator/Setup:	MIKE DERKNDEREN/Burlington 2582.mmb

Serial Number	UM6857 V 10-89 Micromate ISEE
Battery Level	3.8 Volts
Unit Calibration	January 15, 2019 by Instantel
File Name	UM6857_20191023115919.IDFW

Notes

Location:	2582 #2 Sideroad, Mount Nemo,On
Client:	Nelson Aggregate
User Name:	Orica Canada Inc.
General:	Monitoring Vibration and Airblast

Extended Notes

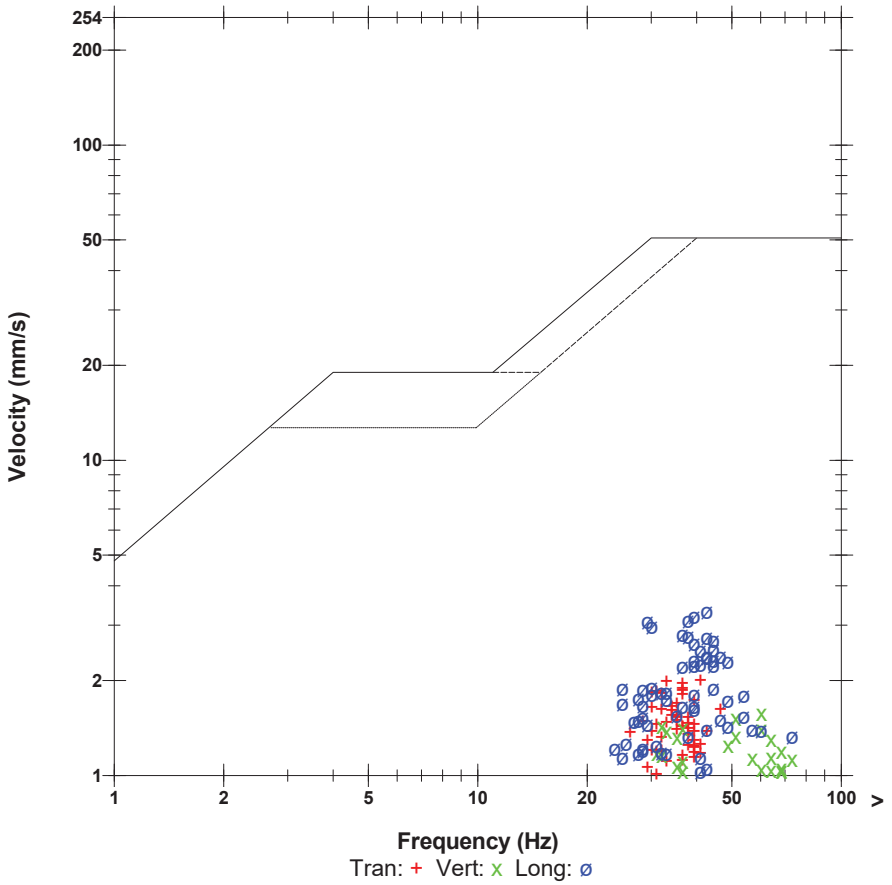
Sand Bagged
N43.40614,W-79.87455

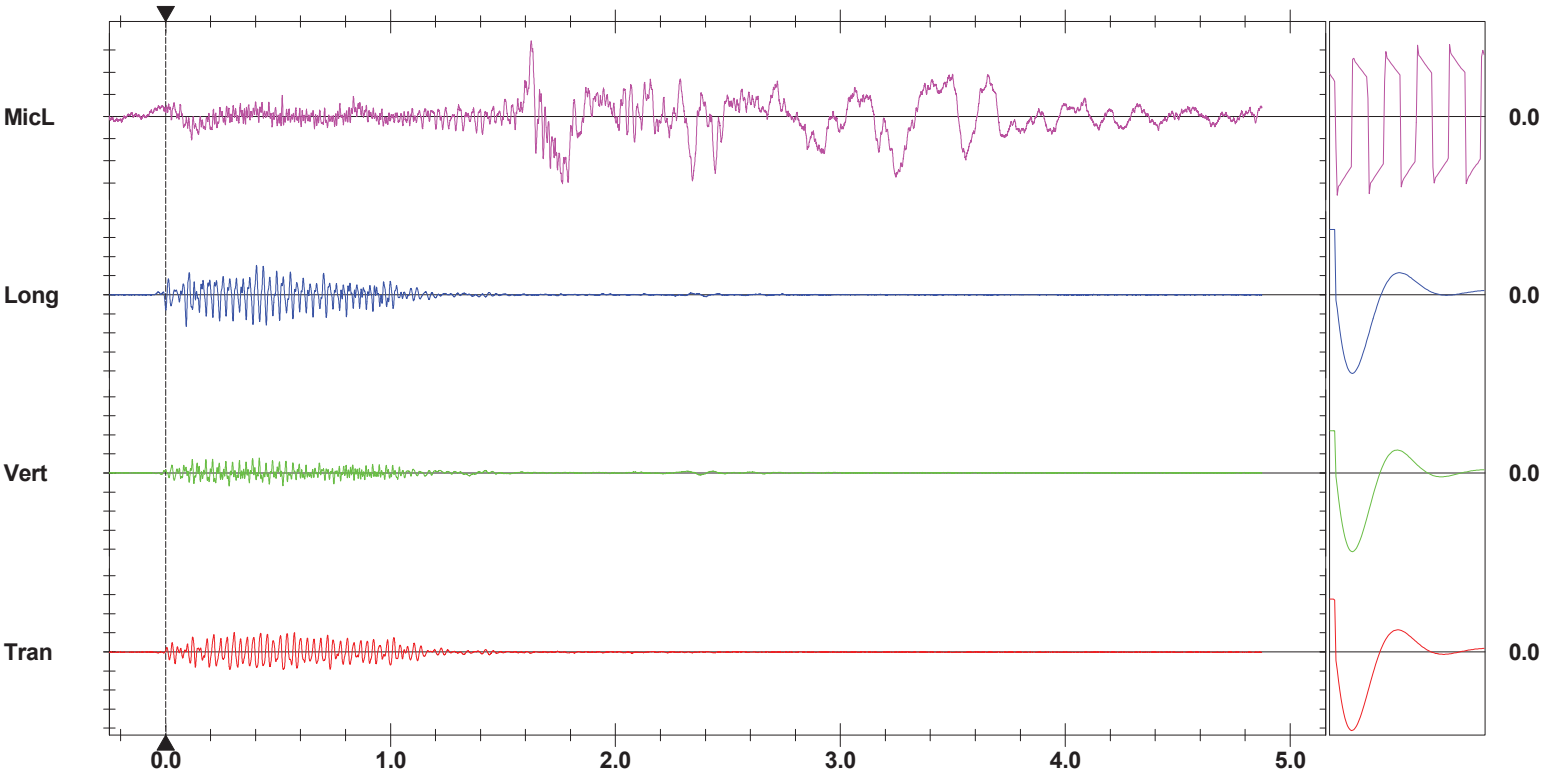
Microphone	Linear Weighting
PSPL	104.6 dB(L) at 1.625 sec
ZC Freq	5.9 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 1484 mv)

	Tran	Vert	Long	
PPV	2.018	1.576	3.334	mm/s
ZC Freq	41	60	43	Hz
Time (Rel. to Trig)	0.572	0.417	0.091	sec
Peak Acceleration	0.064	0.077	0.145	g
Peak Displacement	0.011	0.005	0.013	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.5	3.4	3.6	

Peak Vector Sum 3.595 mm/s at 0.388 sec

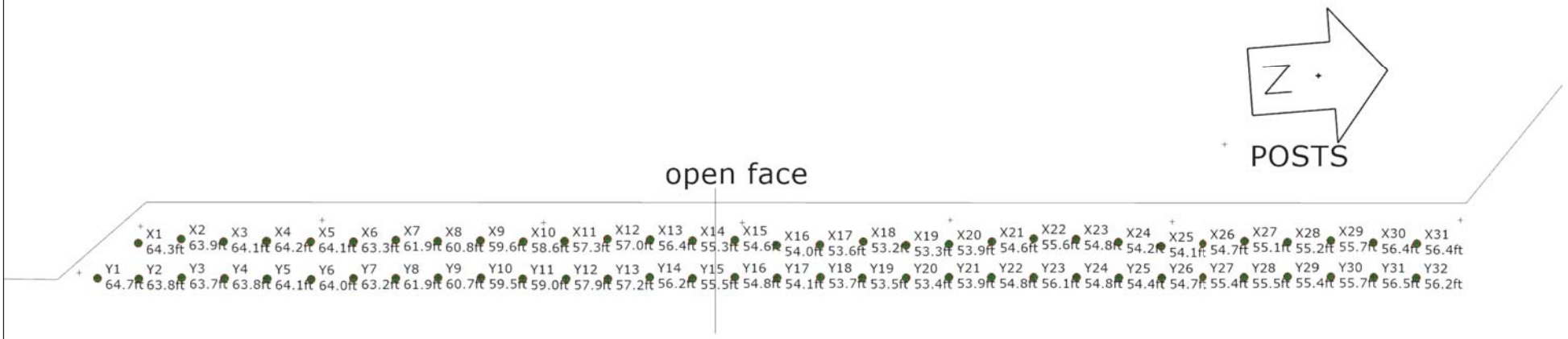
USBM RI8507 And OSMRE





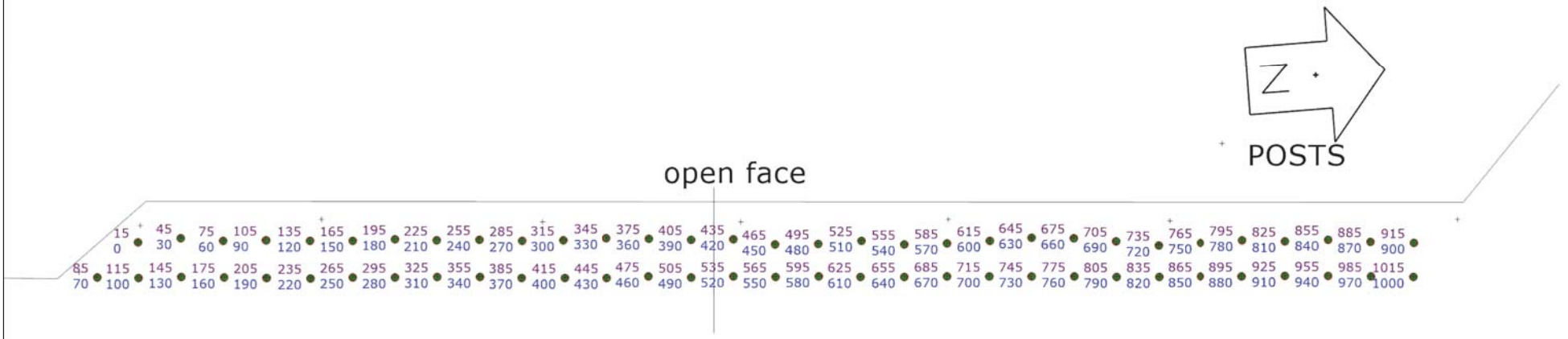
Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 1.000 pa.(L)/div Sensor Check
Trigger = ▶----------◀

