Attachment H

Blasting Plan





Blasting Plan

Enbridge Energy, Limited Partnership • Line 3 Replacement Project

November 2020

ENBRIDGE®

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FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
Enbridge	Enbridge Energy, Limited Partnership
IEM	Independent Environmental Monitor
L3R or Project	Line 3 Replacement Project
MDNR	Minnesota Department of Natural Resources
Plan	Blasting Plan
PPV	peak particle velocity

1.0 INTRODUCTION

This Blasting Plan ("Plan") describes the procedures and conditions that Enbridge Energy, Limited Partnership ("Enbridge") will use where blasting is required for the Line 3 Replacement Project ("L3R" or "Project"). Blasting activities will follow the general guidance and specifications in this Plan as well as the site-specific plans to be prepared by Enbridge's blasting contractor(s).

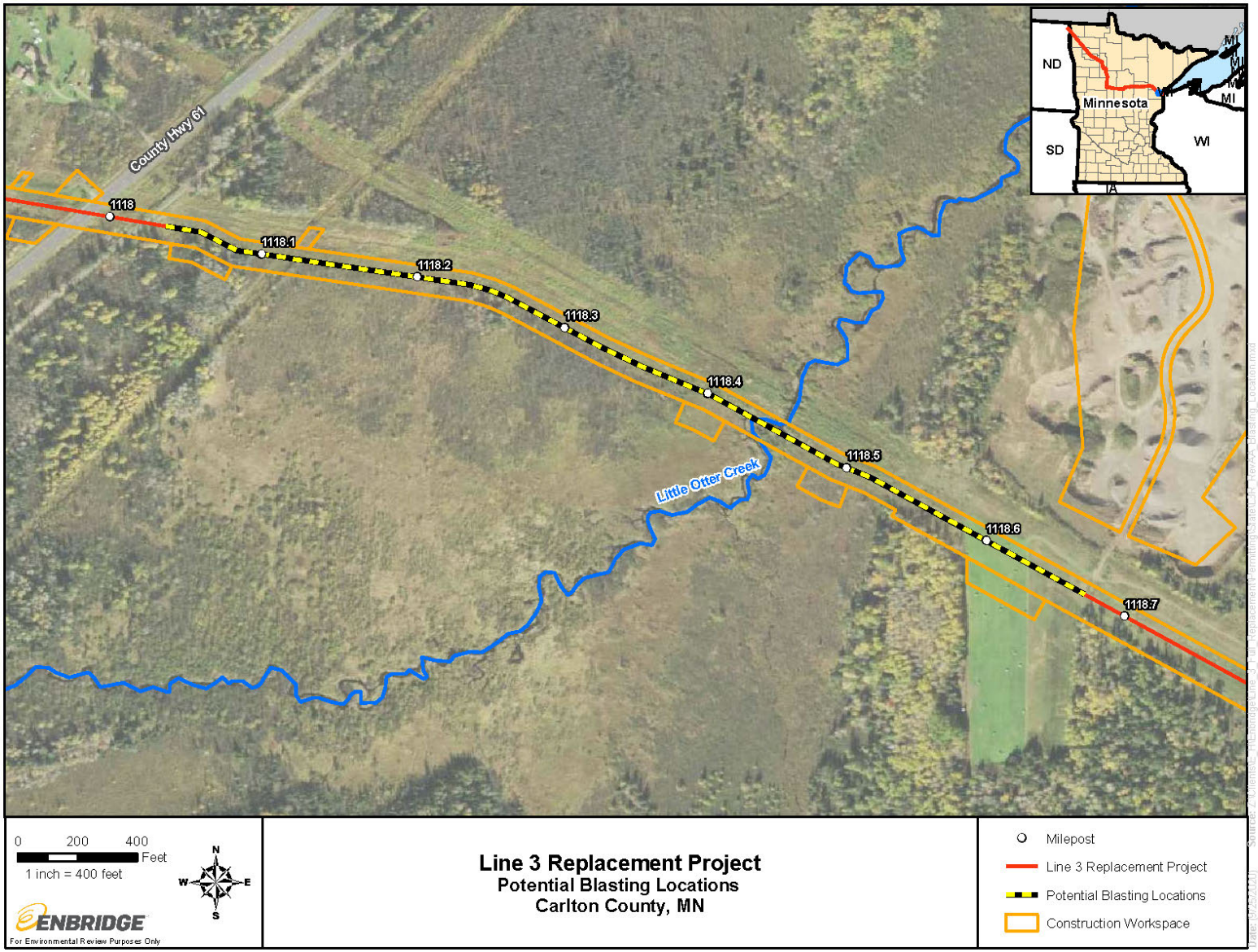
2.0 PURPOSE OF BLASTING PLAN

This Plan provides guidelines and general conditions for all blasting activities that may occur during the Project. In addition, Enbridge's blasting contractor(s) will be required to develop their own overall blasting procedures and site-specific blasting plans for each blasting location, which will provide more specifics than provided in this Plan.

This Plan is intended to identify general blasting procedures, including safety, use, storage, and transportation of explosives that are consistent with minimum safety requirements as defined by federal, state, and local regulations (e.g., Title 27 Code of Federal Regulations ["CFR"] 181 – Commerce in Explosives; Title 49 CFR 177 - Carriage by Public Highway; Title 29 CFR 1926.900 et seq. Sub-part U – Safety and Health Regulations for Construction – Blasting and Use of Explosives; Title 29 CFR 1910.109 – Explosives and Blasting Agents; 29 CFR 1926.900-General Provisions and sections 901, 902, and 904-911; Minnesota Administrative Rules Chapter 7500, Explosives, Blasting Agents, Firearms) and National Fire Prevention Association 495, Explosive Materials Code, Chapter 11. Additionally, this Plan is intended to address environmental aspects of blasting activities and to identify areas of concern along the proposed pipeline route.

