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Chapter 8
Existing Line 3 Abandonment and Removal

8.1 INTRODUCTION

Options for Existing Line 3 Include Abandonment, Removal, and Removal with Replacement in the Same Trench

As part of the Project, Enbridge proposes to abandon in-place the existing Line 3, permanently removing it from service, following state[1] and federal[2] regulations, which outline the process and requirements for pipeline abandonment. As an alternative to abandonment, this FEIS evaluates excavating and removing the existing Line 3, as well.

Four of the five routes considered in this EIS (the Applicant's preferred route and route alternatives RA-03AM, RA-06, and RA-08) could be coupled with either abandonment of the existing Line 3 or removal of the existing Line 3. As discussed in Chapter 4, RA-07 specifically contemplates removal of the existing Line 3 with the new line placed in the existing trench, so therefore abandonment in place is not an option for that route alternative.

Whether the existing line is abandoned, removed, or removed with replacement in the same trench, the proposed pipeline will eventually require replacement, as well. The following discussion of alternatives is pertinent not only to the existing pipeline, but will also apply to the proposed pipeline at the end of its service life.

Options for Existing Line 3 Provide Benefits but Also Raise Challenges

This chapter discusses the benefits and drawbacks of each of the options for the existing Line 3. Additionally, this chapter discusses the potential impacts and identifies possible mitigation measures.

Major issues considered in the assessment of abandonment of the existing Line 3 include:

- Potential environmental benefits of avoiding disturbance to active pipelines located in the immediate vicinity of the existing Line 3;
- Potential environmental risks and adverse impacts of unknown existing contamination surrounding the pipe that would never be discovered and remediated if the line was abandoned;
- Providing a potential conduit for migration of water or contaminants that are present and/or associated with releases from nearby pipelines; and

[1] Minnesota Statutes § 216D.04, Subd. 3(f) and Minnesota Administrative Rules Part 7560.0125 (known collectively as "Gopher State One Call," or call before you dig) require specific document retention for all abandoned underground utilities in Minnesota (after December 31, 1998) and require providing specific information to excavators.

[2] 49 Code of Federal Regulations (CFR) 195.402(10) "Abandoning Pipeline Facilities"; 49 CFR 195.59 abandonment reporting requirements.

- Potential environmental risks and impacts associated with ongoing deterioration of abandoned pipeline, which include subsidence and becoming buoyant and exposed at the ground surface.

Major issues considered in the assessment of removal of the existing Line 3 include:

- Removal activities could damage an active pipeline located on in the near vicinity of the existing Line 3, causing a release;
- Potential impacts associated with disturbances at waterbody and roadway crossings, such as increased erosion potential;
- Potential environmental benefits associated with identification and remediation of existing contamination surrounding the pipe during removal;
- Removal of a potential conduit for contaminant migration associated with a release from an adjacent pipeline;
- Potential economic benefits from employing workforce to remove Line 3; and
- Avoidance of potential environmental risks and impacts associated with subsidence or buoyancy issues from ongoing deterioration of abandoned pipeline.

The option of removing the existing Line 3 and placing the new Line 3 in the existing trench (RA-07) has similar issues to those listed for removing the existing Line 3. Additionally, replacement of Line 3 using the same trench would require Line 3 to be out of service for the period during removal and construction activities. Issues, impacts, and mitigation associated with the option of removal and replacement within the same trench are addressed in detail in the evaluation of RA-07 in Chapter 6.

8.2 REGULATORY FRAMEWORK AND METHODOLOGY

Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations govern the abandonment of pipelines. These regulations prescribe certain steps for formal abandonment of oil pipelines, including the disconnection, purging, and sealing of pipelines that are to be abandoned in place.[3] Enbridge has provided a plan describing how the basic requirements will be met, which is included as Appendix B. In addition, federal regulations require pipeline operators to file an abandonment report for each abandoned facility that crosses a navigable waterway. This abandonment report includes certification that the facility was abandoned in accordance with all applicable laws.[4] Minnesota's regulations require specific document retention for all abandoned underground utilities in the State to prevent unexpected discovery during excavation activities.[5] State and federal pipeline regulations do not specifically regulate the removal of pipelines. For crude oil pipelines located in Minnesota, Minnesota Office of Pipeline Safety (MNOPS) coordinates with PHMSA to review reports, records, and procedures in addition to performing field visits. MNOPS typically performs inspections during new construction, decommissioning/abandonment, and integrity digs.

3 49 CFR 192.3; 195.2.

4 49 CFR 192.727(g); 195.59.

5 Minnesota Statutes § 216D.04, Subd. 3(f) and Minnesota Administrative Rules Part 7560.0125 (known collectively as "Gopher State One Call," or call before you dig).

Abandonment and removal activities that involve clearing and ground disturbance would require authorizations, permits, and approvals similar to any other construction activity including, for example, construction stormwater permits, permits for construction in public waters, and permitting for impacts on wetlands. The regulations that govern these programs are presented in detail in Chapters 5 and 6.

Impacts of abandonment have been characterized based on:

- A review of the nature and extent of the on-the-ground activities that are involved in each step of abandonment (e.g., disconnection, purging, sealing, and long-term monitoring); and
- A review of literature and studies that characterize potential short- and long-term interactions between the abandoned pipe and the surrounding resources as the pipeline degrades.