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 63	Hole angle: 0.0°
Total drilled: 3628.0ft			



Not to scale

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 63	Hole angle: 0.0°
Total drilled: 3628.0ft			



ORICA

Not to scale

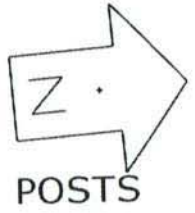
SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 63	Hole angle: 0.0°
Total drilled: 3628.0ft			

Load Sheet
85 Kg / Top Deck
75 Kg / Bottom Deck

open face



Package 55 77 83 83 75 67 66 63 62 75 58 52 38 36 43 48 41 35 40 51 61 61 18 46 54 59 51 56 58 53 60
55 85 82 73 75 64 76 65 58 56 61 75 61 47 64 48 47 48 52 53 59 57 69 55 75 70 62 53 57 59 53 57

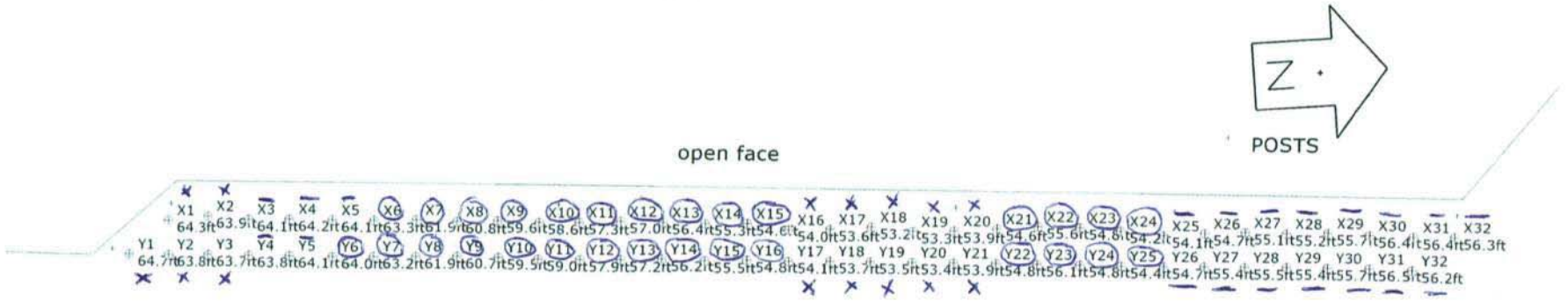
ORICA

Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 64	Hole angle: 0.0°
Total drilled: 3684.3ft			



9MID022 Design Fnl - 4" Blast Hole 12x10 9x10 268 266.5 and 250 + .6 SUB ELEV
DRILLER NAME:_____

DRILL TO DEPTH OR SHALE + 2 FEET

ORICA

Scale 1:500

SHOTPlus™ Professional 5.7.4.4		10/1/2019
Mine	Burlington	
Location	MID TO NORTH WALL DESIGN	
Title/author	9MID022 Design Fnl	
Filename		

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-023
P.O. #:		Orica Order #:	2550103
Blast Date:	2019-10-31	Blast Time:	10:56 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40370 °N Latitude (Centre of Blast) 79.88137 °W Longitude (Centre of Blast)

Wind from the: E at 5 kph Temperature: 6 to 10 °C

Clear:		Rain:	x	Overcast:	x
Partly Cloudy:		Snow:		Inversion:	

Ceiling: 18,000 ft

Tonnes Blasted:	19,709 te	7,580 m3
Total tonnes per day:	19,709 te	NB60-18 Rate Code
Total Holes Loaded:	41 holes	
… including:	2 Dead Holes	
… and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	2 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	21 front row	
- Pattern (Back Row) -		
Burden:	9.0 ft avg	
Spacing:	10.0 ft avg	
# Holes:	20 back row	
Bench Height:	65.1 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	67.1 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Back Row:	ft avg	
# Decks:	41 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Back Row:	7.0 ft avg	
Material used:	3/4" Clear	
- Charge Length -		
Front Row:	56.1 ft avg	
Back Row:	60.1 ft avg	
- Charge Weight -		
Front Row:	163.7 kg/hole	
Back Row:	175.4 kg/hole	
Max. per delay:	kg/delay	
SD () Equation:	13.9 kg/delay	
Total kg Loaded:	7,563 kg	
Rock Density:	2.60 g/cc = te/m^3	

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blastec

- Drilling Information -

			Angle from Vertical		# Holes		Nominal Bit Diameter:
Primary Bit diam:	101.6	mm	0 °	# Holes:	41	=	2,753.0 ft (4 " diam)
Secondary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:		mm	°	# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,440	25,960	7,480

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	0	50

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	41	13.9
PENTEX DUO (OR EQUIVALENT)	0.45	41	18.6

total explosives weight in Blast (kg): 7,563

Pkgd Prod (50 kg) % of Total kg: 0.7%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 15M			41
UNITRONIC 600 25M			82

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	5.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

- Powder Factor -

1.682 lb/yd^3	Yield PF:	0.384 kg/te (actual)
1.247 lb/yd^3	Front row:	0.284 kg/te (theoretical)
1.781 lb/yd^3	Main Body:	0.406 kg/te (theoretical)
1.514 lb/yd^3	"KPI" PF:	0.345 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Unitronics were used instead of 25ms Excel MS in bottom deck due to an error on Orica.

Blast Report

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-023
P.O. #:		Orica Order #:	2550103
Blast Date:	2019-10-31	Blast Time:	10:56 AM

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	**43.40370**	**79.88136**	0.757537	1.394193
Front Row Corner	43.40345	79.88143	0.757533	1.394194
Back Row Corner	43.40395	79.88133	0.757542	1.394192
Average (Centre of Blast)	43.40370	79.88137	0.757537	1.394193

1st

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast)	**296.0**	m				
Post Blast Data: ppV:	**8.6**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**20.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**115.7**	dB	Trigger set at:	**115**	dB	

2450 #2 Sideroad, Burlington, On

2nd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40614	79.87455	0.757580	1.394074
2nd Reading				
Average	43.40614	79.87455	0.757580	1.394074

Distance **(2nd Seis. From Centre of Blast)**	**615.0**	m				
Post Blast Data: ppV:	**3.3**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**28.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**Set to not trigger**	dB	Trigger set at:	**n/a**	dB	

2582 #2 Sideroad, Burlington, On

3rd

Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40466	79.88098	0.757554	1.394186
2nd Reading				
Average	43.40466	79.88098	0.757554	1.394186

Distance (3rd Seis. From Centre of Blast)	**111.8**	m				
Post Blast Data: ppV:	**36.2**	mm/s	Trigger set at:	**2.0**	mm/s	
frequency:	**26.0**	Hz	V / T / L :	**?**	(Vertical, Transverse or Longitudinal)	
air overpressure:	**130.5**	dB	Trigger set at:	**115**	dB	

Gas Line

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(111.8)^2}{30^2} \text{ kg}$$

$$= \frac{12{,}499}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 14 kg

jim bray

Orica
Blaster-in-charge: *Mike derkinderen*

Signature required, indicating that
Blast Report is Complete & Accurate.

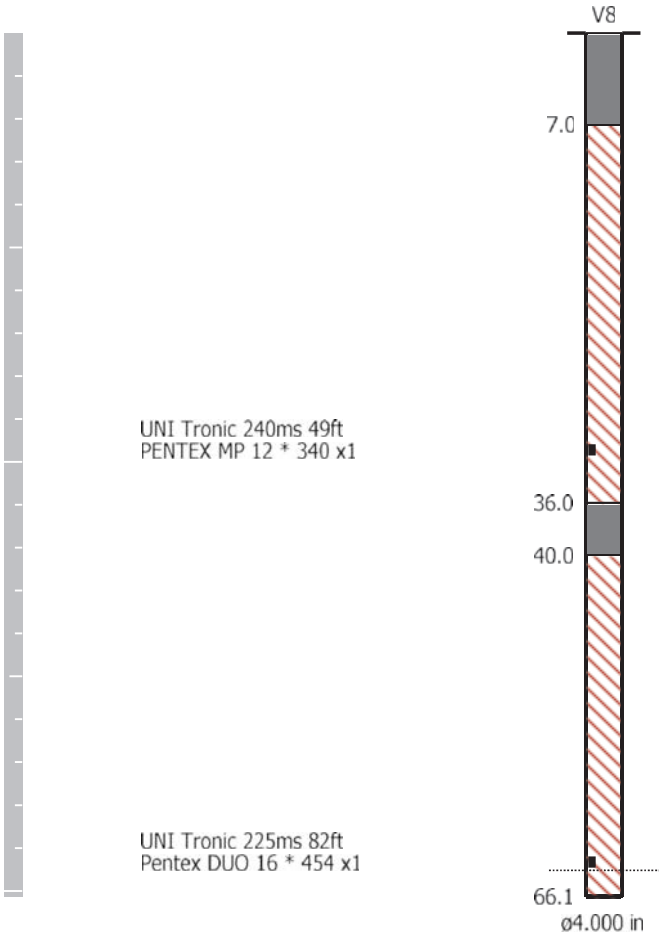
Blast Design

Nelson Aggregate

Quarry:	Burlington	Blast Number:	19-023
P.O. #:		Orica Order #:	2550103
Blast Date:	10/31/2019		

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge: Mike der Kinderen

Quarry Manager: Nich Heap

Signature required, indicating sign off on Blast Design.

Event Report

Date/Time Vert at 10:56:06 October 30, 2019
Trigger Source Geo: 1.500 mm/s
Range Geo: 254.0 mm/s
Record Time 1.0 sec at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.1 Volts
Unit Calibration December 4, 2018 by Instantel
File Name __TEMP.EVT