Conventional trenching techniques will typically be used to bury the pipeline below existing grade; however, field survey and desktop data have identified a location of shallow bedrock from about mileposts 1118.1 to 1118.6 where blasting will be necessary (see Figure 2.0-1), which includes Little Otter Creek (milepost 1118.4, see Section 8.0). No blasting will occur on the nearby Willard Munger Trail or within the associated Minnesota Department of Natural Resources ("MDNR") trail easement. Shallow bedrock may also be encountered in other locations along the Project route during the course of construction; however, no specific additional locations have been identified at this time. Should future blasting locations be identified, they will be subject to the guidance and specifications in this Plan. If blasting is required on MDNR-administered lands or adjacent to MDNR-administered public waters, Enbridge will notify the MDNR for prior approval.

Figure 2.0-1 Potential Blasting Locations



3.0 GENERAL BLASTING REQUIREMENTS

Blasting operations must be conducted by or under the direct and constant supervision of personnel legally licensed and certified to perform such activity in the jurisdiction where blasting occurs. Prior to any blasting activities, the blasting contractor(s) will provide Enbridge with appropriate information documenting the experience, licenses, and permits associated with blasting personnel.

Blasting-related operations, including obtaining, transporting, storing, handling, loading, detonating, and disposing of blasting material; drilling; and ground-motion monitoring shall comply with applicable federal, state, and local regulations; permit conditions; and the construction contract.

Blasting for grade or trench excavation must be used where deemed necessary by a construction expert after examination of the site and in other locations only after other reasonable means of excavation have been used and are unsuccessful in achieving the required results. Enbridge may specify locations (e.g., foreign line crossings, near structures) where consolidated rock must be removed by approved mechanical equipment such as rock-trenching machines, rock saws, hydraulic rams, or jack hammers in lieu of blasting.