Impacts of removal have been characterized based on:

- A review of the nature and extent of the on-the-ground activities that are involved in each of the steps involved in removal (e.g., excavation, removal/transportation/disposal, and remediation of contaminated soil).

8.3 ABANDONMENT

Enbridge Has Filed a Proposed Abandonment Plan per PHMSA Regulations

In its Certificate of Need and route permit applications, Enbridge proposes to abandon the existing Line 3 following the PHMSA requirements for abandonment and generally described how the work would be performed. Subsequently, Enbridge filed with the Minnesota Public Utilities Commission (Commission) a draft of the required plan that details how the basic requirements of the PHMSA abandonment regulations will be met (Appendix B). Enbridge's abandonment plan for the portion of existing Line 3 in Canada is discussed in the Canadian National Energy Board's (CNEB's) Report regarding Line 3. The discussion here draws upon Enbridge's abandonment plan filed with the Commission and the CNEB report.

Enbridge proposes abandonment in place of the existing Line 3 that includes:

- **Removing the Oil** – Oil within existing Line 3 would be purged from the pipeline using cylindrical plug-like devices known as "pigs." The pigs would be propelled by nitrogen gas. Oil removed from the line would be moved to holding tanks at the Clearbrook terminal and the Superior terminal.
- **Cleaning the Pipeline** – Following oil removal, the pipeline would undergo a multi-step cleaning process. The process involves sending a variety of cleaning solutions and specialized pigs through the pipeline to remove remaining oil or associated hydrocarbons. Enbridge has indicated that solid and liquid waste materials generated as a result of cleaning activities, including spent cleaning solution, must be handled and disposed of in accordance with applicable federal and state requirements and permits. According to Enbridge documentation provided in Appendix B, purging and subsequent cleaning on a 12-mile section of Line 3 that was abandoned in 2014 resulted in 99.99 percent removal of hydrocarbons, as indicated by analysis of rinse water. However, the analysis of rinse water does not provide detailed information associated with whether residual product might be remaining within the pipeline.

- **Disconnecting the Pipeline** – Once the cleaning process has been completed and passed inspection, the existing pipeline would be physically disconnected from pump station terminals. The pipeline's mainline valves would be closed and electrically disconnected so that they could not be operated.
- **Segmenting the Pipeline** – In addition to disconnecting the pipeline and closing mainline valves, engineers for Enbridge would evaluate the existing line to determine whether additional segmentation of the pipeline would be needed to prevent the pipeline from acting as a conduit for water or residual oil, either within or outside the pipeline. At any such locations, the pipeline would be accessed and cut, and a cap welded onto "opened" ends of the pipeline. To reduce the potential for the pipe trench to act as a water/contaminant conduit, the installation of trench breaks can be considered to segment sloped locations.
- **Monitoring and Maintaining the Pipeline** – Enbridge would be required to continue to monitor and maintain the abandoned Line 3 right-of-way in accordance with PHMSA regulations indefinitely. Enbridge notes that this monitoring would enable them to identify and assess impacts to the public or the environment caused by the abandoned Line 3. Enbridge would take measures to mitigate identified potential risks, and cathodic protection would be maintained for the abandoned pipeline to prevent corrosion. In addition to Enbridge's own monitoring, Minnesota (MNOPS) is authorized by PHMSA to provide local regulatory oversight. This includes safety inspections of operating pipelines and during decommissioning, as well as, inspections during integrity digs.

8.3.1 Potential Impacts and Mitigation Measures

Disconnecting and Segmenting Existing Line 3 Would Require Some Ground Disturbance

Clearing and ground disturbance required for cleaning, disconnecting, segmenting, and on-the-ground activities associated with long-term monitoring of the abandoned pipeline would occur within the Mainline corridor. With clearing and excavation activities limited to the Mainline corridor, the potential impacts associated with abandonment activities are anticipated to be minimal. As noted above, impacts from clearing and ground disturbance would be managed through permitting similar to other construction activity including, for example, construction stormwater permits, permits for construction in public waters, and permitting for impacts on wetlands. Many of the same construction techniques and environmental protection measures described in Chapters 5 and 6 would be required for pipeline abandonment activities, including the use of work windows to avoid sensitive species' lifecycles (like breeding or nesting), vehicle and equipment crossing methods, sediment control measures, and bank restoration.

Abandonment May Limit Risks to Other Pipelines

The existing Line 3 is situated between other active oil pipelines within Enbridge's Mainline corridor (see Figure 4.3-2). The existing Line 3 is approximately 282 miles in length. Of that, approximately 104 miles of it has another pipeline on each side that is within a 20-foot buffer. The remaining 178 miles has either a single pipeline within the 20-buffer or no pipelines. Enbridge reports that in some cases the distance between pipelines is 10 to 15 feet apart. Enbridge believes that abandonment would reduce risk to other pipelines in the Mainline corridor by limiting the extent of disturbance and reducing the potential of striking the adjacent pipelines with equipment or stressing the adjacent pipelines with the weight of heavy equipment traveling across the ground. However, using timber mats and/or long reach boom cranes, removal activities can be performed such that adjacent pipelines are protected.