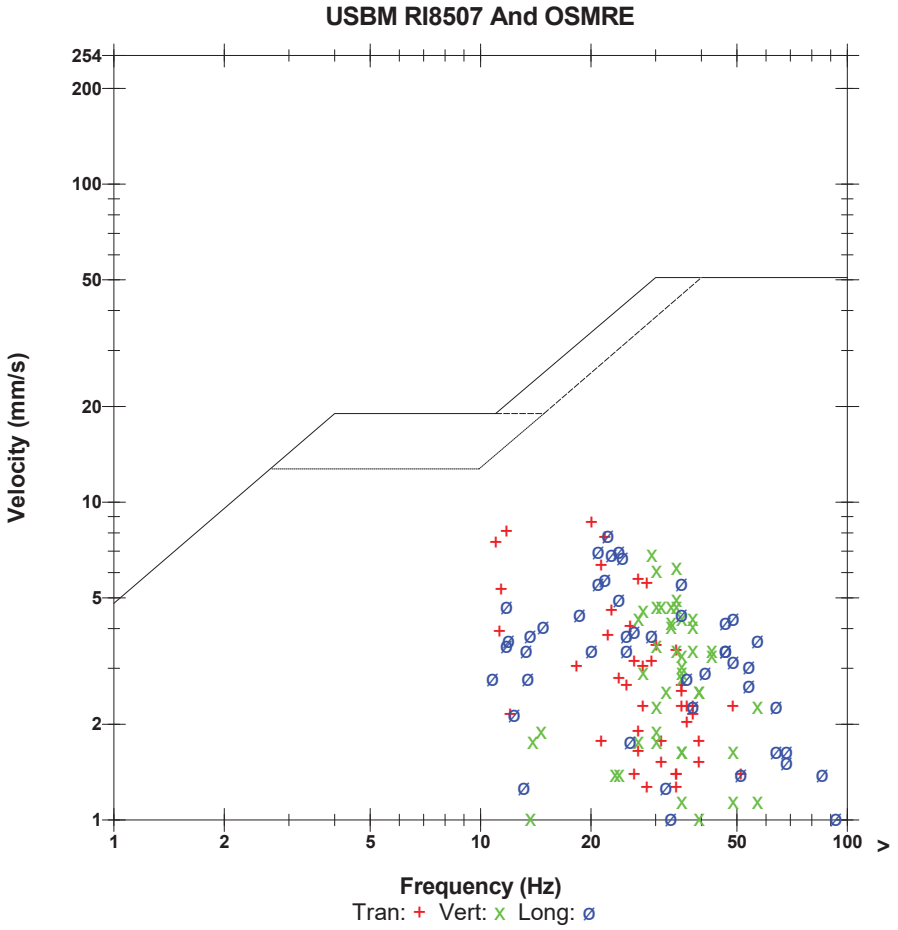
Notes
Location: 2450 #2 Road, Burlington, On
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

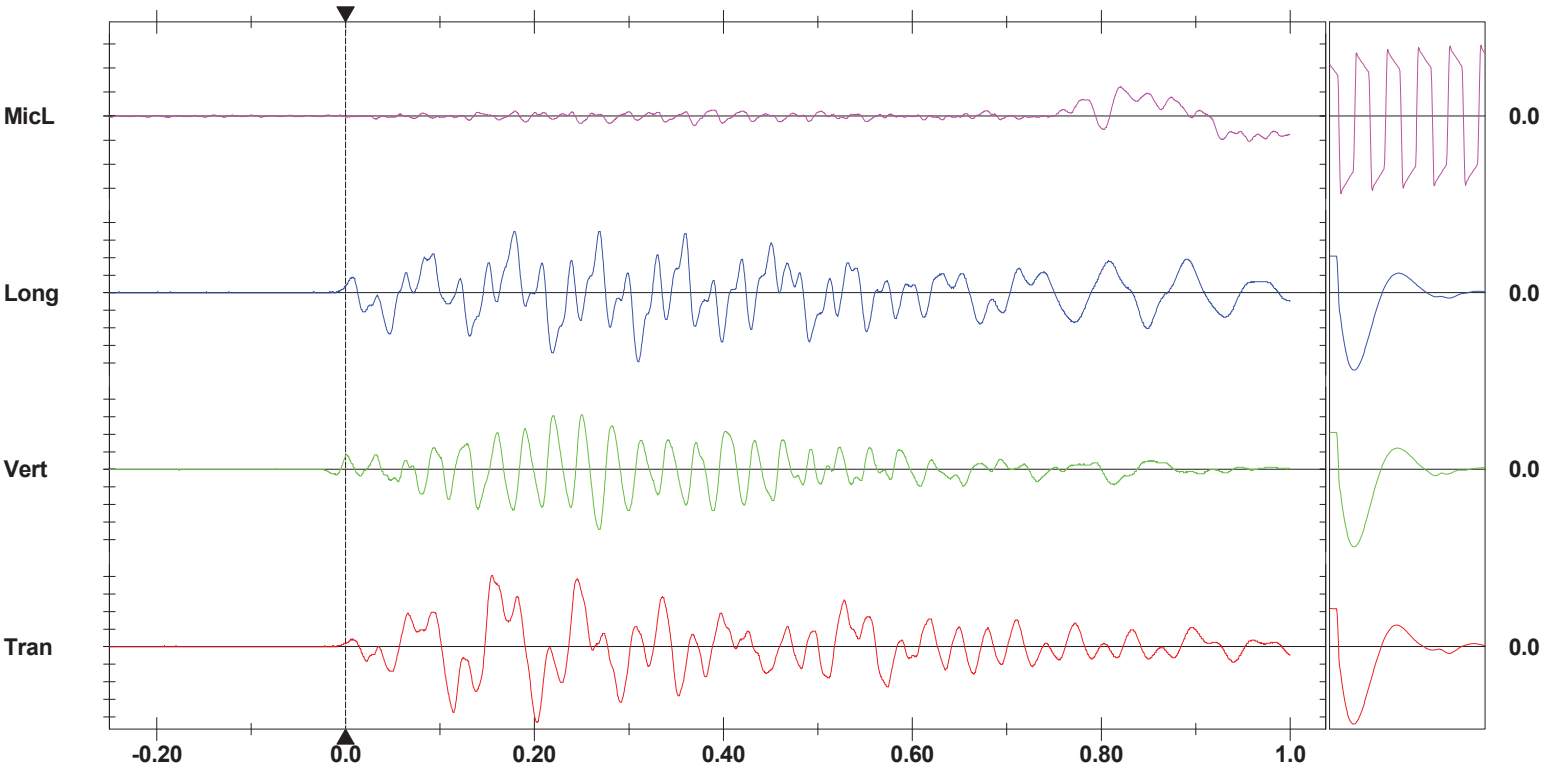
Extended Notes
Sand Bagged

Microphone Linear Weighting
PSPL 115.7 dB(L) at 0.821 sec
ZC Freq 6.0 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 612 mv)

	Tran	Vert	Long	
PPV	8.636	6.858	7.874	mm/s
ZC Freq	20	29	22	Hz
Time (Rel. to Trig)	0.202	0.268	0.310	sec
Peak Acceleration	0.159	0.159	0.186	g
Peak Displacement	0.102	0.037	0.048	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.2	Hz
Overswing Ratio	3.7	3.7	4.0	

Peak Vector Sum 9.809 mm/s at 0.269 sec





Time Scale: 0.10 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Event Report

Date/Time Long at 10:56:07 October 30, 2019
Trigger Source Geo: 1.500 mm/s
Range Geo: 254.0 mm/s
Record Time 4.756 sec (Auto=4Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington 2582.MMB

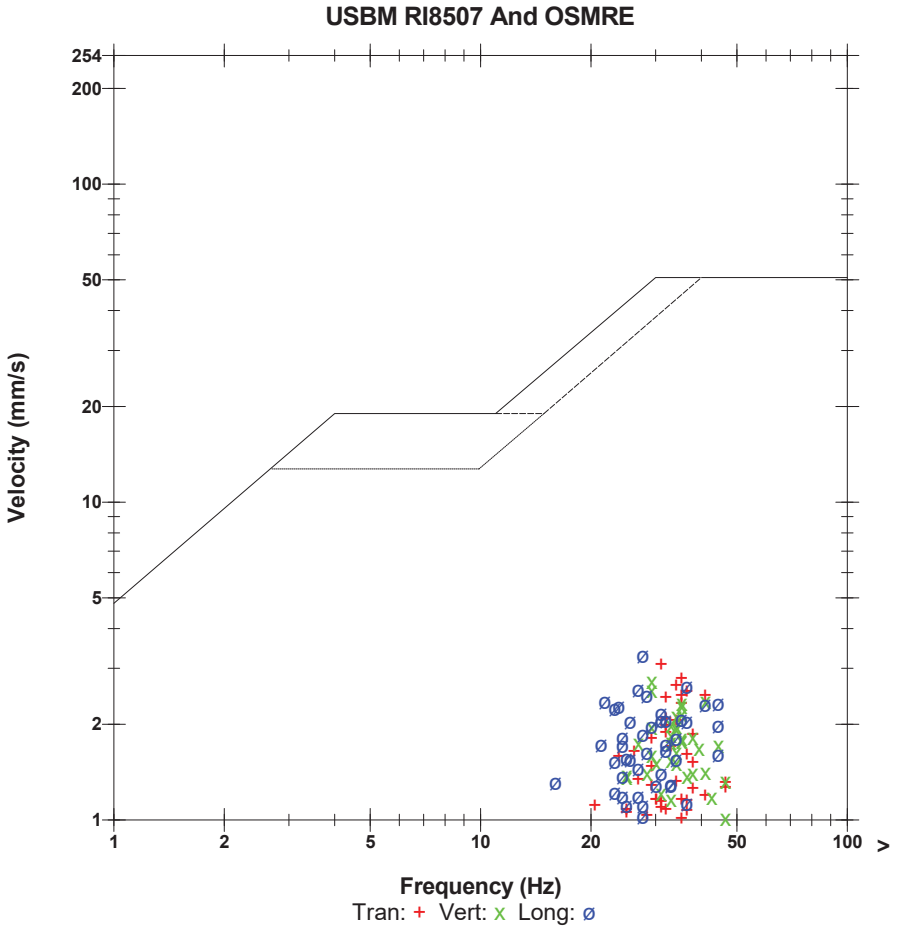
Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.8 Volts
Unit Calibration January 15, 2019 by Instantel
File Name UM6857_20191030105607.IDFW

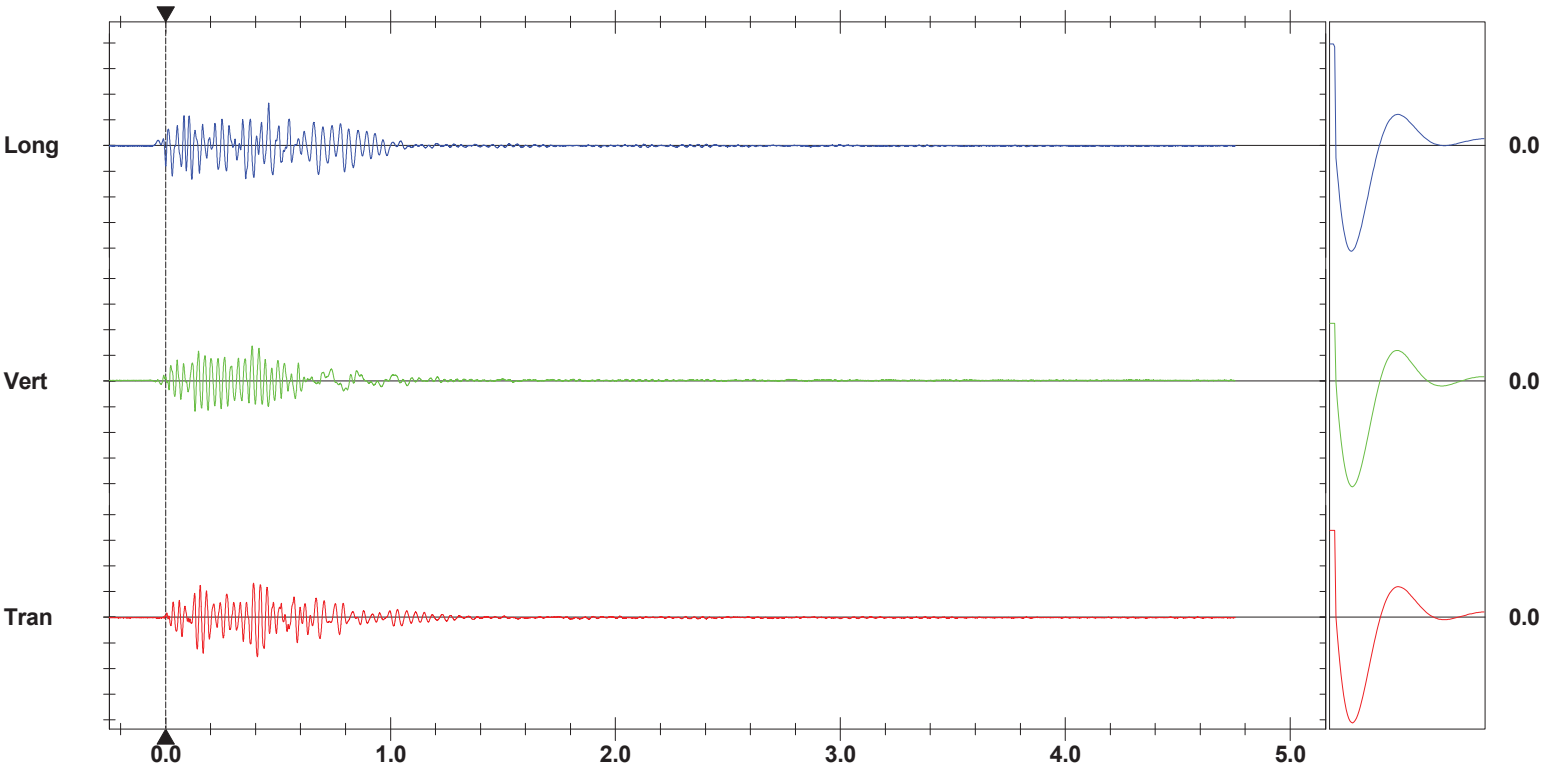
Notes
Location: 2582 #2 Sideroad, Mount Nemo,On
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Monitoring Vibration and Airblast