Before blasting, site-specific blasting plans consistent with the provisions of this Plan must be submitted by the blasting contractor(s) to Enbridge for approval and review by a licensed Enbridge engineer. Should there be an existing pipeline within 50 feet of an area proposed for blasting, the blasting contractor will complete a stress calculation to propose the allowable pounds of explosive per delay interval and determine the combined stress level of each affected pipeline. These recommendations must be reviewed by Enbridge and approved before blasting may commence.

All blasting must be conducted with an Enbridge Environmental Inspector and agency Independent Environmental Monitor(s) (IEM) present.

4.0 SITE-SPECIFIC BLASTING PLANS

The blasting contractor(s) will create a site-specific blasting plan for any area determined to require blasting. The site-specific blasting plan will include specific details and calculations regarding dynamic environmental variables that will be measured closer to the time of the blast. This site-specific blasting plan will consider environmental conditions and specific blasting methods to be used at the time of construction. The site-specific blasting plan will include a pre-blast risk assessment and must include at a minimum the following information:

- Blasting contractor's name, company, copy of license, and statement of qualifications; seismograph company, names, equipment, and sensor location;
- Site location (milepost and stationing), applicable alignment sheet numbers, and associated rock type and geological structure (e.g., solid, layered, or fractured);
- Copies of all required federal, state, and local permits;
- Methods and materials including explosive type, product name and size, weight per unit, and density; stemming material; tamping method; blasting sequence; use of non-electrical

initiation systems for all blasting operations; magazine type; and locations for storage of explosives and detonating caps;

- Site dimensions, including explosive depth, distribution, and maximum charge and weight per delay, and hole depth, diameter, and pattern, and number of holes per delay;

- Dates and hours of conducting blasting, distance and orientation to nearest aboveground and underground structures, and schedule identifying when blasting will occur within each waterbody greater than 10 feet wide or within any designated coldwater fishery;

- The distance within which structures will be affected by the blast and all structures located within that distance; and

- Blasting procedures for:

    - Storing, handling, transporting, loading, and firing explosives;

    - Prevention of misfires, flyrock (including the flyrock performance measures specific to the blasting location/activity), fire prevention, noise, and stray current accidental-detonation;

    - Signs, flagmen, and warning signals prior to each blast;

    - Those locations where the pipeline route and construction workspace:

        - Parallels or crosses an electrical transmission corridor, cable, or pipeline;

        - Parallels or crosses a highway or road;

        - Is within or adjacent to treed areas;

        - Approaches a potable water source (distance to be determined by blasting contractor, based on technical specifications of the blasting effort); or

        - Approaches any residence, building, or occupied structure (distance to be determined by blasting contractor, based on technical specifications of the blasting effort); and

        - Approaches any recreational area (e.g., state trail) (distance to be determined by blasting contractor, based on technical specifications of the blasting effort);

    - Local notification of affected residences, buildings, and occupied structures within the distances established by the blasting contractor's pre-blast surveys. The contractor must include the method(s) and timing of all notifications;

    - Inspections after each blast; and

    - Disposal of waste blasting material.

5.0 PRE-BLASTING REQUIREMENTS

Prior to the initiation of blasting operations, the blasting contractor(s) must comply with the following:

- Submit to the Enbridge representative its site-specific blasting plan for approval prior to execution of blasting activity. The Enbridge representative will share the approved blasting plan with the appropriate IEM(s).

- Obtain all required federal, state, and local permits relating to the transportation, storage, handling, loading, and detonation of explosives.

- Make all necessary "One Call" notifications 48 hours prior to construction where One-Call systems are in place.

- Complete all necessary notifications, surveys, and testing for the protection of aboveground and underground structures as described under Section 7.1, and be responsible for the protection of existing underground facilities.

- Before performing any work on or accessing the right-of-way, verify to Enbridge that all property owners have been notified of the impending construction.