Effects of Pipeline Abandonment

There are, however, some potentially significant impacts associated with abandoning the existing Line 3. These longer term impacts are associated with the continued presence of undiscovered legacy contamination that may exist surrounding the existing pipeline, as well as the potential hazards associated with the aging of the abandoned pipe. These potential impacts include soil and water contamination from residual contamination around or beneath the pipeline, the ability of the pipeline to serve as a contaminant and/or water conduit, subsidence due to the failure over time of the pipeline, and loss of buoyancy control[6] for the pipeline. These impacts are discussed further below. A summary of potential impacts of abandonment of the existing Line 3 is provided in Table 8.3-1.

It should be noted that due to other pipelines existing within the corridor, the degree to which contaminated soils can be addressed, if found, may be limited.

8.3.1.1 Soil and Water Contamination

Remaining Oils and Cleaning Agents May Cause Future Environmental Problems

Oil or cleaning agents that remain in the pipeline after cleaning have the potential, at some time in the future, to leak and contaminate soils and waters near the pipeline. Corrosion of the pipeline would be slowed by cathodic protection. Over a long enough period of time, however, the pipeline will corrode and begin to fail (discussed further below). Thus, ensuring that the pipeline contains as few oils or cleaning agents as possible is key to minimizing potential future impacts on nearby soils and waters.

Enbridge Has Developed a Cleaning Protocol to Comply with PHMSA Regulations

As mentioned in Appendix B, the Department of Justice Consent Decree mandates that cleaning and purging of the existing line must begin within three months of the in-service date of the proposed pipeline. The decree further states that cleaning and decommissioning of the existing line shall be completed within one year of commencement[7]. The Consent Decree includes a provision in section VII.J that requires Enbridge to secure an independent third party to verify compliance with the Consent Decree. However, no specific guidelines have been provided that indicate adequacy of pipeline cleanliness after purging and cleaning. Section XI of the Consent Decree stipulates penalties associated for violating the requirements set forth within the document.

Enbridge's proposed abandonment plan includes removing the oil from the existing Line 3, cleaning the line of remaining oil and associated hydrocarbons, and using a variety of pigs and a cleaning agent to clean the pipeline. The pigs would have a variety of smooth and scraping surfaces to remove oils, hydrocarbons, and other materials on the pipeline walls. The pigs would be driven through the pipeline using an increase in back pressure created by nitrogen gas, and the cleaning solution would consist of water and biodegradable cleaning agents, as indicated by Enbridge in Appendix B.

6 Buoyancy controls prevent the pipeline from becoming buoyant and, eventually, becoming exposed at the surface. The buoyancy of a pipeline depends on the weight of the pipe, the weight of the volume of water displaced by the pipe, the weight of the liquid load carried by the pipe, and the weight of the backfill. When a pipe is empty, the weight of the liquid load that once contributed to buoyancy control is lost. As a result, the pipe could become buoyant and begin rising toward the surface at watercourse crossings, in wetlands, and in locations where soil density is low and the water table is high.

7 Consent Decree for Civil Action No. 1:16-cv-914, United States v. Enbridge and subsidiaries.

Table 8.3-1. Potential Impacts of Line 3 Abandonment

Resource	Impact
Human Settlements	In the near term, impacts on human settlements are anticipated to be minimal. Work to clean, disconnect, segment, and monitor the pipeline would occur within the Mainline corridor. Some segmentation activities could require site-specific excavation. It is anticipated that this work, and all work within the Mainline corridor, would comply with applicable permits and approvals, thus minimizing and mitigating potential impacts. In the longer term, impacts on transportation and public services could be significant due to potential subsidence. These impacts could be reduced and potentially mitigated through long-term monitoring, adaptive management, and site-specific mitigation measures.
Natural Resources	In the near term, impacts on natural resources are anticipated to be minimal. Enbridge proposes to protect these resources by clearing the pipe of potential pollutants and segmenting the pipe to prevent it from acting as a contaminant/water conduit. The effectiveness of Enbridge's cleaning protocol and proposed segmentation of Line 3 could require further review and alteration as appropriate. In the longer term, impacts on natural resources could be significant due to subsidence and exposed segments of pipeline (buoyancy). These potential impacts could be mitigated by monitoring, adaptive management, and site-specific mitigation measures.
Cultural Resources	No impacts on cultural resources are anticipated. Abandonment activities would take place within the Mainline corridor and along the existing Line 3.
Socioeconomics	In the near term, impacts on socioeconomics are anticipated to be minimal. Abandonment could decrease tax revenues or shift them to other taxing authorities. In the longer term, impacts on socioeconomics, particularly agricultural production, could be significant due to subsidence and/or exposure of pipeline. These potential impacts could be lessened by monitoring, adaptive management, and site-specific mitigation measures. It is expected that job creation related to abandonment would be negligible.
Cost	Enbridge estimates the short-term cost of deactivating Line 3 in place to be approximately $85 million.[8] Enbridge estimates annual monitoring costs for Line 3 to be about $100,000.[9] Costs for future site-specific mitigation measures (e.g., to mitigate subsidence or loss of buoyancy control) are uncertain and would depend on the nature of the mitigation measures.
Environmental Justice	Communities with potential environmental justice impacts related to the Line 3 Project are discussed in Chapter 11. The abandonment of existing Line 3 could negatively affect these communities due to ongoing stress or anxiety related to the presence of the pipeline and ongoing risks related to water flow, soil and water contamination, and subsidence.