Extended Notes
Sand Bagged
N43.40614,W-79.87455

	Tran	Vert	Long	
PPV	3.090	2.743	3.302	mm/s
ZC Freq	31	29	28	Hz
Time (Rel. to Trig)	0.408	0.384	0.458	sec
Peak Acceleration	0.081	0.114	0.102	g
Peak Displacement	0.016	0.017	0.016	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.5	Hz
Overswing Ratio	3.5	3.4	3.4	

Peak Vector Sum 3.783 mm/s at 0.458 sec





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div
Trigger = ▶----------◀

Sensor Check

Event Report

Date/Time	Tran at 10:56:05 October 30, 2019
Trigger Source	Geo: 10.000 mm/s
Range	Geo: 254.0 mm/s
Record Time	3.75 sec (Auto=3Sec) at 1024 sps

Serial Number	BE19461 V 10.72-8.17 MiniMate Plus
Battery Level	6.3 Volts
Unit Calibration	August 31, 2018 by Instantel
File Name	__TEMP.EVT

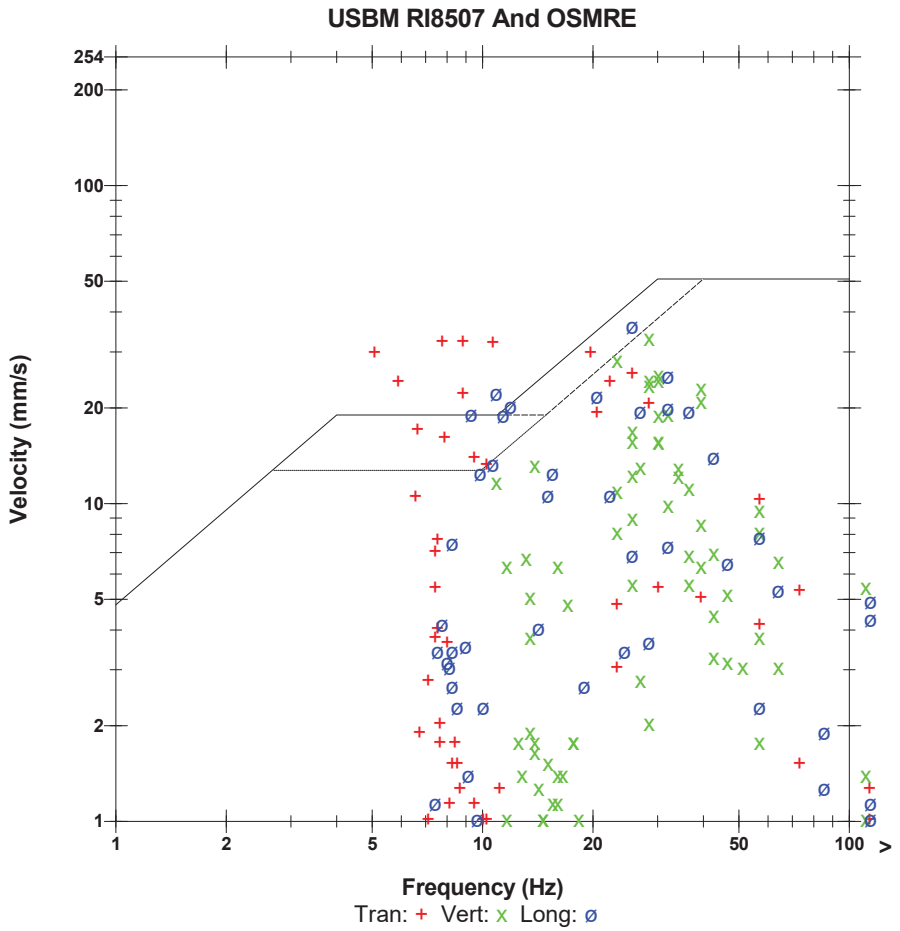
Notes
Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

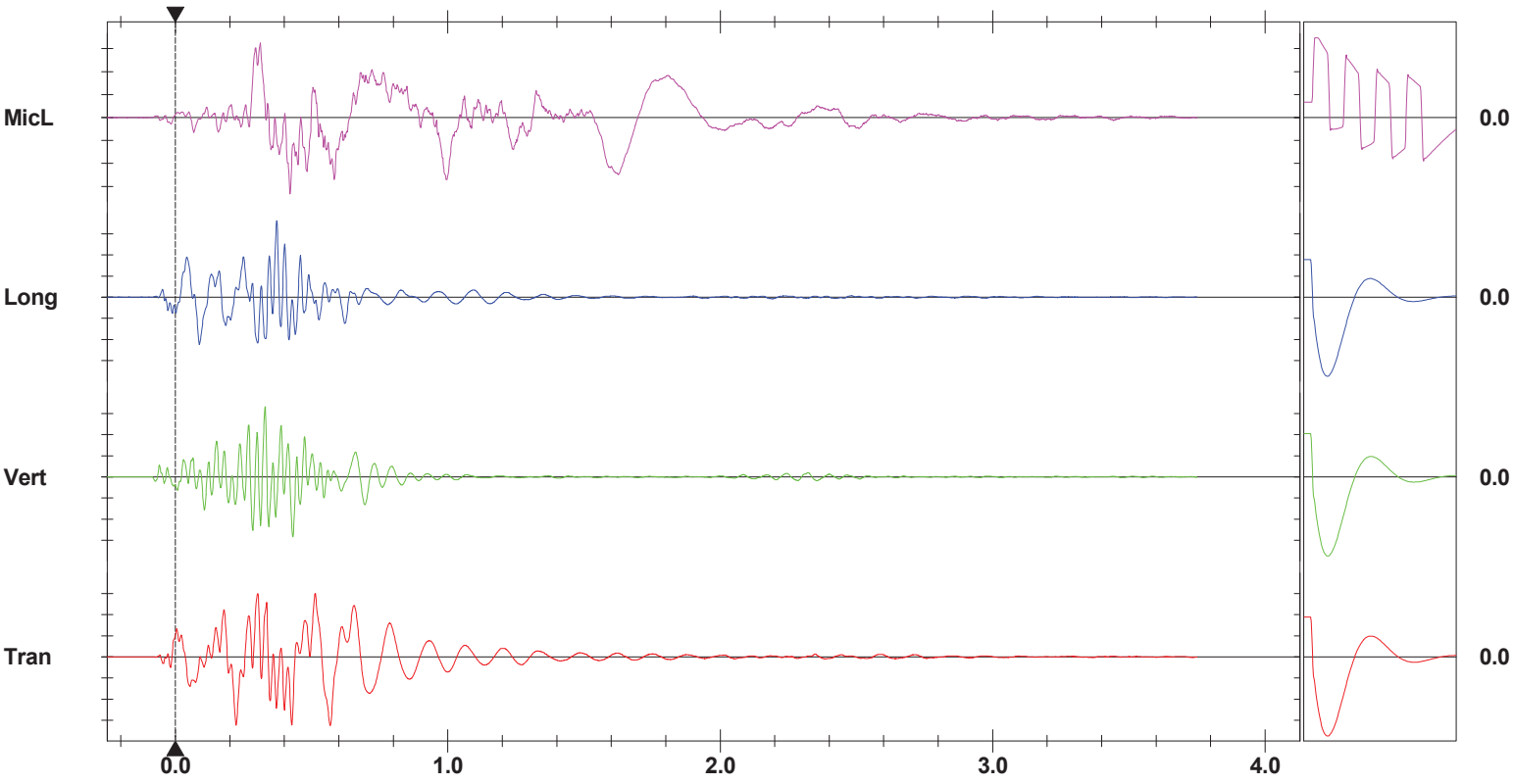
Extended Notes
Sand Bagged at gas line

Microphone	Linear Weighting
PSPL	130.5 dB(L) at 0.421 sec
ZC Freq	9.0 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 658 mv)

	Tran	Vert	Long	
PPV	32.51	33.27	36.19	mm/s
ZC Freq	8.8	28	26	Hz
Time (Rel. to Trig)	0.568	0.329	0.372	sec
Peak Acceleration	0.610	0.848	0.623	g
Peak Displacement	0.579	0.182	0.257	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.3	7.4	Hz
Overswing Ratio	3.8	3.9	4.3	

Peak Vector Sum 45.51 mm/s at 0.371 sec





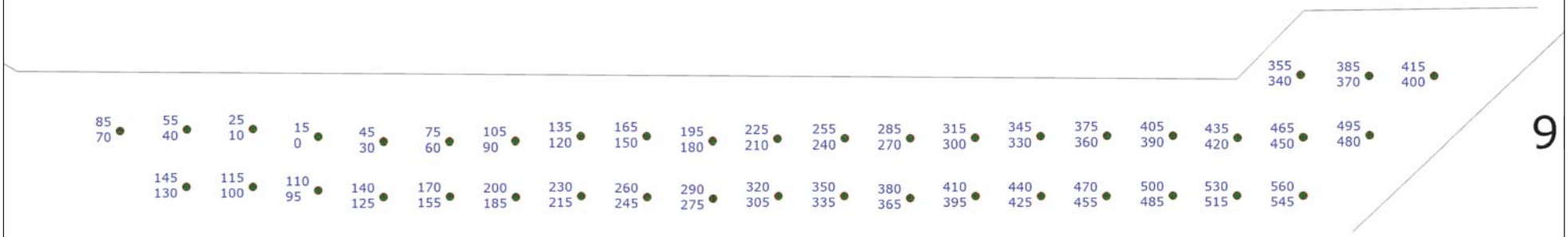
Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 10.000 mm/s/div Mic: 20.00 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 41	Hole angle: 0.0°
Total drilled: 2774.7ft			