6.0 MONITORING

During blasting operations, the blasting contractor(s) will be required to monitor operations in the following manner:

- Provide seismographic equipment to measure the peak particle velocity ("PPV") of all blasts in the vertical, horizontal, and longitudinal directions. Seismic monitoring can only be discontinued if 1) the blasting schedule and blasting performance consistently produce PPVs at the pipeline that are lower than the maximum allowable limit; and 2) an Enbridge representative provides written authorization.

    - An independent third-party contractor will monitor the seismographs and provide Blasting Log records to an Enbridge representative.

    - All seismographs will be deployed and calibrated per the standards outlined by the International Society of Explosive Engineers.

- Measure the PPV at adjacent pipeline(s), any potable water sources and systems, and any aboveground structure within the distance established by the blasting contractor.

- Complete a Blast Report (example provided in Appendix A) immediately after each blast and submit a copy to an Enbridge representative and applicable agencies, along with any other documentation required by Enbridge.

Air overpressure monitoring may be conducted at the blasting contractors' discretion, as applicable.

7.0 SAFETY

7.1 PROTECTION OF ABOVEGROUND AND UNDERGROUND STRUCTURES

Where blasting is required, Enbridge will identify any municipal water mains and will consult the local water authority. Reports of identified crossings will include location by milepost, owner, and status and results of contacts with the water authority.

The blasting contractor(s) will exercise control to prevent damage to aboveground and underground structures, including buildings, pipelines, utilities, springs, and water wells. The contractor will implement the following procedures:

- Any potable water source and/or associated pipe system within the distance established by the blasting contractor will be tested for yield and water quality before blasting. If damaged, Enbridge will repair or otherwise restore any damage, or Enbridge will compensate the owner for damages. Enbridge will provide an alternative potable water supply to the landowner until repairs occur. Locations of potable sources and/or associated pipe systems within the distance established by the blasting contractor will be indicated on Enbridge's construction alignment sheets.

- A third-party vibration monitor and an Enbridge representative will inspect all aboveground structures within the distance established by the blasting contractor before and after blasting. In the unlikely event that damage occurs to the aboveground structure, the owner will be compensated.

- The blasting contractor(s) is responsible for the ultimate resolution of all damage claims resulting from blasting. Such liability is not restricted by the inspection distance established by the blasting contractor, as discussed above.

- Blasting will not be allowed within 15 feet of an existing pipeline, unless specifically authorized by Enbridge.

- Holes that have contained explosive material shall not be re-drilled. Holes must not be drilled where danger exists of intersecting another hole containing explosive material.

- Blasting mats or padding may be used on all shots where necessary to prevent scattering of loose rock onto adjacent property and to prevent damage to nearby structures and overhead utilities.

- Blasting cannot begin until occupants of nearby buildings, stores, residences, places of business, places of public gathering, administrators of public recreation areas, and farmers have been notified by the blasting contractor(s) sufficiently in advance to protect personnel, property, and livestock. The blasting contractor(s) must notify all such parties at least 48 hours prior to blasting; the specifics of how this notification will occur will be in the site-specific blasting plan.

- Blasting in or near environmentally sensitive areas such as streams and wildlife areas may include additional restrictions.

- All blasting is subject to the following limitations.

- Maximum PPV of 12.0 inches per second in any of three mutually perpendicular axes, measured at the lesser distance of the nearest facility or the edge of the permanent easement.
- Maximum diameter of explosive may be no larger than 2 inches unless approved by Enbridge.
- Maximum quantity of explosive per delay is governed by the recorded measurements as influenced by work site conditions.
- Explosive agents and ignition methods shall be approved by Enbridge. Ammonium nitrate-fuel oil and other free flowing explosives and blasting agents are not acceptable and cannot be used.
- Drill holes cannot be left loaded overnight.
- Clean, crushed 1/4 - 3/8 inch angular stemming material is to be used in all holes.