As discussed in Appendix B, Enbridge has developed and tested a cleaning protocol using a 12-mile abandoned section of Line 3 in Manitoba. Enbridge indicates that its proposed cleaning protocol removes over 99.99 percent of hydrocarbons, indicated by testing performed on rinse water after the cleaning process. Liquid and solid waste materials generated as a result of cleaning activities, including spent cleaning solution, must be handled and disposed of in accordance with applicable federal and state requirements and permit conditions.

Based on laboratory analytical results, Enbridge indicates that its proposed cleaning protocol is effective at removing potential contaminants from the interior of the pipeline, minimizing the potential adverse effects associated with a pipeline line failure and contaminant release to soils and waters (Appendix B).

8 Communication with Enbridge, March 10, 2017.

9 Id.

Therefore, the risk associated with potential impacts to soil and water resources near the existing Line 3 due to oils or other hydrocarbons from the abandoned Line 3 are reduced.

If Effective on Long Pipelines, Enbridge's Protocol Could Minimize Effects on Soils and Waters

The testing done by Enbridge associated with its cleaning protocol was conducted on a 12-mile length of pipe, and the existing Line 3 in Minnesota is approximately 282 miles long. It is currently unknown whether Enbridge's protocol works on a longer length of pipeline. Potential future impacts on soils and waters along the existing Line 3 could be minimized by ensuring that Enbridge's protocol works on the longer length of pipeline in Minnesota with similar effectiveness as that observed in testing of the protocol. Post-cleaning observations via pipeline inspection (e.g., in-line video) and other methods would provide resource agencies and authorities with substantial evidence that Enbridge has ensured the efficacy of the cleaning protocol and properly removed the waste materials.

8.3.1.1.1 Contamination Outside of the Pipeline

Past and Present Contaminants Outside Existing Line 3 Could Cause Impacts

Soils and waters near the abandoned Line 3 could also be adversely affected where either undiscovered or known contamination along the existing pipeline (from lubricants, process chemicals, and oil releases and spills) are left in-place. Potential impacts on soil and water resources cannot be readily ascertained, as they depend on the extent of the potential existing undiscovered contamination.

Enbridge has been, and would continue to be responsible for preventing discharges and contamination, as spelled out in Minnesota Statutes 115E[10]. Enbridge has indicated that it would develop a contaminated sites management plan to identify, manage, and mitigate historically contaminated soils and waters. Such a plan would require them to identify potential contamination sources along abandoned Line 3 and coordinate with resource agencies and authorities to determine appropriate mitigation measures (see Sections 5.2.1.1, 5.2.2, 6.3.1.1, and 6.3.2). One such mitigation measure may be to sample nearby wells and wells within the right-of-way to determine human health impacts.

8.3.1.2 Existing Line 3 as a Water Conduit

If It Were to Act as a Water/Contaminant Conduit, Existing Line 3 Could Adversely Affect Water Resources

Over time, despite cathodic protection, the abandoned Line 3 would continue to corrode and lose structural integrity such that water and/or contaminants could enter the pipeline. This material could flow through the pipeline by gravity and exit the pipeline at another location. Thus, the abandoned pipeline could serve as a conduit for water and/or contaminants to move from one water resource to another, creating hydrological connections that might not otherwise occur. These connections could make water relatively more scarce or more abundant in specific locations and create/increase the extent of a contaminant plume, which can lead to potential impacts on wetlands, watercourses, and lakes and on human uses of water such as drinking water or for agricultural irrigation.

Cathodic Protection and Segmenting the Pipeline May Minimize Effects on Water Resources

Enbridge's proposed abandonment plan includes maintaining cathodic protection of the pipeline to minimize corrosion, segmenting the pipeline to prevent the pipeline from acting as a water conduit, and

[10] 2016 Minnesota Statutes 115E.02 Duty to Prevent Discharges.

monitoring the pipeline. Enbridge's abandonment plan proposes to segment (i.e., cap) Line 3 at 47 locations, with three other locations requiring further study (for a possible total of 50 locations; see Appendix B).

It should be noted that in 1996, Enbridge determined that the polyethylene tape used for cathodic protection has been "wrinkling." Water/contaminants tend to seep under the wrinkles and follow the pipe. Additionally, all identified external metal loss locations occurred at locations of wrinkled tape. While additional information associated with this phenomenon is presented in Appendix B, it is unclear what Enbridge is doing about this issue. This effect will increase the deterioration of the existing Line 3.

Additionally, pipelines that are located in the immediate vicinity of high-voltage power lines can be adversely affected by the alternating currents that are generated, which can accelerate the corrosion process. In addition to a standard cathodic protection system, the pipeline section(s) located near high voltage lines should be augmented with a polarization cell that dissipates the stray voltage into the ground and away from the pipeline. It is uncertain as to whether the existing Line 3 or the new pipeline's cathodic protection system has been designed to offset alternating currents.

The 47 locations selected for segmentation, consist of 40 mainline valves, six pump stations, and one pump station/terminal. Enbridge selected the segmentation locations based on topographical data, GIS analysis, and computer modeling. Enbridge notes that water resources are generally located at lower elevations within a landscape. Because the pipeline elevation on either side of a waterbody is higher than the elevation of the segment of pipe that passes beneath the waterbody, gravity may keep water that might enter the pipe from flowing uphill and passing beyond the limited segment of pipe that runs beneath the water body. These conditions imposed by elevation and gravity typically effectively limit water movement beyond the limited segment of pipe that passes below a particular water resource.