Open Face



9MID023 Final
4" Blasthole
12 X 10, 9 X 10 Pattern
250 + 0.6m Subdrill

DRILL TO DEPTH OR SHALE + 2 FEET

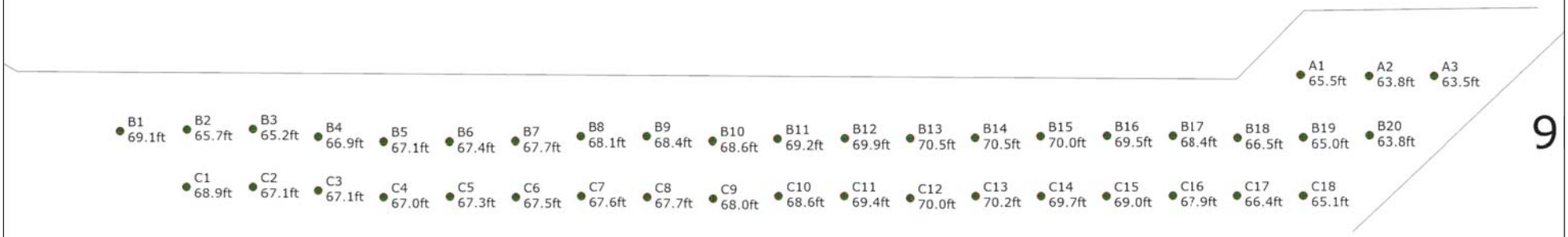
ORICA

Not to scale

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 41	Hole angle: 0.0°
Total drilled: 2774.7ft			

Open Face



9

9MID023 Final
4" Blasthole
12 X 10, 9 X 10 Pattern
250 + 0.6m Subdrill

DRILL TO DEPTH OR SHALE + 2 FEET

ORICA

Not to scale

SHOTPlus Plan

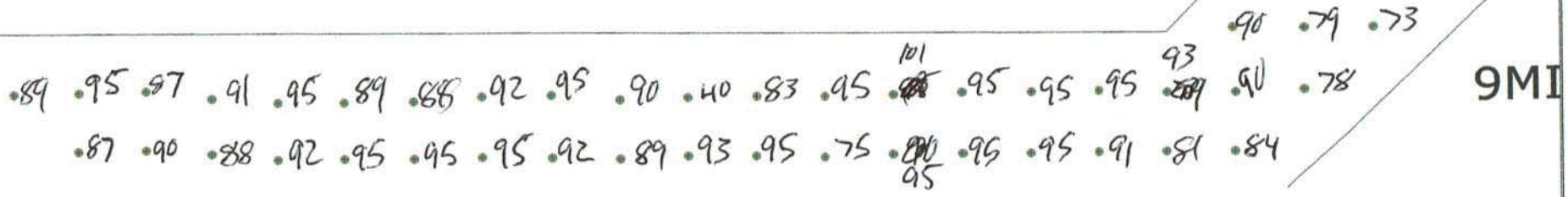
Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 41	Hole angle: 0.0°
Total drilled: 2774.7ft			

Open Face

Load Sheet

95Kg/ Delay



9MI

9MID023 Final

4" Blasthole

12 X 10, 9 X 10 Pattern

250 + 0.6m Subdrill

DRILL TO DEPTH OR SHALE + 2 FEET

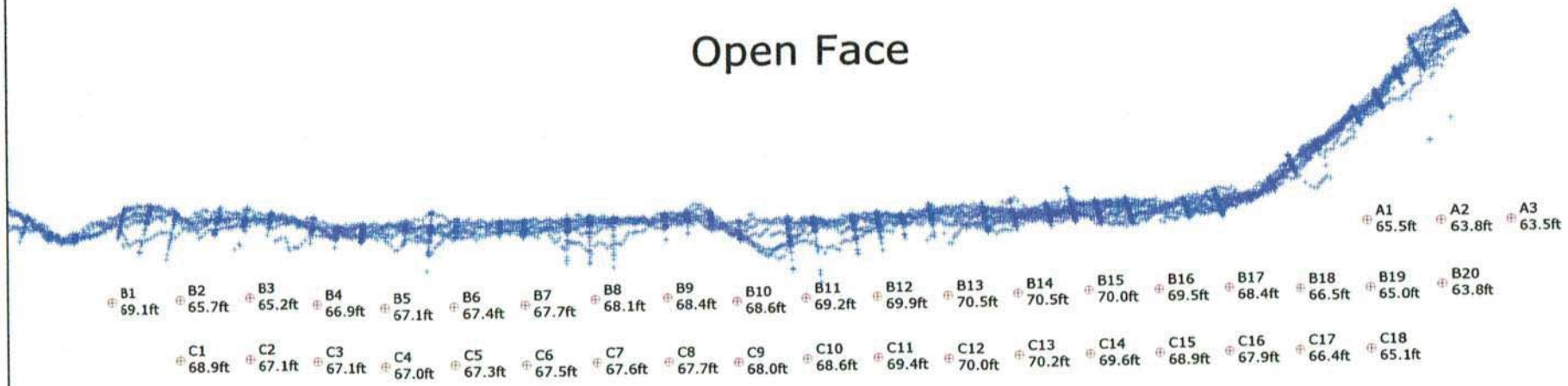
ORICA

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 41	Hole angle: 0.0°
Total drilled: 2774.6ft			



9MID023 Final
4" Blasthole
12 X 10, 9 X 10 Pattern
250.0 + 0.6m Subdrill

DRILL TO DEPTH OR SHALE + 2 FEET

ORICA

Not to scale

Appendix D

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Robert J. Cyr, P. Eng.

Principal, Explotech Engineering Ltd.

EDUCATION

Bachelor of Applied Science,
Civil Engineering, Queen's University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Association of Professional Engineers and Geoscientists of BC (APEG)
Association of Professional Engineers, Geologists and Geophysicists of Alberta
Association of Professional Engineers and Geoscientists of New Brunswick
Association of Professional Engineers of Nova Scotia
Association of Professional Engineers and Geoscientists Manitoba
Professional Engineers and Geoscientists Newfoundland and Labrador
Northwest Territories and Nunavut Association of Professional Engineers (NAPEG)
International Society of Explosives Engineers (ISEE)
Ontario Stone Sand & Gravel Association (OSSGA)
Surface Blaster Ontario Licence 450109

SUMMARY OF EXPERIENCE

Over thirty five years experience in many facets of the construction and mining industry has provided the expertise and experience required to efficiently and accurately address a comprehensive range of engineering and construction conditions. Sound technical training is reinforced by formidable practical experience providing the tools necessary for accurate, comprehensive analysis and application of feasible solutions. Recent focus on vibration analysis, blast monitoring, blast design, damage complaint investigation for explosives consumers and specialized consulting to various consulting engineering firms.

PROFESSIONAL RECORD

2001 – Present	-Principal, Explotech Engineering Ltd.
1996 – 2001	-Leo Alarie & Sons Limited - Project Engineer/Manager
1993 – 1996	-Rideau Oxford Developments Inc. – Project Manager
1982 – 1993:	-Alphe Cyr Ltd. – Project Coordinator/Manager

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Mitch Malcomson, P.Eng.

Consulting Engineer, Explotech Engineering Ltd.

EDUCATION

Bachelor of Engineering,
Civil Engineering with Concentration in Business Management,
Carleton University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Association of Professional Engineers and Geoscientists of BC (APEG)
International Society of Explosives Engineers (ISEE)
Ontario Stone Sand and Gravel Association (OSSGA)

SUMMARY OF EXPERIENCE

A Consulting Engineer and Project Manager for Explotech Engineering Ltd., Mitch holds a Bachelor of Engineering degree from Carleton University in Civil Engineering with a Concentration in Business Management. Mitch has strong analytical, technical, business and leadership skills. As a Project Manager, Mitch is responsible for operational strategies, scheduling and contract procurement. As a Consulting Engineer, the technical responsibilities include detailed blast designs, blast investigations and reviews, implementation of vibration monitoring programs, development of monitoring equipment/ technologies and building assessments for construction and the drilling and blasting portions of mining, quarrying and construction projects across Canada.

PROFESSIONAL RECORD

2008 – Present - Consulting Engineer / Project Manager, Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Mark Morelli, B.Eng.

Explotech Engineering Ltd.

EDUCATION

Bachelor of Engineering,
Civil Engineering, Carleton University

PROFESSIONAL AFFILIATIONS

International Society of Explosives Engineers (ISEE)

SUMMARY OF EXPERIENCE

A technician working for Explotech Engineering Ltd., Mark holds a Bachelor of Engineering degree in Civil Engineering and has strong technical, leadership, interpersonal, communication, and presentation skills. Recent focus on blast monitoring, data management, scheduling, job estimations, vibration analysis, damage complaint investigation and attenuation anlysis.

PROFESSIONAL RECORD

2006 – Present - Technician, Explotech Engineering Ltd.

2003 – 2004 - Labourer, Hydracorp Canada Ltd.

2002 – 2003 - Labourer, Quad Construction

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Michael Tobin, B.A.Sc.

Explotech Engineering Ltd.

EDUCATION

Bachelor of Applied Science,
Geological Engineering, Queen's University

PROFESSIONAL AFFILIATIONS

International Society of Explosives Engineers (ISEE)

SUMMARY OF EXPERIENCE

A technician working for Explotech Engineering Ltd., Michael holds a Bachelor of Applied Science degree from Queen's University in Geological Engineering. Michael has strong analytical, technical, and interpersonal skills. Recent projects have focused on blast monitoring, vibration analysis, job estimation, damage complaint investigation and equipment maintenance and repair.

PROFESSIONAL RECORD

2017 – Present - Technician, Explotech Engineering Ltd.