- The drilling pattern must be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) in order to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications. The blasting contractor(s) must submit the proposed drilling pattern to Enbridge for approval.
- Under pipeline crossings and all other areas where drilling and blasting is required within 15 feet of existing facilities:
  - Drill holes must be reduced to a maximum of 2 inches or less in diameter.
  - The number of holes shot at one time is limited to three unless otherwise approved by Enbridge.
  - Appropriate delay between charges to attain desired fragmentation.

7.2 PROTECTION OF PERSONNEL

The blasting contractor(s) must include in its procedures all federal, state, county, and local safety requirements for blasting. The blasting contractor's procedures must address, at a minimum, the following requirements:

- Only authorized, qualified, and experienced personnel can handle explosives.
- All blasting activities must be conducted only during daylight hours.
- No explosive materials can be located where they may be exposed to flame, excessive heat, sparks, or impact. Smoking, firearms, matches, open flames, and heat- and spark-producing devices shall be prohibited in or near explosive magazines or while explosives are being handled, transported, or used.

- A code of blasting signals must be established, posted in conspicuous places, and utilized during blasting operations. Employee training shall be conducted on the use and implementation of the code.

- The blasting contractor(s) must use every reasonable precaution to ensure personnel safety, including but not limited to visual and audible warning signals, warning signs, flag person, and barricades.

- Warning signs, with lettering a minimum of 4 inches in height on a contrasting background, will be erected and maintained at all approaches to the blast area.

- Flaggers will be stationed on all roadways passing within 1,000 feet of the blast area to stop all traffic during blasting operations.

- All personnel not involved in the actual detonation must stand back at least 1,000 feet and workers involved in the actual detonation must stand back at least 650 feet from the time the blast signal is given until the “ALL CLEAR” has been sounded.

- No loaded holes can be left unattended or unprotected. No explosives or blasting agent can be abandoned.

- In the case of a misfire, the blaster must provide proper safeguards for personnel until the misfire has been re-blasted or safely removed.

- The exposed areas of the blast will be matted wherever practicable. In cases where such a procedure is not deemed to be feasible, the blasting contractor(s) will submit an alternative procedure for review by Enbridge and the site in question must be visited and examined by the consultant before any approval is granted.

- Enbridge may employ two-way radios for communication between vehicles and office facilities. The blasting contractor(s) must advise Enbridge and other pipeline contractors of any need to cease use of such equipment during blasting activities.

- All loading and blasting activity must cease and personnel in and around the blast area will retreat to a position of safety during the approach and progress of an electrical storm irrespective of the type of explosives or initiation system used. **THIS IS A MAJOR SAFETY PRECAUTION AND WILL ALWAYS BE OBSERVED.** All explosive materials, all electrical initiation systems, and all non-electric initiation systems are susceptible to premature initiation by lightning.

- Previous blast areas must be inspected to verify the absence of misfires. No drilling may commence until such inspection occurs. If a misfire occurs adjacent to a hole to be drilled, the misfire will be cleared by the blaster using whatever techniques are called for by the situation prior to commencement of drilling. If a misfire occurs at some distance from the drilling area, drilling may be stopped while clearing preparations are underway. When the misfire is to be cleared by re-shooting, drilling will be shut down and personnel evacuated to a place of safety prior to detonation.

- All transportation of explosives will be in accordance with applicable federal, state, and local laws and regulations. Vehicles used to transport explosives must be in proper working condition and equipped with tight wooden or non-sparking metal floor and sides.

If explosives are carried in an open-bodied truck, they will be covered with a waterproof and flame-resistant tarpaulin. Wiring will be fully insulated to prevent short-circuiting and at least two fire extinguishers will be carried onboard. The truck will be plainly marked to identify its cargo so that the public may be adequately warned. Metal, flammable, or corrosive substances will not be transported in the same vehicle with explosives. There will be no smoking, and unauthorized or unnecessary personnel will not be allowed in the vehicle. Competent, qualified personnel will load and unload explosives into or from the vehicle.