Work at Pump Stations and Mainline Valves Would Take Place within Their Fenced Boundaries

At pump stations and terminals, the abandoned Line 3 would be disconnected and segmented by excavating down to the pipeline, cutting the pipeline, and welding a cap onto the pipe. Enbridge anticipates that this work would occur within the fenced boundaries of the pump stations and terminals. Mainline valves that serve as segmentation locations would be closed and electrically disconnected so that they could not be operated. For all other segmentation locations, Enbridge proposes to excavate to the pipeline, cut the pipeline, and weld a cap onto the pipe or close the pipe with grout.

It is unclear whether valves can be operated manually after electrical disconnection. If valve stems remain in place, an assurance of ongoing functionality to maintain isolated segmentation should be provided by Enbridge.

Additional Segmentation Locations Still Need to Be Studied

If Enbridge's proposed abandonment plan is effectively implemented, including segmentation of the existing Line 3, the potential risks to water resources resulting from a potential flow of water through existing Line 3 can be reduced. As Enbridge acknowledges in its plan, however, additional segmentation locations require further study. Additionally, water resources may be identified by state, federal, and tribal resource agencies that these agencies believe are not adequately protected by Enbridge's proposed plan and that, as a result, require additional segmentation of an abandoned Line 3.

One example of potentially high priority segmentation locations is where pipelines cross under streams. These locations may see increased streamflow and become deeper over time, leading to exposed portions of the pipeline.

8.3.1.3 Subsidence

Failure of Existing Line 3 Depends on Structural Integrity and Applied Loads

As the abandoned Line 3 corrodes and loses its structural integrity, soil could enter the pipeline, causing a subsidence of the ground in that area. This would likely occur over time with soil slowly filling the pipe, but the pipeline could also collapse quickly, before it has much soil in it. Subsidence could affect public safety, particularly if it occurred at highways, railroads, or other utility crossings. It could also affect agricultural production and could lead to water channeling and erosion with adverse impacts on water resources.

Underground Loads Are Typically Less Than Surface Loads

Whether subsidence occurs, and the extent to which it occurs, depends on the structural integrity of the pipe and on the loads applied to the pipe associated with deformation and failure. In general, loads at the pipe level (underground) are less than live loads at the surface (like those from a heavy truck), because part of the load is shared with the surrounding soil. If there is a dearth of surrounding soil, or if the cover for the pipeline is relatively shallow, the pipeline bears more of the load and, all things being equal, is more likely to fail.

The Longer the Pipe Is in the Ground, the More Likely It Is to Fail

Enbridge has analyzed and modeled potential subsidence of the abandoned Line 3 in its proposed abandonment plan (see Appendix B). This analysis includes projecting loss of pipeline wall thickness due to corrosion over time, possible failure modes for the pipeline, and estimated subsidence levels should the pipeline fail. In general, subsidence is a time-dependent risk. The longer the pipe is in the ground, the greater the advancement of corrosions and increased risk that the pipe may fail.

Subsidence Is Inversely Proportional to the Amount of Soil That Has Entered the Pipeline

Enbridge's analysis indicates that it would take a minimum of 506 years for the abandoned Line 3 to fail under typical highway loads and 87 years to fail under typical railway loads. How much subsidence occurs as a result of these failures depends on whether or not soil has been slowly filling the pipe over these time periods. The greatest subsidence would occur when no soil has entered the pipe. Enbridge estimates that subsidence with no soil having entered the pipeline prior to loss of structural integrity would range from about 3 to 7 inches, depending on the pipeline's depth of cover (2.0 feet to 13.1 feet, respectively).

Near-Term Effects on Natural Resources, Land-Based Economies, and Public Safety

In light of Enbridge's analysis, impacts on natural resources and land-based economies such as agriculture are anticipated to be minimal in the near term (i.e., the next 40 years) but could be significant longer term. For many areas and land-uses along the route of the existing Line 3, mitigation of subsidence can be corrected, to some extent, by fill with soil. In some areas, however, a fill would not be possible (e.g., in each incident where the pipeline passes underneath a watercourse). Due to the length of the existing Line 3 and the variety of resources along it, Enbridge proposes that the primary mitigation strategy would be effective monitoring and adaptive management to address these issues at

first identification. Additional identification and/or analysis of existing and potential subsidence locations may allow Enbridge to preemptively address short- and long-term impacts related to subsidence.

Enbridge's analysis also indicates that impacts on public safety are anticipated to be minimal in the near term, but that the potential exists for significant impacts on highway, railways, and other utilities, absent monitoring, adaptive management, and effective mitigation measures. Subsidence of highways and railways could result in significant adverse impacts, and avoiding and mitigating these impacts is a site-specific and authority-specific endeavor. Initial analysis by Enbridge indicates that the existing Line 3 crosses under 297 roads and 17 railways.

Enbridge notes that tolerable subsidence levels for roads, railways, and utilities have not been established with respect to pipelines. Each pipeline crossing scenario is evaluated independently to determine potential risks and mitigation measures. In some instances, the preferable approach for road or railway crossings could be to fill the abandoned pipe with an engineered fill material that would provide structural integrity over the longer term.

Long-Term Effects Could Be Significant and Would Require Site-Specific Mitigation Measures

In sum, impacts on human and natural resources due to potential subsidence of the ground above the abandoned Line 3 are anticipated to be minimal in the near term but could be significant in the longer term, absent effective monitoring, adaptive management, and the timely introduction of mitigation measures. Because of the length of Line 3 and the variety of resources crossed, mitigation measures would be site specific and would need to be designed in collaboration with those agencies and authorities responsible for the resources in question.