Appendix E

EXPLOTECH

Blasting Terminology

ANFO:	Ammonium Nitrate and Fuel Oil – explosive product
ANFO WR:	Water resistant ANFO
Blast Pattern:	Array of blast holes
Body hole:	Those blast holes behind the first row of holes (Face Holes)
Burden:	Distance between the blast hole and a free face
Column:	That portion of the blast hole above the required grade
Column Load:	The portion of the explosive loaded above grade
Collar:	That portion of the blast hole above the explosive column, filled with inert material, preferably clean crushed stone
Face Hole:	The blast holes nearest the free face
Overpressure:	A compressional wave in air caused by the direct action of the unconfined explosive or the direct action of confining material subjected to explosive loading.
Peak Particle Velocity:	The rate of change of amplitude, usually measured in mm/s or in/s. This is the velocity or excitation of the particles in the ground resulting from vibratory motion.
Scaled distance:	An equation relating separation distance between a blast and receptor to the energy (usually expressed as explosive weight) released at any given instant in time.
Sensitive Receptor:	Sensitive land use may include recreational uses which are deemed by the municipality or provincial agency to be sensitive; and/or any building or associated amenity area (i.e. may be indoor or outdoor space) which is not directly associated with the industrial use, where humans or the natural environment may be adversely affected by emissions generated by the operation of a nearby industrial facility. For example, the building or amenity area may be associated with residences, senior citizen homes, schools,

	day care facilities, hospitals, churches and other similar institutional uses, or campgrounds.
Spacing:	Distance between blast holes
Stemming:	Inert material, preferably clean crushed stone applied into the blast hole from the surface of the rock to the surface of the explosive in the blast hole.
Sub-grade:	That portion of the blast hole drilled band loaded below the required grade
Toe Load:	The portion of explosive loaded below grade

EXPLOTECH

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Appendix F

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Fax 905-567-6561

REPORT ON

BLASTING IMPACT ASSESSMENT
PROPOSED NELSON AGGREGATE
NELSON QUARRY EXTENSION

Submitted to:

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ont. L7R 4L8

DISTRIBUTION:

20 Copies - Nelson Aggregate Co.
2 Copies - Golder Associates Ltd.

April 2006

021-1238

EXECUTIVE SUMMARY

Blasting operations within the proposed extension of the Nelson quarry may be readily carried out in compliance with existing provincial environmental guideline limits with respect to ground and air vibrations. These effects are subject to recommended limits of 12.5 mm/s and 128 dBL respectively, as established by the Ontario Ministry of the Environment and outlined in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, for operations where monitoring of these effects is carried out as a matter of routine.

Ground and air vibration attenuation characteristics were monitored and assessed from a number of routine production blasts within the existing Nelson quarry. The results indicate that the majority of the proposed extension may be excavated using the blast parameters currently being used in the existing quarry. These would include reducing the borehole diameter, reducing the bench height and reducing the explosive weight per delay period. The Nelson quarry would continue monitoring all blasts during extraction within the proposed extension area. The blasting operations within the proposed extension would have no impact on the integrity of adjacent water wells.

By ensuring that the ground and air vibration levels produced during blasting operations at the Nelson quarry continue to remain within the recommended provincial guideline limits, there would not be any noticeable cumulative effect on adjacent structures associated with the blasting operations within the proposed extension.

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1.0 INTRODUCTION

Golder Associates was retained by Nelson Aggregate Co. to carry out an impact assessment of the environmental effects from future blasting operations within the proposed extension of the existing licensed area of the Nelson Quarry Company quarry. The proposed extension would be located immediately south of No. 2 Sideroad on Part Lots 17 and 18, Concession 2 in the City of Burlington. The impact assessment specifically addresses whether the applicable Ontario Ministry of Environment guidelines with respect to ground and air vibration effects could be met at the residential properties closest to the proposed extension.

The investigation included monitoring a number of regularly scheduled production blasts at various receptor points around the blast site to assess site-specific ground and air vibration decay characteristics.

This report addresses the following topics:

- reviews existing provincial and federal guidelines for the assessment of environmental impacts from blasting,
- provides recommendations for the continued control of ground and air vibration effects,
- evaluates the potential impact of the blasting operations on bedrock strata and adjacent water wells,
- evaluates the long term impact of the blasting operations on surrounding structures.

2.0 EXISTING CONDITIONS

2.1 Site Description

The existing licensed Nelson Quarry Co. quarry (Nelson) is situated immediately north of No. 2 Sideroad and south of Colling Road between Guelph Line and Cedar Springs Road in the City of Burlington, Ontario in the Region of Halton (see Figure 1). The proposed extension area would encompass an area of approximately 82.3 Hectares immediately south of the existing quarry and No. 2 Sideroad, as seen in Figure 2.

As shown in Figures 2 and 4, the closest residential properties to the proposed extension consist of those residences to the east and west on the south side of No. 2 Sideroad. Compared to the existing quarry location, the proposed extension is relatively remote from the existing neighbouring properties. The closest residential receptors have been identified as the residences along No. 2 Sideroad (see Appendix B). The topography of the area generally consists of gently rolling hills.

2.2 Quarry Blasting Operations

The Nelson quarry currently operates a single bench which varies in height from approximately 19 to 26 m. Typical blast design details for the existing quarry are given in Table 1 while common quarry blasting terms and procedures are illustrated in Figure 3.

All blasting at the Nelson quarry is monitored for ground and air vibration effects. Monitoring is routinely being carried out at three locations along the south side of No. 2 Sideroad and occasionally within Mount Nemo Court, east of Guelph Line.

Blasting procedures within the proposed extension would be carried out in a manner similar to those currently being carried out for the existing Nelson quarry, as shown in Table 1.

3.0 PROPOSED EXTRACTION OF EXTENSION AREA

The proposed sequence of extraction for the extension is illustrated in Figure 4. Extraction within the proposed extension area would commence with the crossing of No. 2 Sideroad west of the existing office. Extraction of Phase 1 would see an approximately 100 m wide working face advanced in a westerly direction along the north side of the proposed extension, as shown in Figure 4. Phases 2 and 3 would see the entire west side of the extension extracted in a southerly direction before proceeding east along the south boundary.

Extraction of Phase 4 would be carried out in a northerly direction which would complete extraction of the west half of the proposed extension. Phases 5a and 5b would be carried out in an easterly direction in the southeast corner of the extension while the remainder of the property would be extracted as Phase 6 in a northerly direction, as seen in Figure 4.

4.0 IMPACT IDENTIFICATION

The environmental effects most often associated with blasting operations are ground vibrations and air concussion.

The intensity of ground vibrations, which is an elastic effect measured in units of peak particle velocity, is defined as the speed of excitation of particles within the ground resulting from vibratory motion. For the purposes of this report, peak particle velocity is measured in mm/s.

While ground vibration is an elastic effect, one must also consider the plastic or non-elastic effect produced locally by each detonation when assessing the effects on the bedrock strata and local water wells. The detonation of an explosive produces a very rapid and dramatic increase in volume due to the conversion of the explosive from a solid to a gaseous state. When this occurs within the confines of a borehole it has the following effect:

- The bedrock in the area immediately adjacent to the explosive product is crushed.
- As the energy from the detonation radiates outward from the borehole, the bedrock between the borehole and quarried face becomes fragmented and is displaced while the bedrock behind the borehole is fractured.
- Energy not used in the fracturing and displacement of the bedrock dissipates in the form of ground vibrations, sound and airblast. This energy attenuates rapidly from the blast site due to geometric spreading and natural damping.

Air concussion, or air vibrations, is a pressure wave traveling through the air produced by the direct action of the explosive on air or the indirect action of a confining material subjected to explosive loading. Air vibrations from surface blasting operations consist primarily of acoustic energy below 20 Hz, where human hearing is less acute (Siskind et al., 1980), while noise is that portion of the spectrum of the air vibration lying within the audible range from 20 to 2000 Hz. It is the lower frequency component (below 20 Hz) of air concussion, that which is less audible, that is of interest as it is often the source of secondary rattling and shaking within a structure. For the purposes of this report, air vibration is measured as decibels in the Linear or Unweighted mode (dBL). This differs from noise (above 20 Hz) which is measured in dBA.

Both ground and air vibration effects produced at private structures adjacent to surface or underground mining operations are subject to guidelines contained in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, dated August, 1978, published by the Ontario Ministry of Environment. Under conditions where monitoring of the blasting operations is routinely carried out, as it is at the Nelson Quarry, the recommended ground and air vibration limitations at the nearest private structure would be 12.5 mm/s and 128 dBL respectively. A copy of Publication NPC 119 is reproduced in Appendix A.

5.0 QUARRY BLAST MONITORING

As part of this study, peak ground and air vibration levels were monitored during several typical quarry production blasts in the existing quarry at progressively increasing distances from the blast site. The blasts occurred both on the south and east faces of the quarry. Instrumentation consisted of Instantel DS-077 Minimates, Minimate Pluses and DS-477 Blastmates. These instruments measure and record ground vibration velocities in each of three orthogonal directions, as well as simultaneously recording air vibration levels. Instrumentation was generally set up in a line at distances ranging from about 100 to 600 m from the blast site. Specific instrument and blast locations were established using a Garmin GPS electronic navigation aid (NAVAID) to determine accurate distances between the blast and receptors.

5.1 Attenuation Characteristics

The rate at which ground vibrations attenuate or decrease with increased distance from a blast source depends on a variety of conditions, including the type and condition of the bedrock being blasted, depth and composition of the earth covering deposits (soil), and the general topography. Air vibration effects are less affected by these factors, being more influenced by the prevailing weather conditions at the time of the blast.

The following relationships were established from the blast monitoring results.

5.1.1 Ground Vibrations

The ground vibration attenuation characteristics established for the Nelson Quarry is presented in Figure 5 as a plot of the peak particle velocity against the Scaled Distance. Scaled Distance is defined as:

$$\text{Scaled Distance (SD)} = D/\sqrt{W}$$

where D = distance (m) between the blast and receptor
W = maximum weight of explosive (kg) detonated per delay period

As seen in Figure 5 the collection of points defining the rate of decay for the ground vibrations exhibits a degree of scatter that is inherent in all Scaled Distance plots. Factors responsible for these variations include the geologic conditions of the bedrock (type and structure), different wave types, errors in blast initiation timing, differences between types of explosives, degree of confinement, and differences in blast efficiencies.

The equation for the 95% regression line developed in Figure 5 can be expressed as:

$$PPV = 896(SD)^{-1.32}$$

where PPV = Peak Particle Velocity (mm/s)

SD = Scaled Distance ($m/(kg^{0.5})$)

The calculated Scaled Distance for a peak ground vibration level of 12.5 mm/s would equal 25.5 $m/(kg^{0.5})$. The purpose of this equation is not so much to predict what a given vibration level would be at a particular location for a given blast, but to indicate the probability that the peak vibration would fall below the level indicated by the equation for a given distance and maximum explosive weight. The equation is therefore a useful blast design tool in establishing maximum explosive charge weights per delay for various distances from a blast site for a given maximum ground vibration level.

5.1.2 Air Vibrations

Cube root scaling was used in establishing the air vibration decay characteristics as given in the following relationship:

Scaled Distance (SD) = $D/\sqrt[3]{W}$, where D and W are defined as previously described.

Figure 6 shows the Scaled Distance air vibration plot, which exhibits considerably more scatter and has a typically poorer correlation than that seen with the ground vibration results. This is primarily due to variable weather conditions during each blast, which are entirely independent of the blasting operations. Other factors influencing air vibration distribution from a blast include the length of collar and type of stemming material used, differences in explosive types and variations in burden distance.

The 95% regression curve given in Figure 6 can be expressed as:

$$APL = 181(SD)^{-0.0867}$$

where SD = as defined above

APL = air pressure level (dBL)

The calculated Scaled Distance for a peak air vibration level of 128 dBL would equal 53.0 $m/(kg^{0.33})$. The variability in the plot suggests that it is less reliable as a tool for guiding blast design.