- No sparking metal tools will be used to open kegs or wooden cases of explosives. Metallic slitters will be used to open fiberboard cases, provided the metallic slitter does not come in contact with the metallic fasteners of the case. There will be no smoking, no matches, no open lights, or other fire or flame nearby while handling or using explosives. Explosives will not be placed where they are subject to flame, excessive heat, sparks, or impact. Partial cases or packages of explosives will be re-closed after use. No explosives will be carried in the pockets or clothing of personnel. The wires of an electric blasting cap shall not be tampered with in any way. Wires will not be uncoiled. The use of electric blasting caps will not be permitted during dust storms or near any other source of large charges of static electricity. Uncoiling of the wires or use of electric caps will not be permitted near radio-frequency transmitters. The firing circuit will be completely insulated from the ground or other conductors.

- No blast will be fired without a positive signal from the person in charge. This person will have made certain that all surplus explosives are in a safe place; all persons, vehicles, and/or boats are at a safe distance; and adequate warning has been given. Adequate warning of a blast will consist of but not be limited to the following:

    - Notification to nearby homeowners and local agencies if necessary;
    - Stop vehicular and/or pedestrian traffic near the blast site; and
    - Signal given by an air horn, whistle, or similar device using standard warning signals.

- Only authorized and necessary personnel will be present where explosives are being handled or used.

- Condition of the hole will be checked with a wooden tamping pole prior to loading. Surplus explosives will not be stacked near working areas during loading. Detonating fans will be cut from spool before loading the balance of charge into the hole. No explosives will be forced into a bore hole past an obstruction. Loading will be done by a blaster holding a valid license or by personnel under his direct supervision.

- Fly-rock leaving the right-of-way must be collected immediately and disposed of at disposal sites approved by Enbridge. This work shall not be left to the cleanup crew.

7.3 PROTECTION OF THREATENED AND ENDANGERED SPECIES

Enbridge has consulted with state and federal agencies regarding sensitive habitats or where species are known to occur and will continue these consultations. Areas identified as containing sensitive habitats or species, as directed by the appropriate agencies, will be staked and flagged. Little Otter Creek, proposed for in-stream blasting, is a known trout stream (see Section 8.0). A qualified project biologist will survey the proposed blasting zone identified by the pipeline blasting contractor(s) immediately in advance of any drilling or blasting. Areas will be checked before and

after blasting for the presence of sensitive species, and disturbance to species and habitats will be resolved in accordance with guidance provided by the appropriate agencies.

7.4 LIGHTNING HAZARD

A risk of accidental detonation caused by lightning strikes exists at any time the workplace is experiencing an electrical storm and there are loaded holes on site. If this hazard is judged to exist by the Enbridge representative, work will discontinue at all operations and workers will be moved to secure positions away from the loaded holes. Furthermore, workers cannot return to the work site until the storm has passed and the Enbridge representative has indicated it is clear to return.

Enbridge's blasting contractor(s) must have on site approved lightning detectors (model SD-2508 manufactured by Electronics Div. of S.D.I. International, Model 350 manufactured by Thomas Instruments Inc., Skyscan Lighting Detector manufactured by Skyscan Technologies, or equivalent) capable of measuring the degree of electrical activity as a storm approaches, and the distance to the storm front from the instrument on the right-of-way.

8.0 IN-WATER BLASTING

In-stream blasting is currently proposed at Little Otter Creek (MP 1118.4), a Minnesota Public Waters Inventory feature and a state-listed trout stream. Enbridge has reviewed the use of other methods to fracture the bedrock adequately and attempt to avoid the use of blasting (i.e., hammer hoes, rock-trenching machines, rock saws, hydraulic rams, or jack hammers). Based on Enbridge's field review of the geologic conditions present at the stream crossing, and the extent of the bedrock present on either side of the stream crossing, these methods are not feasible in that the rock is too hard, and could require several weeks of hammering, working within the streambed, to achieve an adequate trench size. Using the blasting method will allow Enbridge and its contractors to minimize the amount of time working in the stream and overall disturbance to the resource. In addition, Enbridge previously used blasting in this area during construction of Enbridge's Alberta Clipper Project (Line 67), and no significant long-term impacts have been identified.