8.3.1.4 Loss of Buoyancy Control

Loss of Buoyancy Control Could Cause Pipe to Become Exposed

Once oil is removed from the existing Line 3, portions of the pipeline could become buoyant. That is, once the pipeline is no longer burdened by the weight of the transported oil, the depth of cover and other buoyancy control measures might no longer be adequate to prevent the pipeline from becoming buoyant and, eventually, becoming exposed at the surface. Enbridge has indicated that loss of buoyancy control could occur at watercourse crossings, in wetlands, and in locations where soil density is low and the water table is high.

For Line 3, Enbridge has documented 223 occurrences totaling a length of 8,496 linear feet of exposure pipeline. Line 3 was originally installed prior to the minimum depth of cover standard that was established under 49 CRF 195.248. Therefore, given the lack of adequate soil cover and the lack of transported oil in the pipe, it is probable that the frequency associated with the pipeline becoming buoyant and being exposed at the ground surface will increase.

Exposed Pipe Could Affect Streambeds and Cause Erosion, but Locations Are Difficult to Predict

If the abandoned Line 3 became buoyant, the exposed pipeline could adversely affect natural resources, including soil erosion and impacts on streambeds. Because of the length of Line 3, the variety of resources crossed, depth of groundwater relevant to the depth of the pipeline, and the number of variables that determine whether a specific segment of pipe will become buoyant, it is difficult to

predict where buoyancy and exposed pipe will occur. Accordingly, the primary mitigation measures are monitoring and adaptive management.

In the CNEB report, Enbridge indicated that it would conduct a preliminary buoyancy analysis of Line 3 in Canada to determine areas where there might be pipeline buoyancy issues. Buoyancy analysis may also be required by PHMSA. Enbridge noted that it would use a variety of mitigation measures to address exposed pipeline, including weights or engineered fill, placing additional cover over the pipeline and, in some circumstances, removing segments of the pipeline.

Complexity and Variety of Affected Resources Would Require Site-Specific Mitigation Measures

Enbridge's proposed abandonment plan for Line 3 in Minnesota mentions the potential need for buoyancy control. The plan also discusses the possibility of exposed pipe and potential mitigation measures. Enbridge indicates in its proposed plan that it would monitor for exposed pipeline and, if found, would work with relevant agencies and authorities to develop site-specific mitigation measures, which could include removing a segment of pipeline, grouting, and/or continued monitoring.

Because of the length of Line 3 and the variety of resources crossed, mitigation measures for buoyancy and exposed segments of the abandoned Line 3 would be site specific and would need to be designed in collaboration with the responsible agencies. In Minnesota, the Department of Natural Resources is responsible for issues that involve crossing the state's waters. Buoyancy is a phenomenon that occurs near and within water resources, making it more likely that mitigation measures designed for specific exposed segments of pipeline would involve working with the Department of Natural Resources. A preliminary analysis and subsequent monitoring plan of potential buoyancy-related issues and locations, along with typical mitigation measures for such conditions would provide the regulatory agencies with additional indication that Enbridge has giving this concern appropriate consideration.

8.3.1.5 Cost

Short-Term Cost of Abandonment Estimated at $85 Million

Enbridge estimates the short-term cost of abandoning Line 3 in place to be approximately $85 million.[11] For context, Enbridge estimates annual monitoring costs for Line 3 to be about $100,000.[12] It is unclear whether ongoing cathodic protection costs are included in the annual monitoring cost estimate. Costs for future site-specific mitigation measures (e.g., to mitigate subsidence or loss of buoyancy control) are uncertain and would depend on the nature of the mitigation measures. It is expected that job creation related to abandonment would be negligible.

8.4 REMOVAL

Removing a Pipeline Requires Much the Same Process as Constructing a Pipeline

An alternative to abandoning Line 3 in place is to remove the pipeline. A description of the removal process is included in the discussion of RA-07 (see Section 4.3.4). Removing an existing pipeline is essentially the reverse of constructing a pipeline and involves topsoil removal, excavation, pipe removal, backfilling and compaction of the trench, replacement of the topsoil, and revegetation measures.

11 Communication with Enbridge, March 10, 2017.

12 Id.

With clearing and excavation activities occurring within and immediately adjacent to the Mainline corridor, potential impacts related to construction disturbance are anticipated to be minimal. As noted above, impacts from clearing and ground disturbance would be managed through permitting similar to other construction activity including, for example, construction stormwater permits, permits for construction in public waters, and permitting for impacts on wetlands. Many of the same construction techniques and environmental protection measures would apply to pipeline removal in order to reduce impacts, including the use of work windows to avoid sensitive species' lifecycles (like breeding or nesting), vehicle and equipment crossing methods, sediment control measures, and bank restoration.

Soil materials required to fill the trench after pipe removal could be recovered from areas immediately adjacent to the pipeline right-of-way, although additional topsoil may need to be obtained from local borrow sources.

As with abandonment, pipe cleaning would be required if the pipe were to be removed to avoid contamination of soil and groundwater during the removal process. Cleaning would need to be conducted using a process similar to the process used for pipeline abandonment to minimize risks to humans and the environment from residual oil. However, the overall cleanliness of the pipe may not have to be as thorough given that the pipe would be removed from the ground and recycled.