Site specific Scaled Distance plots are commonly used as a blast design tool since peak vibration levels can be reasonably predicted at specified distances from a blast site. Based on the 95%

regression equations given in Figures 5 and 6, Table 2 shows the maximum suggested explosive loads for various distances from the blast site based on the provincial guideline limits of 12.5 mm/s and 128 dBL discussed previously. It can be seen that the ground vibration limit of 12.5 mm/s becomes the more restrictive guideline when determining maximum explosive loads beyond a distance of about 225 m for the quarry's blasting operations.

6.0 IMPACT ASSESSMENT

6.1 Compliance with NPC 119

It is evident from the regression equations discussed in Section 5 that the distance between the blast and the receptor and the amount of explosive detonated per delay period are the principal parameters in controlling ground and air vibration effects. The maximum explosive loads given in Table 2 for limiting peak ground and air vibration levels to 12.5 mm/s and 128 dBL respectively, indicate that the provincial guidelines may be complied with for all blasting beyond a distance of about 200 m from adjacent private residential properties. This represents a majority of the proposed extension and is based on a maximum explosive weight per delay of about 60 kg. When blasting approaches to within about 200 m of adjacent private residences, it may become necessary to reduce the maximum explosive weight detonated per delay period within the blast. Any one or combination of the following operations would achieve this:

1. Reducing the borehole diameter with a corresponding reduction in the drill pattern.
2. Introduce additional decked charges within each borehole, as illustrated on Figure 3.
3. Reduce the borehole length (depth) by reducing the bench height.

For example, a reduction in the borehole diameter from 127 mm to 76 mm would effectively reduce the explosive column weight per hole by about 65%. Decking the explosive column could further reduce the explosive column weight by an additional 50%. Additional decking and reductions in bench heights, as identified above, could achieve further reductions in maximum explosive weights.

As it is the intention of the Nelson quarry to continue monitoring all blasting operations, the attenuation curves discussed previously would be used in conjunction with the monitoring data collected at adjacent properties to dictate when changes to the blast procedure become necessary within the proposed extension. Although a reduction in the maximum instantaneous explosive load is anticipated as blasting approaches the residences to the east and west, the ground and air vibration guideline limits contained within NPC 119 would continue to be maintained.

6.2 Repeated Vibration Effects on Structures

Blast vibrations characteristically produce temporary transient strains within the various materials that makeup a residential structure. These strains would typically have durations of no more than one or two seconds for each blast as the vibration passed the structure. In additional to these temporary strains, Table 3 shows the strain levels produced in a household by changes in temperature and humidity (environmental changes), as well as those produced by regular household activities (Dowding, 1985), which occur on a recurring and often frequent basis. These strain levels are compared to equivalent levels of ground vibration produced from blasting

operations. It is evident from Table 3 that routine household activities and environmental changes can at times produce strains within a structure that are well in excess of those produced by blasting.

Several studies have also been carried out to look at the long-term effects of repeated blasting on structures (Stagg et al, 1984, Siskind et al, 1980). These studies concluded that repeated blasting over several decades, producing peak vibration levels well in excess of the provincial guideline limit, were required to cause cosmetic threshold cracking to occur. By ensuring that blasting continues to remain within the provincial guideline limits, there would not be any noticeable cumulative effect associated with the blasting operations within the extension area.

6.3 Effects on Bedrock and Water Wells

As discussed previously, under typical blasting conditions stresses introduced into the bedrock by the explosive detonation and the accompanying gas pressures create and extend fractures within the bedrock around each borehole. Fracture development is usually limited to the equivalent distance of about 20 times the borehole diameter. In the case of the blast procedures expected for the proposed extension, this would equate to about two to three metres for a 114 mm diameter hole. The gas pressures within the hole may extend micro-cracks or existing natural discontinuities within the bedrock, such as joints or bedding planes, beyond this distance.

Studies on crack development within bedrock from blast detonations (Keil et al., 1977) indicate that peak ground vibration levels of 300 to 600 mm/s are required to create micro-cracks or open existing discontinuities. Our own experience within the limestone of Southern Ontario indicates that such values would not be anticipated beyond a distance of about 10 to 20 m from the blast site, depending on such parameters as drill hole diameter and the type of explosive product. It is evident therefore that the creation or extension of fractures within the bedrock would remain confined to an area immediately around the blast site.

Several studies have been carried out to investigate the effects of blasting on ground water wells (Froedge, 1983). These studies have concluded that:

1. When blast induced ground vibrations are less than about 25 mm/s maximum resultant particle velocity, the response of the well is limited to a slight temporary variation in water level on the order of 3 to 6 cm either up or down. The specific capacity of the water well is unchanged based on drawdown tests.

2. Vibration measurements made at the surface and at the bottom of the observation wells indicate the vibration levels are always lower at the bottom of the well.

3. All of the data collected indicates that a ground vibration limit of 50 mm/s peak particle velocity is adequate to protect the wells from any significant damage. There is a possibility that temporary turbidity may be caused at lower levels periodically, although not at any constant threshold level.

The research consistently indicates that blast vibrations below 25 mm/s should have no adverse effects on nearby wells. As the maximum provincial guideline vibration limitation at the nearest residence is only half of this value, at 12.5 mm/s, the ground vibrations produced from the quarry's blasting operations within the proposed extension area would have no effect on the integrity of neighbouring water wells.

7.0 CONCLUSIONS

Based on the foregoing considerations, it is our opinion that blasting operations may be readily performed within the limits of the proposed extension of Nelson Quarry Company quarry in compliance with the current quarry blasting guidelines published by the Ministry of Environment. All blasting and blast monitoring would occur in accordance with the Aggregate Resources Act prescribed conditions in order to ensure compliance with the provincial guidelines.

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MVVB/AC/ms/co

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TABLES

TABLE 1

Existing Blast Details for Nelson Quarry Company

PARAMETER	NELSON QUARRY
Bench (face) height (m)	19 - 26
Drill hole pattern (m)	2.4 x 2.4 – 4.3 x 4.3
Drill hole diameter (mm)	76 – 114
Sub-drill depth (m)	0.6
Collar length (m)	1.7 – 3.0
Holes per blast	7 – 40
Explosive product(s) used	Emulsion/ANFO blend
Initiation system	Electric, Electronic
Delay timing (ms)	25ms (electric), 13ms (electronic)
Maximum explosive weight per delay period (kg)	30 – 279

Note: See Figure 3 for a description of blasting terms.

TABLE 2

Maximum Explosive Loads vs Distance
for 12.5 mm/s and 128 dBL

Distance (m)	PPV = 12.5 mm/s SD = 25.5 kg/m$^{0.5}$	INL = 128 dBL SD = 53.0 kg/m$^{0.33}$
100	15	7
150	35	23
200	61	54
250	96	105
300	138	181
400	246	429
500	384	838
600	553	1449

Note: See Section 5 of accompanying report.

TABLE 3

Strain Levels Induced by Household Activities, Environmental Changes and Blasting

Loading Phenomena	Site[a]	Microstrain Induced by Phenomena (μin.in.)	Corresponding Blast Vibration Level[b] (mm/s)
Daily environmental changes	K_1	149	30.0
	K_2	385	76.0
Household activities:			
1. Walking	S_2	9.1	0.8
2. Heel drops	S_2	16.0	0.8
3. Jumping	S_2	37.3	7.1
4. Door slams	S_1	48.8	12.7
5. Pounding nails	S_{12}	88.7	22.4

[a] K_1 and K_2 were placed across a taped joint between two sheets of gypsum wallboard.

[b] Blast equivalent based on envelope line of strain vs ground vibration.

Source: Dowding (1985)

FIGURES

KEY LOCATION PLAN
NELSON QUARRY

FIGURE 1

REFERENCE:
THIS FIGURE WAS CREATED FROM A MAPART MAP TITLED "HAMILTON" 2003 EDITION.

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Project: 021-1238

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Chkd:

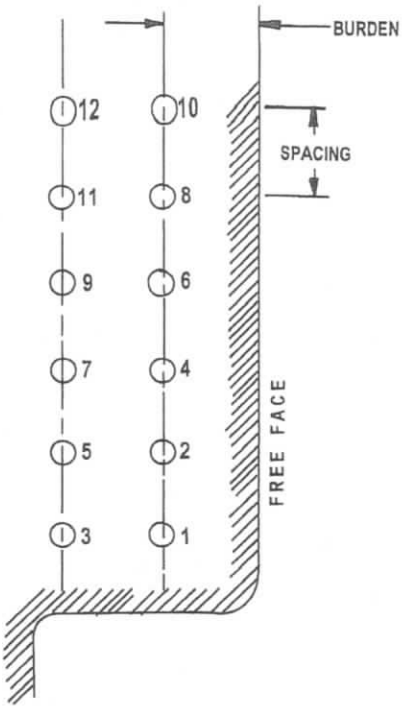
Golder Associates

0211238FIG01.cdr

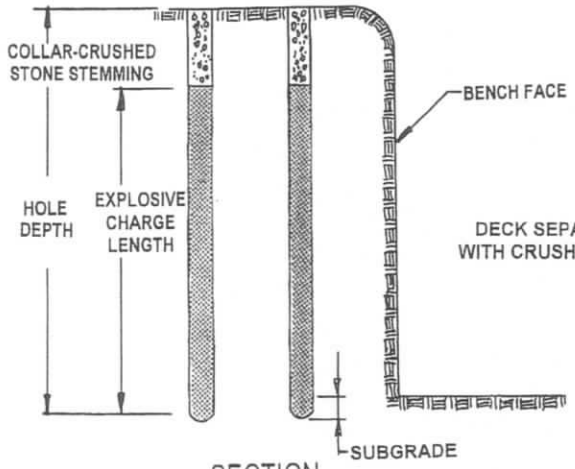
DESCRIPTION OF BLASTING TERMS

FIGURE 3

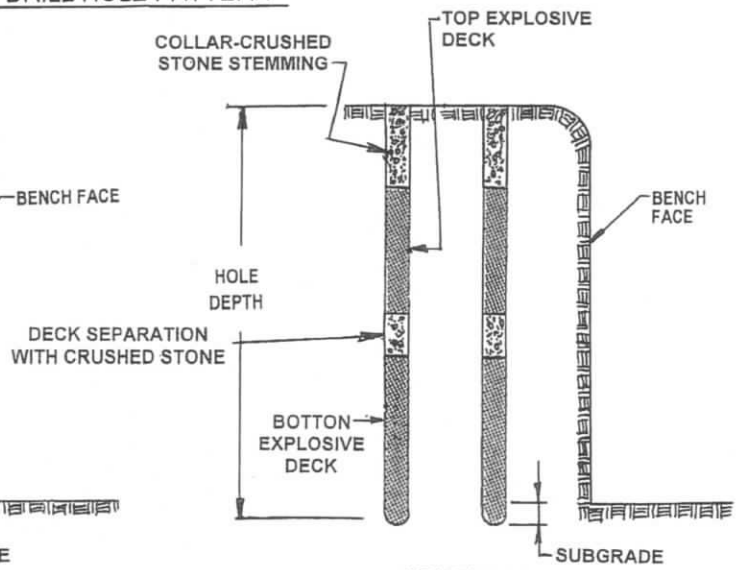
NUMBERS SHOW SHORT PERIOD DELAY	EXAMPLE OF FIRING TIMES (MILLISECONDS)
PERIOD 1	25
PERIOD 2	50
PERIOD 3	75
PERIOD 4	100
PERIOD 5	125