Enbridge is consulting with the MDNR regarding this crossing to understand the presence and quality of local fisheries. Based on this consultation, Enbridge will not allow in-stream work, including blasting, during the work exclusion dates established by the MDNR (September 15 – June 30) to allow for fish spawning and migration. Enbridge will make necessary notifications to all appropriate resource agencies prior to blasting activities. Enbridge also expects that an Independent (Third-Party) Environmental Monitor will be on-site at this location to observe the planning of, and execution of, the public water crossing. Enbridge will also require that the blasting contractor select the type of explosive, size of charges, sequence of firing, and other protective measures to minimize shock wave stresses on aquatic life adjacent to the blasting area. Following all construction activities, the Little Otter Creek stream channel and adjacent floodplain will be restored to pre-construction contours, alignment, and conditions through a Site-Specific Restoration Plan developed as part of the License to Cross Public Waters permitting effort. Enbridge will monitor this crossing following construction as part of its Post-Construction Monitoring Plan.

Where specified, the blasting contractor(s) will furnish the necessary labor and equipment to employ air bubble curtains for the protection of existing pipelines, wildlife, or other facilities, or other best management practices required by regulatory agencies. The blasting contractor must

ensure that blasting operations outlined in each site-specific blasting plan will be carried out in such a manner that they conform to industry standards, guidelines, and best management practices. The Site-Specific Blasting Plan for Little Otter Creek will include contractor-proposed and Enbridge-approved best management practices (e.g., impact resistant blankets, tarps, or blasting mats) to reduce the potential for blasting residuals, including particulates and dry abrasive material, to become airborne and settle within the floodplain and wetlands adjacent to Little Otter Creek. Explosives used for crossings must be non-sympathetically propagating explosives and shall be approved by Enbridge.

9.0 STORAGE REQUIREMENTS

All explosives, blasting agents, and initiation devices must be stored in authorized magazines provided by third-party vendors that meet U.S. Department of Homeland Security and Bureau of Alcohol, Tobacco, Firearms, and Explosives security regulations. The magazines must further be constructed, approved, and licensed in accordance with all additional local, state, and federal regulations. Magazines must be dry, well-ventilated, reasonably cool (painting of the exterior with a reflective color), bullet and fire resistant, and clean.

Initiation devices cannot be stored in the same box, container, or magazine with other explosives. Explosives, blasting agents, or initiation devices cannot be stored in wet or damp areas; near oil, gasoline, or cleaning solvents; or near sources of heat radiators, steam pipes, stoves, etc. No metal or metal tools can be stored in the magazine. There can be no smoking, matches, open lights, or other fire or flame inside or within 50 feet of storage magazines or explosive materials. The loading and unloading of explosive materials into or out of the magazine will be done in a business-like manner with no loitering, horseplay, or prank playing.

Magazines will be kept locked at all times unless explosives are being delivered or removed by authorized personnel. Admittance will be restricted to the magazine keeper, blasting supervisor, or licensed blaster. Magazine construction shall meet the requirements of Bureau of Alcohol, Tobacco, Firearms, and Explosives P5400.7 “Explosives Law and Regulations” and be in accordance with local, state, or federal regulations and the Blaster’s Handbook.

Accurate and current records must be kept of the explosive material inventory to ensure that oldest stocks are utilized first, satisfy regulatory requirements, and facilitate immediate notification of any loss or theft. Magazine records will reflect the quantity of explosions removed, the amount returned, and the net quantity used at the blasting site.