8.4.1 Potential Impacts and Mitigation Measures

The potential impacts of removing the existing Line 3 are anticipated to be similar to those for removing and replacing Line 3 in the same trench (route alternative RA-07). Potential impacts of RA-07 are discussed in Chapter 6. Impacts are also summarized here in Table 8.4-1.

Table 8.4-1. Potential Impacts of Line 3 Removal

Resource	Impacts
Human Settlements	Impacts on human settlements are anticipated to be similar to those for route alternative RA-07, as discussed in Section 6.2, and include temporary noise and aesthetic impacts and impacts due to the heavy use of local roads. There is a risk of damage to existing nearby pipelines with the risk of an oil leak that could significantly affect human settlements. Impacts on roads, railways, and utilities could be significant if subsidence occurs with removal of Line 3. These impacts could be reduced and potentially mitigated through accurate marking of existing pipelines, long-term monitoring, adaptive management, and site-specific mitigation measures.
Natural Resources	Impacts on natural resources are anticipated to be similar to those for RA-07, as discussed in Section 6.3, and include minor vegetation clearing, air emissions, and construction stormwater impacts. There is a significant risk of damage to existing pipelines and the risk of an oil leak that could significantly affect natural resources. In wetland areas, it might not be possible to remove Line 3 without damaging existing pipelines. Impacts of removal could be minimized by targeting portions of the pipeline for removal that would not cause undue damage to such natural resources, and by preparing for potential spill response and cleanup.
Cultural Resources	Impacts on cultural resources are anticipated to be similar to those for RA-07, as discussed in Section 6.4, and are anticipated to be negligible, with ground-disturbing activities limited to the Mainline corridor and immediately adjacent areas.

Table 8.4-1. Potential Impacts of Line 3 Removal

Resource	Impacts
Socioeconomics	Impacts on socioeconomic resources are anticipated to be similar to those for RA-07, as discussed in Section 6.5, and include minor impacts associated with disturbance to recreation and tourism as well as minor impacts on local economies. There is a significant risk of damage to existing pipelines and the risk of an oil leak that could significantly affect socioeconomic resources. In wet soils, it might not be possible to remove Line 3 without damaging existing pipelines. Tax revenues could decrease or shift to other taxing authorities. As discussed below, based on Enbridge's cost estimates for construction and removal, it is assumed that removal of the existing Line 3 would create approximately half as many jobs as the construction of the new line.
Cost	Enbridge estimates the cost of removing Line 3 at approximately $1.28 billion. Enbridge estimates the cost for removal to be approximately $855 per linear foot of pipeline.[a]
Environmental Justice	Communities with potential environmental justice impacts related to the Line 3 Project are discussed in Chapter 11. Removal of the existing Line 3 could positively affect these communities by removing the presence of the abandoned pipeline and associated risks related to water flow, soil and water contamination, and subsidence.

[a] Communication with Enbridge, March 10, 2017.

Primary Challenge Is Proximity of Other Pipelines, but Mitigation Measures Would Be Used

The primary challenge in removing Line 3 is that it is situated between other active oil pipelines within Enbridge's Mainline corridor (see Figure 4.3-2). As previously stated, roughly 104 miles of the 282 mile long Line 3 has pipelines located on both sides within a 20-foot buffer. The remaining 178 miles has either no adjacent pipelines or has one side without a pipe. Enbridge believes that in isolated areas that an adjacent pipeline may be as close as 10-feet away. An analysis of the provided data for the 104 mile stretch shows that adjacent pipelines are within an average of 11 feet of Line 3. This data broken down by segment is shown in Table 8.4-2. Enbridge has indicated that there is a significant risk that pipeline removal activities could damage an active pipeline and cause an accidental release. Damage could be caused by striking a pipeline with equipment or by the weight of the equipment as it works above operating pipelines. This damage could be immediately apparent if equipment struck a pipeline, or observable later if the pipeline was damaged and only leaked in the future.

Table 8.4-2. Average Distance to Nearest Adjacent Pipeline[a]

Line 3 Segment	Average Distance to Nearest Adjacent Pipeline (feet)[b]
North Dakota border to Clearbrook	12.1
Clearbrook to Carlton	12.4
Carlton to Wisconsin	11.0

[a] Analysis only performed for pipeline segments that have adjacent pipelines within a 20-foot buffer on both sides of the existing Line 3.

[b] Averages were calculated by measurements at the following points: one point at the beginning and end of each segment as well as points every 10 miles along the pipeline.

Enbridge's assessment of the risks and benefits of removal included in their abandonment plan contemplated the use of timber mats over operating pipelines to create a work and travel surface for equipment. These mats would help disperse the weight of the equipment and minimize potential impacts on these pipelines. The use of timber mats for this purpose is typical in wetland and other sensitive environments where heavy equipment is necessary. Enbridge provided an estimate in Appendix B of 600,000 to 900,000 timber mats to complete this work. It is unclear how this estimate was determined.

As a highly conservative estimate that assumes 20-foot long mats that are 4 feet wide each and are placed the entire length of the pipeline at once to create a 16-foot-wide corridor (appropriate for typical excavators and dump trucks), approximately 300,000 mats would be needed. However, the work would not require that the entire corridor have timber mats at any given time. Instead, several access points can be constructed for multiple crews at once. For each crew, approximately 500 to 1,000 feet of matting can be used and moved as work progresses. Assuming five crews work concurrently and each requires 1,000 feet of matting 16 feet wide, a total of 1,000 mats would be required.