PLAN OF DRILL HOLE PATTERN



SECTION
FULL COLUMN EXPLOSIVE LOAD



SECTION
DECKED EXPLOSIVE LOAD

0211238FIG03.cdr

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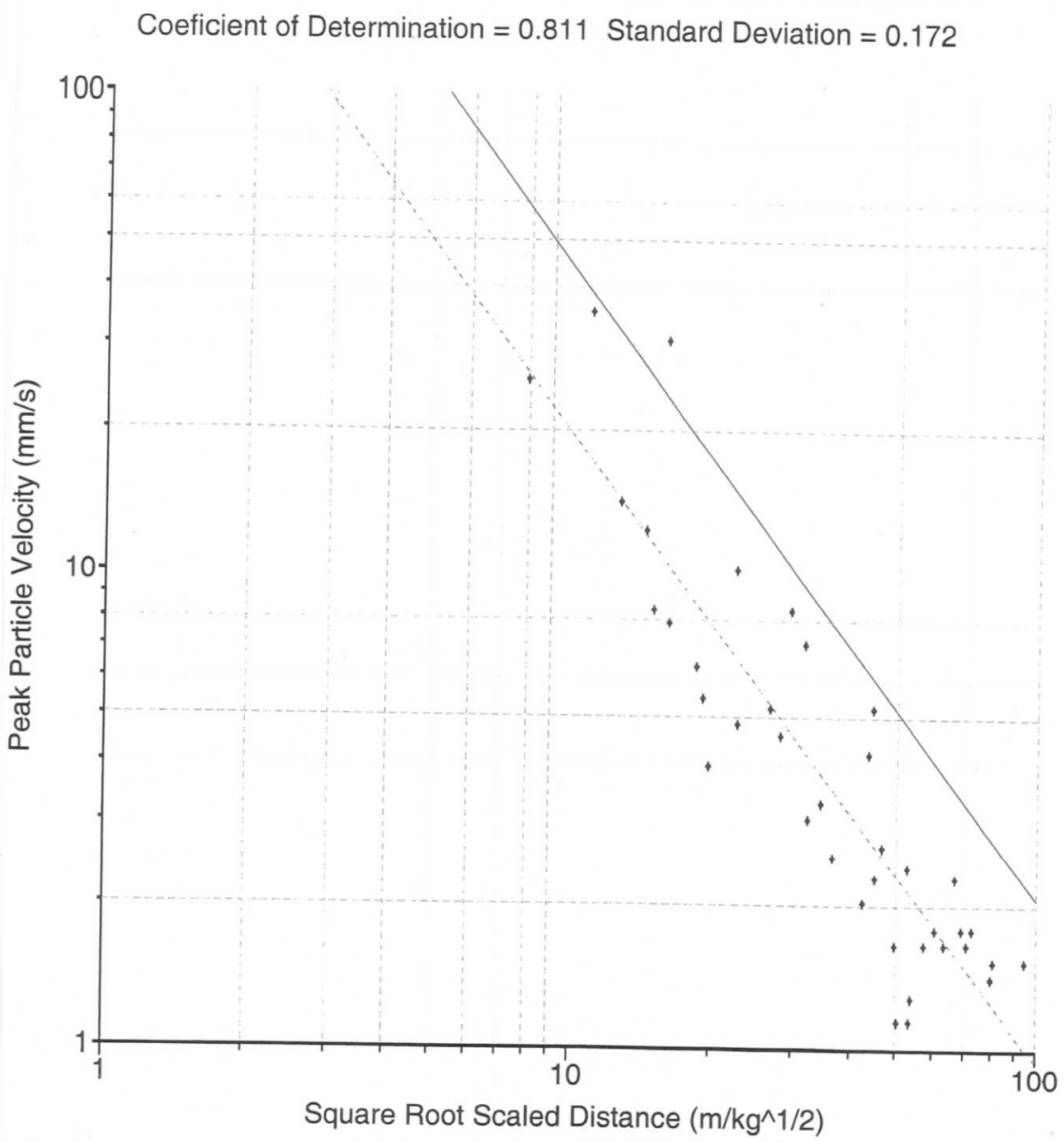
Drawn: RJ

Chkd:

NELSON QUARRY GROUND VIBRATION ATTENUATION CURVE

FIGURE 5



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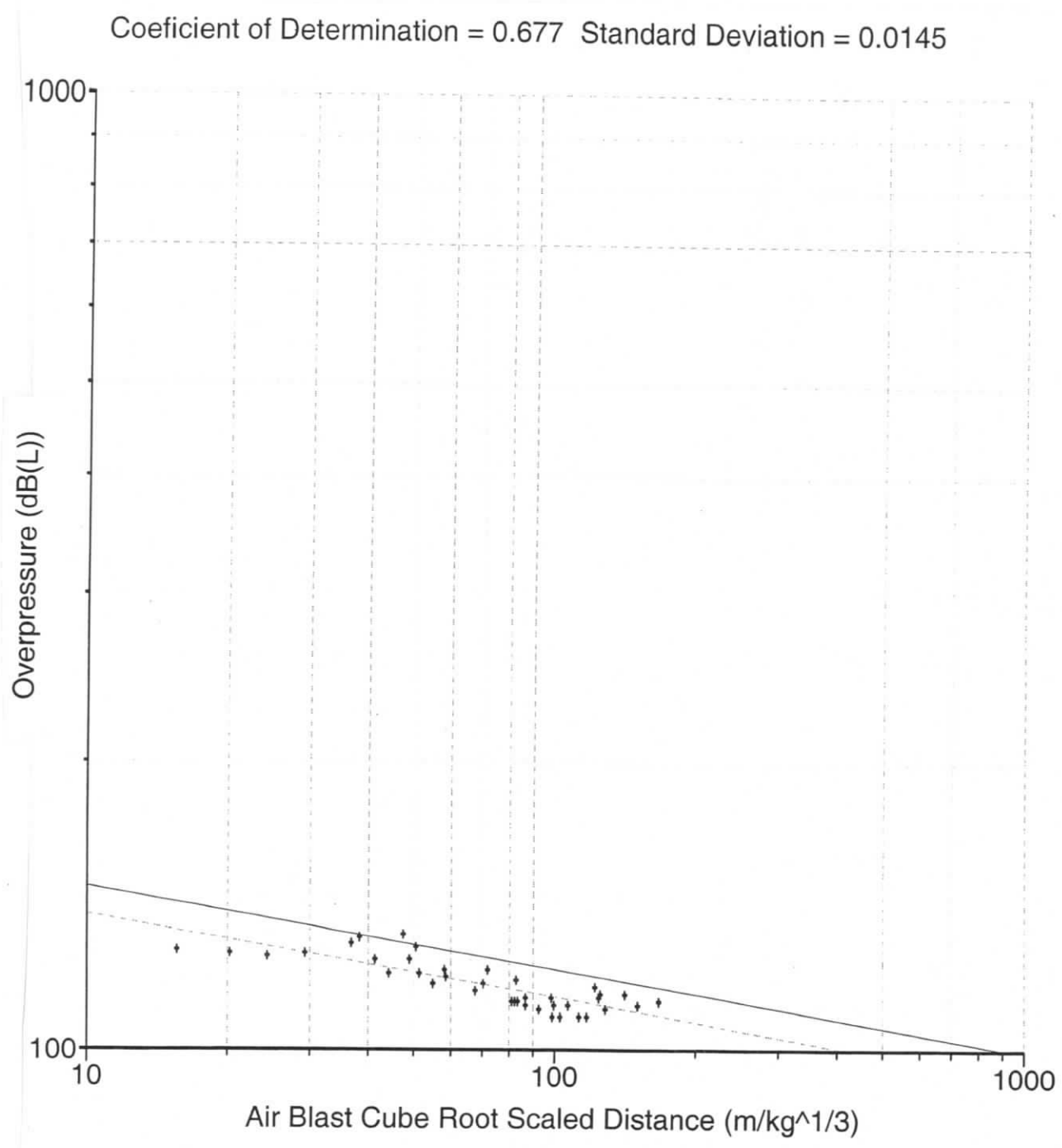
Chkd.....MB.....

NELSON QUARRY AIR VIBRATION ATTENUATION CURVE

FIGURE 6



Date.....Aug 29/04.....

Project...021-1238.....

Drawn.....

Chkd.....

APPENDIX A
PUBLICATION NPC 119

PUBLICATION NPC-119

Blasting

Scope

This Publication refers to limits on sound (concussion) and vibration due to blasting operations.

Technical Definitions

The technical terms used in this Publication are defined in Publication NPC-101 – Technical Definitions.

Measurement Procedures

All measurements of peak pressure level and vibration velocity shall be made in accordance with the "Procedure for Measurement of Sound and Vibration due to Blasting Operations" set out in Publication NPC-103 – Procedures, section 5.

Concussion – Cautionary Limit

Subject to section 5 the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 120 dB.

Concussion – Peak Pressure Level Limit

If the person in charge of a blasting operation carries out routine monitoring of the peak pressure level, the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 128 dB.

Vibration – Cautionary Limit

Subject to section 7, the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.00 cm/s.

Vibration – Peak Particle Velocity Limit

If the person in charge of a blasting operation carries out routine monitoring of the vibration the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.25 cm/s.

APPENDIX B
NEW RESIDENCE RECEPTOR LOCATION

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone 905-567-4444
Fax 905-567-6561

December 13, 2004

021-1238

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ontario
L7R 4L8

Attention: Mr. Tom Palko
Property Manager

RE: BLASTING IMPACT ASSESSMENT PROPOSED NELSON AGGREGATE NELSON QUARRY EXTENSION NEW RESIDENCE RECEPTOR LOCATION

Dear Mr. Palko:

Further to our report entitled "Blasting Impact Assessment Proposed Nelson Aggregate Nelson Quarry Extension" dated September, 2004, it is our understanding that the closest residential receptor to the proposed Nelson Aggregate Nelson quarry extension has now been identified as the residence at 2416 No. 2 Sideroad, located in the northeast corner of the proposed extraction area. The residence and ancillary buildings at 2416 No. 2 Sideroad are located a minimum of 290 m from the Phase 1 extraction area and 370 m from the Phase 5B extraction area.

As stated in Section 6.0 Impact Assessment of the report identified above, the recommended Ontario provincial ground and air vibration guideline limits of 12.5 mm/s and 128 dBL respectively, may be complied with for all blasting beyond a distance of about 200 m. This indicates that the extraction of Phases 1 through 5B and part of Phase 6 may be carried out without any changes to the quarry's existing blasting procedures.

It is our opinion that blasting operations may be carried out within the proposed extension area in compliance with the current quarry blasting guidelines while the residence at 2416 No. 2 Sideroad is occupied. If you have any additional questions please do not hesitate to contact me.

Yours truly,

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED BY

Marcus V. van Bers, P.Eng.
Associate

MVB/co
cc: Mr. Brian Zeman, MHBC Planning

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