When explosive materials are taken from the storage magazine, they must be kept in the original containers until used. Small quantities of explosive materials may be placed in day boxes, powder chests, or detonator boxes. Any explosive material not used at the blast site must be returned to the storage magazine and replaced in the original container as soon as possible.

Magazine locations must be in accordance with local, state, or federal regulations. Where no regulations apply, magazines shall be located in accordance with the latest edition of the 175th Anniversary Edition of the Blaster’s Handbook and ATF P5400-7 “Explosives Law and Regulations.”

Magazines will be marked in minimum 3-inch high letters with the words “**DANGER – EXPLOSIVES**” prominently displayed on all sides and roof.

Appendix A

Example Blast Report

DYNO NOBEL INC.

BLAST REPORT

DYNO Dyno Nobel

SERVICE SITE LOCATION _____

BLAST NUMBER _____ BLAST TIME _____ BLAST DATE _____

CUSTOMER NAME/NUMBER _____ ADDRESS _____

ROCK TYPE _____ ROCK SPECIFIC GRAVITY _____

LOCATION OF BLAST

LOCATION OF BLAST IN MINE _____ BENCH _____ BLAST GRID _____

DATE OF GRID MAP _____ BLAST GPS POINTS _____ & _____

WEATHER

WEATHER _____ CEILING FEET _____ TEMPERATURE _____ WIND FROM & SPEED _____

NEAREST NON-OWNED STRUCTURE

NAME _____ GPS POINTS _____ & _____

DISTANCE _____ DIRECTION _____ GRID _____

SEISMOGRAPH DATA

	LOCATION	GRID	GPS POINTS	CALIBRATION DATE
A			&	
B			&	

	L (F)	T (F)	V (F)	AIR (DECIBELS)	SEISMOGRAPH TYPE & SERIAL NUMBER
A					
B					

"A" OPERATOR _____ "B" OPERATOR _____

BLAST DATA

		EXPLOSIVES SIZE, TYPE, & POUNDS		
NUMBER OF HOLES (EA)		SIZE	TYPE	POUNDS
HOLE DIAMETER (IN)				
HOLE DEPTH (FT)				
FACE HEIGHT (FT)				
SUB DRILLING (FT)				
AVG. STEM FACE HOLES (FT)				
STEM OTHER HOLES (FT)				
BURDEN FRONT ROW (FT)				
BURDEN OTHER ROWS (FT)				
SPACING FRONT ROW (FT)				
SPACING OTHER ROWS (FT)			TOTAL POUNDS	

BRAND NAME OF DETONATORS _____ ☐ NONELECTRIC ☐ ELECTRIC

DELAY OR TYPE	LENGTH	NUMBER USED	DELAY OR TYPE	LENGTH	NUMBER USED	DELAY OR TYPE	LENGTH	NUMBER USED

TONS OR YDS^3 IN SHOT _____ AVERAGE POUNDS/HOLE _____ HOLES/DELAY _____

MAX. LBS/DELAY _____ % OF ANFO _____ FUEL OIL (BULK LOADED) _____ %

POWDER FACTOR (TONS/POUND) _____ OR POWDER FACTOR POUNDS/YD^3 _____

SCALED DISTANCE FACTOR _____ CUBED DISTANCE FACTOR _____

BLASTER'S NAME _____ BLASTER'S NUMBER & STATE _____

BLASTER'S SIGNATURE _____ SITE SAFETY INSPECTION PERFORMED YES _____ NO _____

MINE MGT. SIGNATURE _____ NUMBER OF DYNO PERSONNEL ON SITE _____

REMARKS : _____

START TIME	END TIME	TOTAL TIME	TRUCK NUMBERS

North

SHOT DIAGRAM

TYPICAL HOLE LOAD

Loading Comments, (i.e., holes on front line, angled holes, hole angle, hole condition, etc.)

Protective Mats Used Y ☐ N ☐ Minimum Delay Interval Number of Rows