Further, the1,000-mat estimate assumes that the entire 282-mile-long Line 3 would require timber mats at some point during construction. As stated previously, only 104 miles of Line 3 has limited access (i.e., a pipeline line on both sides within a 20-foot buffer zone). This is equates to 37 percent. Therefore, it is possible that only 370 mats would be needed.

Enbridge also indicates that sheet piling would likely be required to isolate specific segments of existing Line 3 and control the trench width, particularly in wet soils and wetlands. The source of Enbridge's estimate of required sheet piling to perform removal (provided in Appendix B) is unclear. Similar to timber mats, sheet piling would be installed at necessary locations as the work progressed to those locations, rather than all at once.

Enbridge notes that it would likely use a hydraulic vacuum or hand dig to minimize potential impacts on existing pipelines.

If the existing Line 3 was removed in its entirety, and adjacent pipelines were adversely impacted,, these pipelines would need to be excavated and repaired.

Special Mitigation Measures Would Be Needed at Watercourses and Where Line 3 Removal Would Create Unacceptable Risks

Where Line 3 crosses underneath watercourses, roads, and railways, excavation and removal may temporarily affect waters and fisheries or access on roads and railways. These impacts would be similar to those arising during construction of the proposed new Line 3, and mitigation measures would also be similar.

There may also be areas where local geology would cause removal to create a higher risk of erosion or subsidence. In these areas, mitigation measures would be site specific and would need to be designed in collaboration with the responsible agencies and authorities.

Where existing Line 3 cannot be safely removed, the appropriate mitigation measure could be segmenting (similar to abandonment in place) or using an engineered fill until the pipeline could be reached without damaging existing pipelines. Similarly, where Line 3 crosses under watercourses,

roads, and railways, the appropriate mitigation measure might be to deactivate and segment the pipeline and use an engineered fill to prevent subsidence.

Contaminated Soil Could Be Remediated

Enbridge has indicated that it would develop a contaminated sites management plan to identify, manage, and mitigate historically contaminated soils and waters. Any existing contamination discovered during excavation of the existing Line 3 could be remediated in accordance with this plan, avoiding the potential for long-term adverse impacts on soil and water quality caused by undiscovered contamination along the existing pipeline (from lubricants, process chemicals, and oil spills) as discussed in Sections 5.2.1.1, 5.2.2, 6.3.1.1, and 6.3.2. However, the location of other existing pipelines in the corridor may limit the ability to access and remediate soil and water contamination.

Proper Handling of Waste Materials Would Be Critical to Minimize Impacts

Enbridge indicates that, if the existing Line 3 was removed with a hydraulic vacuum process, the removal would generate approximately 1.7 million gallons of slurry waste that would need to be properly handled to minimize potential impacts. In addition, the pipe would need to be recycled or disposed of. Pipe that would be used for another purpose after removal would also be cleaned of hazardous materials while in place and can include supplementary cleaning techniques after the pipe has been removed from the ground. For pipe that is targeted for disposal, existing disposal or landfilling guidelines would determine the required cleanliness of the pipe.

Cost of Removal Estimated at Approximately $1.28 Billion

Minnesota Statutes 116D.04 Subdivision 6 prohibits state actions, on the basis of cost alone, which may affect the environment. Such actions include permit approval for development.[13] Enbridge estimates the cost of removing Line 3 at approximately $1.28 billion.[14] This estimate is based on a per-foot cost for removal at about $855.[15] Of this cost estimate, approximately 25 percent would be for labor, 40 percent for equipment, and 35 percent for materials costs. This overall estimate does not account for the value of scrap metal recovered from the pipeline, which would offset approximately $19 million of this cost. [16] As this estimate is slightly more than half of the cost of installing the portion of the proposed Line 3 that would be located in Minnesota ($2.1 billion), it appears that the potential jobs created during the removal effort would be approximately half of the jobs generated by construction of a new Line 3.

8.5 SUMMARY

The above discussion and Appendix B, identify key benefits and risks associated with abandonment and removal as options for decommissioning the existing Line 3. Generally, the negative impacts due to removal of the pipeline are concentrated in the near term (i.e., removal occurs in conjunction with the construction of the new line). Conversely, these impacts shift towards long-term concerns in the case of abandonment (i.e., subsidence, corrosion, and buoyancy). The primary exception to this is the

13 2016 Minnesota Statutes 116D.04

14 Communication with Enbridge, March 10, 2017.

15 Id.

16 Enbridge Response to Data Request 05, July 14, 2017

associated cost, which is expected to be higher for removal than for abandonment. Additionally, removal would likely create about half as many jobs as would the construction of the new line.

In addition to considering abandonment and removal as stand-alone alternates, a combination of the two may most adequately mitigate risks. For example, high priority locations that are adequately spaced from adjacent pipelines or are more likely to experience subsidence, exposure or cause hydraulic problems would be removed, while lengths of pipe that are not expected to have these issues would be purged, cleaned, and abandoned in-place with ongoing monitoring and associated maintenance. To best inform this approach, additional studies regarding potential locations of subsidence, corrosion, and buoyancy issues could be conducted prior to finalizing a more detailed decommissioning plan.

8.6 REFERENCES

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